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INFLUENCE OF COORDINATION COMPOUNDS OF MICROELEMENTS ON COTTON PRODUCTIVITY

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The article presents the data of field experience which show that the increase of the yield of raw cotton when using the coordination compounds of microelements of cobalt and copper on the optimal nutritional background – N250 P175 K125 increases by 4.5 and 5.8 c / ha, respectively, relative to the cotton crop, grown without microelements, and by 2.8 and 3.2 c / ha in the variants with the use of inorganic salts. Also, research has found that the use of coordination compounds of microelements has a positive effect on the course of physiological and biochemical processes and the yield of various cotton varieties. It is noted that the increase of the yield obtained from the introduction of coordination compounds of trace elements, an average in three years increase of yield was from 12.4 to 17.7%, compared with the control. Coordination compounds Co-31, Co-34 and Cu-12 significantly improve the technological properties of the fiber and increase the oil content of the nucleus' seeds. Thus, the greatest increase of cotton yield is observed in the variants with the coordination compound of cobalt – 5.8 q / ha; the share of the first harvest of raw cotton in the variant is 74.6%, i.e. by 12.3% more than in the control variant, and in the variant with the coordination compound of copper is 4.3 centners per hectare, compared to the control. The share of the first harvest in these conditions increases by 8.3-12.9% compared with the control options and 1.5-2 to 2 times more than in the variant with the addition of inorganic cobalt and copper salts to the cotton. The coordination compounds of microelements in combination with the optimal norms of mineral fertilizers improve the technological properties of the fiber and increase the oil content of seeds more than their inorganic compounds.

Keywords: microelements, growth, development, variety, cotton, fruit trees, copper, cobalt

An important factor of increasing of raw cotton's production, along with the introduction of advanced methods of cotton cultivation technology, the use of new high-yielding varieties is the rational and effective use of mineral and organic fertilizers [1].

As is known, trace elements are found in plants in small quantities. However, the lack, like the excess of many trace elements, causes adverse consequences for the growth and productivity of plants, which affects the provision of human and animal nutrition of a certain qualitative composition. In this regard, the problem of supplying plants with microelements is increasingly acquiring a general biological significance [1].

When studying the effect of two biological products RIZOKOM-1 and SERHOSIL on the content of trace elements such as zinc, copper and arsenic in cotton plants and saline soils, the researchers noted that the content of these elements was not within the normal range and toxic effects on plants were not detected. The use of these biologics contributed to the improvement under the action of the state of saline soils under cotton, which had a positive impact on the yield of raw cotton, an increase of 13.4 centners per hectare compared with traditional cotton sowing [2].

Studying, using the method of neutron-activation analysis, the content of 6 macro- and microelements in medicinal plant raw materials was determined. It was determined that the content of macronutrients in all pro-

posed plants is comparable. The content of trace elements allows to select more promising species [3].

Studies with the use of trace elements in the composition of mineral fertilizers for cotton show low efficiency of inorganic salts of trace elements in carbonate soils of cotton areas of the Republic of Uzbekistan. It is connected with the fact that inorganic salts of microelements in the soil are transformed into insoluble forms that are inaccessible to plants [4, 5].

In recent years, as is well known, much attention has been paid to intracomplex coordination compounds of microelements called complex or chelates.

Some researchers have considered the role of trace elements in plant life and highlighted theoretical and practical issues regarding the use of complex micronutrients on crops, rice, which provide increase yields, seed quality and grain. Metal complexonates, used as micronutrients, are effective form of microelements by regulating the production process of agricultural crops, both when treating seeds before sowing and when conducting non-root dressings of vegetative plants. Their inclusion in the rice fertilizer system allows to balance the mineral nutrition necessary for plant life, which provides increase of yield, seed quality and grain [6].

According to many researchers, complex microelement compounds accelerate growth, development, increase the yield of cotton and other crops more than their inorganic salts.

In addition, entering to the plant, coordination compounds of microelements exhibit great biological activity, remain in soil solution in a form accessible to plants for a long time, have high resistance to microbiological cleavage and are not deposited in an alkaline environment, which determines the high efficiency of their application under crops [7].

Purpose of the study

In recent years, the agrochemistry of plant nutrition with microelements and the practice of their application in agriculture have paid much attention to intracomplex compounds of microelements. The aim of the study is identifying ways to increase the yield of the cotton varieties, which we study, by using the coordination compounds of microelements. Especially, the effectiveness of the using of trace elements of copper and cobalt for cotton has not been studied enough [5, 6].

The limited information about the effectiveness of microelement coordination compounds in increasing cotton productivity determined the direction of our research.

Materials and research methods

The influence of coordination compounds of trace elements copper and cobalt on the growth and development of cotton varieties Namangan-34, S-6524, Bukhara-102 and Omad was investigated in field conditions. Field experiments were conducted in the experimental area of the Uzbek Research Institute of Cotton.

The dependence of cotton yield on the application of inorganic salts and coordination compounds of microelements on typical sierozem has been studied in field conditions. The initial content in the soil of the arable layer of field experiments of humus, gross nitrogen, phosphorus and potassium was 1.10; 0.09; 0.11 and 2.3 %. The humus content and the gross amount of nutrients are reduced in the subsoil horizon of the soil. The initial content of nitrates in the soil is 20.4 – 21.2 mg / kg of soil. Available phosphorus in soil, soluble in ammonium carbonate, was 22.3–23.2 mg / kg in arable and 11.3–11.9 mg / kg in subarable horizons, exchange potassium, respectively, 190–201 and 130 –134 mg / kg of soil.

The content of conditionally digestible forms of microelements averaged: cobalt 0.12-0.14; copper 0.30-0.34 mg / kg and, therefore, the soil of the experimental plots belongs to the low-provided by these trace elements soils. Field experiments were located in 2 tiers, with eight-row strips, where 4 middle rows were used to account for growth and development, to conduct agrochemical studies, and 2 extreme rows as defensive measures. The plot area is 67.2 m2 (14.4 and 4.8 m). The repetition of the experiment is fourfold. The layout of plants 60x15-1 with a thickness of 105-110 thousand. Before sowing, cotton seeds were soaked with an aqueous solution of inorganic, as well as coordination compounds of microelements with subsequent addition to the budding phase of ammophos or superphosphate at a depth of 14-16 cm.

From a large number of coordination compounds of microelements by the two-three-year field tests, the following are most effective for the growth, development and yield of the cotton: Co-31 – cobalt trismethioninate – Co (C 15 H16 N3S3O9) with a cobalt content of 14 %; Cu-12 – bis-glutaminatocuproat tetrahydrate [Cu (C5H7O4N) 2] · 4H2Oc with a copper content of 13.2 % and Co-34 bis (glutamine cobalt) cobalt (II) Co [Cu (gluta-2H2)] · 4H2O with cobalt content of 11 %, copper 13 %.

Research results and discussion

Researchers have found that the absorbtion of microelements of copper, molybdenum, and especially zinc by Artemisia leucodes Schrenk and SOPHORA JAPONICA L ....is increased at combined using of nitrogen, phosphorus, potassium and half-dead manure.

Thus, to obtain sustainable yields with high quality raw cotton, the use of trace elements is becoming increasingly important along with balanced nitrogen-potassium and phosphate nutrition. So, they play an important role in the metabolism of plants, their lack can lead to significant disturbances in growth and development, decreasing of yield and a deterioration of product quality.

The long-term results of scientific research and the practice of using trace elements in the composition of mineral fertilizers for cotton show the low effectiveness of inorganic salts of trace elements in the carbonate soils of cotton regions of Central Asia. This is due to the fact that with the introduction of inorganic salts of microelements in the soil are transformed into insoluble, inaccessible to plant forms [7].

We have established that the use of coordination compounds of trace elements of cobalt and copper by setting seeds at 0.3 % in their solutions and the subsequent application of 6.0–8.0 kg / ha increases the productivity (biomass) of wormwood on average 3, 2-2.0 q / ha in two years.

The results of research have shown that the use of coordination compounds of trace elements have a positive effect on the course of physiological and biochemical processes and the yield of various cotton varieties.

Table 1

Removal and consumption of copper, cobalt (g/ha), nitrogen and phosphorus (kg/ha) at application of their inorganic and organic compositions

Option of experiment	Copper		Cobalt		Nitrogen		Phosphorus	
	Removal 1 ha	Consumption on 1t of raw cotton	Removal 1 ha	Consumption on 1t of raw cotton	Removal 1 ha	Consumption on 1t of raw cotton	Removal 1 ha	Consumption on 1t of raw cotton
Control (without microelements)	$49,99 \pm 2,74$	$13,96 \pm 0,31$	$6,59 \pm 0,38$	$1,84 \pm 0,11$	$184,7 \pm 0,17$	$51,16 \pm 0,10$	$60,7 \pm 2,4$	$16,80 \pm 0,11$
CoSO$_4$ (inorganic compositions)	$52,31 \pm 3,12$	$13,52 \pm 0,11$	$7,64 \pm 0,41$	$1,97 \pm 0,08$	$201,3 \pm 0,14$	$51,22 \pm 0,09$	$65,5 \pm 2,2$	$16,67 \pm 0,18$
CuSO$_4$ (inorganic compositions)	$55,15 \pm 2,86$	$14,40 \pm 0,10$	$7,13 \pm 0,39$	$1,86 \pm 0,07$	$199,7 \pm 0,11$	$51,34 \pm 0,12$	$66,2 \pm 2,7$	$17,02 \pm 0,017$
Co-31 (coordination compositions)	$57,67 \pm 2,36$	$13,70 \pm 0,17$	$8,45 \pm 0,10$	$2,01 \pm 0,06$	$230,0 \pm 1,86$	$54,89 \pm 1,78$	$72,6 \pm 0,08$	$17,33 \pm 0,19$
Co-34 (coordination compositions)	$62,77 \pm 1,98$	$15,20 \pm 0,47$	$8,56 \pm 0,12$	$2,07 \pm 0,05$	$238,7 \pm 1,75$	$57,80 \pm 0,32$	$72,2 \pm 0,07$	$17,48 \pm 0,72$
Cu-12 (coordination compositions)	$62,84 \pm 2,88$	$15,75 \pm 0,11$	$7,52 \pm 0,20$	$1,88 \pm 0,18$	$232,0 \pm 1,67$	$56,76 \pm 0,29$	$69,990,09 \pm$	$17,11 \pm 0,09$

It is noted that the difference in the yield increase, obtained by making the coordination compounds of microelements, depending on the varietal characteristics of cotton, is not significant. On average, over three years, the yield increase was between 12.4 and 17.7% compared to the control.

According to the research results, it was established that the content of copper and cobalt in the tissues of the cotton organs does not differ significantly when introducing inorganic salts and coordination compounds of these trace elements. With the introduction of cobalt alone, the copper content in the tissues of the plant organs in the variant with the introduction of copper. In terms of cobalt and copper content, when they are introduced in the form of inorganic salts, the options differ slightly, and when cotton is grown using coordination compounds, they are marked to a greater increase in the organs of cotton.

The removal of copper and cobalt by a single plant when these batteries are introduced in the form of coordination compounds exceeds the indicator in the variant with the use of their inorganic compounds (Table 1).

It confirms the opinion that the coordination compounds of microelements are less fixed in the soil than their inorganic salts again. The total removal of copper and cobalt by plants with the addition of their coordination compounds is 57.6 and 62.8 g / ha, respectively, while in the control (with the addition of inorganic salts) it is 52.3 – 55.1. Currently, it is established that copper, manganese, zinc, cobalt, boron and other trace elements increase the activity of many enzymes and enzyme systems, redox processes, are involved in photosynthesis, carbohydrate and protein metabolism and other biological processes. Enzymes can form with microelements various metal-organic and intracomplex compounds. The effect of individual microelements on growth processes, fruiting and the quality of agricultural products, including cotton, has been widely studied.

Studies have established that the height increase of the main stem of cotton varies considerably depending on the use of inorganic and coordination compounds of microelements. On variants (by 5.VI) of inorganic salts of cobalt and copper, the length of the stem increases by 1.8–2.3 cm, while their coordination compounds – by 2.5–6.0 cm relative to control plants (without trace elements). Coordination compounds of microelements (cobalt and copper) increase the growth of the main stem to a greater extent than their inorganic salts.

According to the research results, it was established that the content of copper and cobalt in the tissues of the cotton organs does not differ significantly when the inorganic salts of the coordination compounds of these trace elements are introduced. When only cobalt is introduced, the copper content in the tissues of the plant organs is higher than in the organs of the control plants, but lower than that of the plants in the variant with the addition of copper. The content of cobalt and copper when they are introduced in the form of inorganic salts varies slightly, and when growing cotton using coordination compounds, there is a tendency for their large increase in the organs of cotton.

The introduction of trace elements in the composition of ammophos has a positive effect on the fruiting of cotton. Inorganic salts of cobalt and copper increase the formation of ovaries and 5.VIII by 0.6 – 0.8 and their coordination compounds by 1.3 – 1.8. The number of fully formed bolls is more formed in the variants using the coordination compounds of microelements – 13.2; 13.0 and 12.5 pieces per plant versus 10.6 pieces in the control. When using inorganic salts (option 2 and 3), the number of boxes was 11.4 and 11.2 pieces. Inorganic cobalt salts increase the yield of raw cotton by 3.2 centners per hectare on average over 3 years, and copper sulphate increases by 2.8 centners per hectare. At the same time, an increase in the yield of first-stage raw cotton in the variant with cobalt sulphate by 6.2 and copper sulphate is 5.8% higher compared to the control (without trace elements).

The greatest increase of cotton yields is observed in the variants with a cobalt coordination compound of -5.8 c / ha; the share of the first harvest of raw cotton in the variant is 74.6%, i.e. by 12.3% more than in the control variant, and in the variant with the coordination compound of copper is 4.3 centners per hectare compared to the control. The share of the first harvest in these conditions increases by 8.3-12.9% compared with the control options and 1.5-2 to 2 times more than in the variant with the addition of inorganic cobalt and copper salts to the cotton.

The use of inorganic salts of microelements for cotton increases the fiber length by 0.1-0.3 mm, the breaking load is 0.2-0.4 gf / tex, and the weight of 1000 seeds is 0.5-1.2 g relative to to control. At the same time, an increase in the oil content of the seed kernel is observed as compared with the variant without trace elements. Coordination compounds of microelements increase the fiber length by 0.4–0.6 mm, the relative breaking load by 0.6–0.9 g / tex and the weight of 1000 seeds by 1.2–2.7 g compared to the control (Table 2).

Table 2

Cotton yield at application of inorganic salts and coordination compositions of microelements on the optimal background of mineral nutrition (Field experiment 2009-2010 y.)

№	Option of experiment	Annual rate of fertilizer, kg/ha			Concentration of the solution for seed lock before sowing, %	Feed by micro-elements kg/ha	Raw cotton crop, c/ha		
		N	P	К			3 years average	Increase to control	The first harvest i average%
1	Control (without microelements)	250	175	125	-	-	$36,1 \pm 1,9$	-	$60,9 \pm 2,7$
2	CoSO$_4$(inorganic compositions)	250	175	125	0,03	2,0	$39,3 \pm 0,8$	$3,2 \pm 0,2$	$67,1 \pm 1,3$
3	CuSO$_4$ (inorganic compositions)	250	175	125	0,03	2,0	$38,9 \pm 0,7$	$2,8 \pm 0,3$	$66,7 \pm 1,4$
4	Co-31 (coordination compositions)	250	175	125	0,03	0,8	$41,9 \pm 0,3$	$5,8 \pm 0,6$	$74,6 \pm 0,6$
5	Co-34(coordination compositions)	250	175	125	0,02	0,6	$41,3 \pm 0,5$	$5,2 \pm 0,4$	$73,8 \pm 0,7$
6	Cu-12(coordination compositions)	250	175	125	0,03	0,8	$40,9 \pm 0,4$	$4,8 \pm 0,3$	$69,2 \pm 1,6$

Thus, coordination compounds of microelements in combination with optimal norms of mineral fertilizers improve the technological properties of the fiber and increase the oil content of seeds more than inorganic compounds.

Studies have established that growing cotton using inorganic salts, the content of gross nitrogen in leaves and stems increases to 0.1 and 0.4%, respectively, in leaflets and raw cotton, to 0.1 and 0.8%. There is a tendency for a larger increase in gross nitrogen when the coordination compounds of trace elements are introduced, especially cobalt. When using inorganic salts and coordination compounds of trace elements on the content of phosphorus in the organs of cotton there is a similar pattern.

As one would expect, the greatest removal of nitrogen and phosphorus occurs in raw cotton than other cotton organs, but also in their total removal.

The results of research also found that the content of cobalt and copper in plant organs when they are introduced in the form of inorganic salts is, respectively, from 3.1 to 7.2 and from 0.34 to 1.37, and coordination compounds from 3.4 to 3 , 3 and from 0.41 to 1.47 mg / kg of dry matter versus from 3.9 to 6.7 and from 0.25 to 1.28 mg / kg in the control. It confirms that the coordination compounds of trace elements are less fixed in the soil than their inorganic salts again. The total removal of copper and cobalt by the plant when the coordination compounds of these elements are introduced is 57.6-32.8 and 7.5–8.6 g per hectare, and when inorganic salts are introduced, 52.3– 56.1 and 7.1 – 7.6 g hectare, where as in the control 50.0 and 6.6 g.

Conclusions

In this way, the using of coordination compounds of microelements of cobalt and copper compared with their inorganic salts by locking seeds and adding ammophos in the cotton budding phase enhances growth processes, fruiting, improving the technological properties of the fiber and increasing the yield of raw cotton. The increase of the yield of raw cotton with the use of coordination compounds of trace elements of cobalt and copper on an optimal nutritional background –N250 P175 K125 increases by 4.5 and 5.8 c / ha, respectively, relative to the yield of cotton grown without microelements, and by 2.8 and 3.2 centners / ha in the variants with the use of inorganic salts of these microelements.

References

1. Turakulov A.A. The influence of coordination compounds of trace elements of copper and cobalt on the efficiency of the use of whitewood nitrogen fertilizers. Collection of articles of the VII international scientific-practical conference. Agricultural science of agriculture. Book 2, Barnaul. 2012. P. 269-270.

2. Gundareva A.N. The effect of trace elements on the growth and development of cereal plants (for example, wheat). J. Bulletin of Astrakhan State Technical University. 2009. № 3. P. 197-201.

3. Babina A.E., Jumaniyazova G.I., Narbaeva Kh.S., Zakiryaeva S.I., Mirsagatova A. The content of trace elements in saline soil and cotton plants when using bioprepates RIZOKOM -1 SERHOSIL. J. Scientific Electronic Library LIBRARY. RU.2017. № 2 (36). P. 28-31.

4. Fedko I.V. Medicinal plants are possible sources of major macro and micronutrients. Scientific and methodical electronic magazine "Concent". 2013. No. 3. P. 526-530.

5. Maksimenko E.P., Sheudzhen A.Kh. Scientific basis for the use of complex microfertilizers in rice cultivation. Polythematic network electronic scientific journal Kuban GAU. № 107. (03) 2015.C.56-57.

6. Pirukhunova F.N., Abzalov A. Patterns of interrelation of the content of trace elements with fruit formation and abscission of the cotton plant organisms. J. Scientific Review. Biological sciences. Publishing House "Academy of Natural Sciences" № 3. 2017. P. 93-98.

7. Sattorov ZH.S., Holiulov S.O. Va Va Kuzgi Bouda Uchun Fitning Yilllik Meyeri Wa Ullash Muddatlarini Hisoblab Topichning Ilmi Asoslari. Materali V Congress of the Society of Soil Scientists and Agricultural Chemists of Uzbekistan. (16-17.09.2010) Tashkent. 2010. P. 23-26.

DIAGNOSTICS OF RESISTANCE TO STRESS FACTORS BY MORPHOLOGY, PHYSIOLOGY AND BIOCHEMICAL PARAMETERS

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Changes in the amount of chlorophyll (a + b) and proline amine acids in three barley varieties were studied. The resistance of stress factors has been evaluated based on the changes. Some morphological, physiological and biochemical parameters have been studied in 12-day plants cultivated in different salt concentrations of these varieties. These include seed germination ability, plant height, tolerance index for plant length, and proline amine acid amount. It has been determined that stress factors affect the physiological and biochemical processes of plants and make certain changes in these indicators, these changes are more vivid as stress increases. Number of germnated seeds of barley variety Jamil was greater than in Ughur and St.Garabagh 7. Also tolerance index by plant height in Jamil variety is higher than in ither varieties. In Jamil variety depression in amount of a-b chlorophyl by stres effect is less. amount of proline amino acid increased by the increasing of saturation of salt stress, changing correlation in the control and comparing variants of proline amino acid was 9,9 % in St. Garabagh 7, 4,6 % in Ughur, 16,6 % in Jamil varieties. As a result of the complex study of 3 barley varieties by different methods,compared to the other 2 varieties of barley Camil variety was evaluated as more resistant to salt and drought.

Keywords: barley, resistance, chlorophyll, proline amino acids

Plants cultivated in natural and field conditions are always affected by stress factors. The most important of stress factors are drought and salinity. During their first effects, the body's defense resources, energy resources are mobilized, and by resisting to harmful effects the organism is adapted to the conditions. If in this case, the stress effect stops, the physiological processes in the organism are normalized, but if the organism can not control the effect of harmful factors, the plant becomes weak and dye.

Drought stress is a meteorological event in the general sense and is a rainless phase that affects the development of plants. The resistance of the plants to drought stress is controlled by the genetic system and and changes depending on their genotype, degree and duration of water loss, developmental phase, age, organism and cell type. at all stages of growth and development, the plants need water, but the growing cells are more sensitive to water stress. Synthesis and accumulation of fat, starch and carbohydrates decrease due to drought stress, while the amount of proteins increases [1].

As a result of droughts, green plastids are split, which naturally leads to a decrease in the amount of chlorophyll. A reduction the amount of chlorophyll can be the result of adaptation-during weak drying and adaptation of plants to drought. Osmotic preservatives that help to regulate the osmotic potential in plant cells, susceptible to drought, are collected. Such osmotic preservatives include proline, betains, etc. can be shown [8].

Salinity is one of the factors that affect the productivity, the growth and development of the plants. The salt stress is the osmotic stress that plants are sustainable. Salt affects the development of plants negatively, slows germination, weakens growth, reduces productivity, and in some cases the plant dies.

Given all this, in recent years, the interest in research of physiological and biochemical processes occurring in plants in stressful conditions, which determines the sustainability of the plants to unfavorable environmental factors (drought and salinity)has been increasing. To this end, various diagnostic methods are used.

Materials and research methods

The study included three barley varieties: Jamil (Hordeum L. var. glabriparallelum), standard Garabagh 7 (Hordeum L. x Nutans), Ughur (Hordeum L. Nutans). Cemiland Ugur barley varieties were obtained by Garaybeyova Nargiz, the employee of the Genetic Resources Institute of ANAS. Different diagnostic methods were used in the study.

One of these methods is the study of the sustainability of the plants due to the stress occured by changes in the amount of chlorophyll (a + b) in the leaves. Study of sustainability in this direction was carried out on plants cultivated in the field. Studies of changes in the amount of chlorophyll under the effect of drought and salt stress have been made on the basis of the methodology proposed by the All-Russian Research Institute of Plant Industry [3]. For this purpose, the circles of plant leaves taken from the field during earing phase, placed in distilled water and osmotic solutions (20 atm sucrose and 14 atmNaCl). After 24 hours of stress, these circles were washed; dried and 96 % alcohol was added on them.

The amount of chlorophyll in the spectrophotometer (UV-3100 PC) was 2-wave

length(E665-649 nµ) and the carotenoids content was 450 nµ after storage in dark place for 5-6 days (until full whitening of circle). After the effects of stress, the stress-depression rate was found by comparing the percentage of change of pigments (xl "a" and xl "b") by control variant, and the resistance level of samples to stress factors was determined. The smaller the amount of pigments under stress means that the high resistance of samples.

Proline amino acid is also of great importance in the process of adaptation of plants to drought and salinity stress. In a physiologically normal condition, a certain amount of proline is transferred to the reproductive organs of plants [5]. It is important for the formation of acid seeds and pollen. There are many different ideas of explaining the causes of increased proline amino acids in stressful conditions. According to some authors, there is a positive correlation between the resistance of the plants and the amount of proline. Therefore, this indicator can be used as a biochemical marker of resistance.

Proline synthesis occurs by the pyrroline 5 carboxylatsinteza enzyme located in green chloroplasts and sytoplasma by glutamate way. But its dedragation occurs by the help of proline dehidrogenaza located in mitochondrias [6].

In the plants, a series of signals (Caions) and hormone mediators (Salicyl Acid) also help in the synthesis of the proline.

The amount of amino acid in proline was determined by the Bates [4] method at wavelength of 520nµ.

Research results and discussion

During stress in the plants a number of physiological and biochemical processes occur. Many of these processes are ptotective and adaptthe plants to the degraded environment. If the stress is not continued, the plant will be able to regenerate itself.

Morphophysiological and biochemical changes in plants under the influence of stress are studied by various diagnostic methods. One of the diagnostic methods used to determine plant resistance to stress factors is to study the changes in the amount of chlorophyll (a + b) in plant leaves under stress effect.

Changes in the amount of chlorophyll in the leaves due to the effects of drought and salinity stress are also reflected in our study. In addition to the effects on the physiological status of plants, the salinity and drought stress are significantly affected by the normal course of photosynthesis [1].

In the work of G.V. Udovenko, it is noted that under the influence of stress factors green plastids break down. This naturally leads to a reduction in chlorophyll content and in some cases a decrease in their volume [3]. This results in a weakening of the photosynthesis intensity. This process occurs mainly in unstable plants resistant to stressors, and more chloroplasts are observed to be weakened by photosynthesis intensity. However, there are also cases of increased chlorophyll levels due to stress. This is considered as the result of adaptation of plants to stress factors. This condition is usually observed in genotypes that are resistant to stress factors.

In our study, we investigated changes in the amount of chlorophyll (a + b) from the effects of salinity and drought stress on the leaves of the genotype of barley and tried to determine the relationship between this physiological indicator and plant resistance rates.

The study was conducted on 3 varieties of barley. The amount of chlorophyll (a + b) in 1-day stress leaves in 20 atm sucrose and 14 atmNaCl solutions was studied comparatively.

The studied barley samples reacted differently to stress factors. In some, the amount of chlorophyll (a + b) was reduced compared to control, and in some cases this amount increased (Fig. 1).

Due to the influence of stress factors on barley variety of Jamil, the amount of chlorophyll (a + b) increased by 4% in drought and 3% in salinity as compared with control. In the st.Garabagh 7 variety, due to stress factors there was a 10% reduction in the amount of chlorophyll (a + b) and a 5% decrease in salinity. The Ughur variety exposed to the effets of stress factors, where 15% of chlorophyll (a + b) drought and 9% depression in salinity were compared to control. According to the results, the Jamil barley variety is highly resistant to both stress factors, st.Garabagh 7 variety is more resistant to drought and salinity than the Ughur variety, and the Ughur variety is regarded as medium drought, salt-resistant variety.

The study showed that the samples studied were more resistant to salinity than drought. So compared to st.Garabagh 7, Jamil barley variety showed high resistance to drought and salt. Success sort is st. Compared to the st. Garabagh 7, Ughur was less resistant to stress factors (Fig. 2).

The study also investigated the variation in the amount of chlorophyll (a + b) under stress, as well as the amount of carotenoids that play a key role in the pigment system of plants (Fig. 2).

Carotenoids are fat-soluble orange, red pigments, present in the chloroplasts of all plants, and they are in chloroplasts in non-green parts. Most chlorophyll in green chloroplasts make them invisible. They play an important role in the transfer of light as an added pigment and protect against chlorophyll molecules from irreversible photosynthesis.

As a result of the stress factors in the studied samples also occur changes in the amount of carotenoids. In some cases there was an increase in their number compared to controls, and in some cases a decrease was observed. The reason for this is that carotenoids play a defense role to return stressful chlorophylls to their previous condition, which is accompanied by an increase in their number.

The high tolerance of barley samples to salt stress is explained by the more active salt resistance genes in this plant.
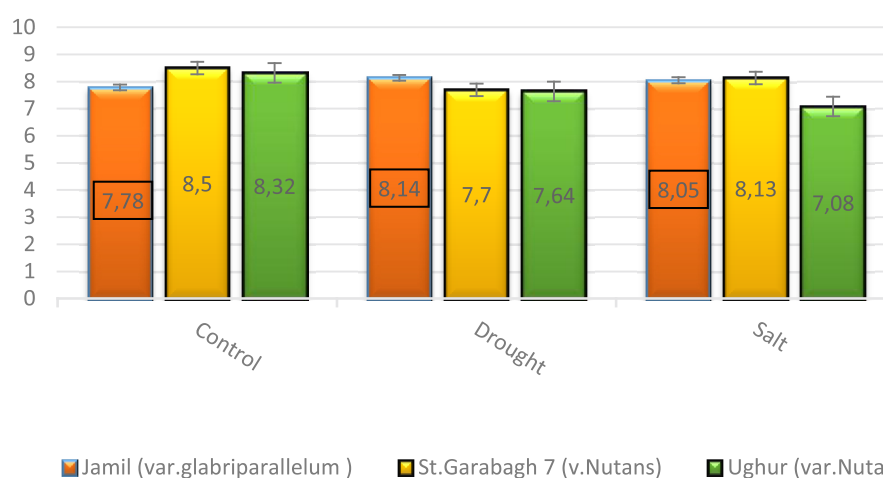
Chlorophyll a+b (in one leave area, Mkgs)

Fig. 1. Determination of resistance of 3 barley samples to stress factors of drought and salinity due to the variability in chlorophyll (a + b)
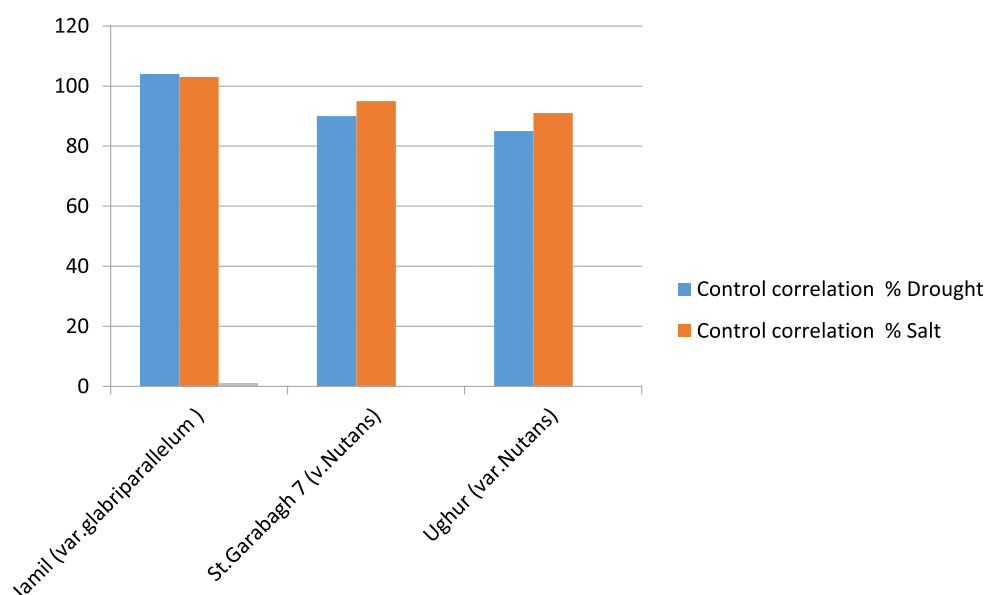
Fig. 2. Determination of the resistance of 3 barley samples to the stress factors of drought and salinity (%)
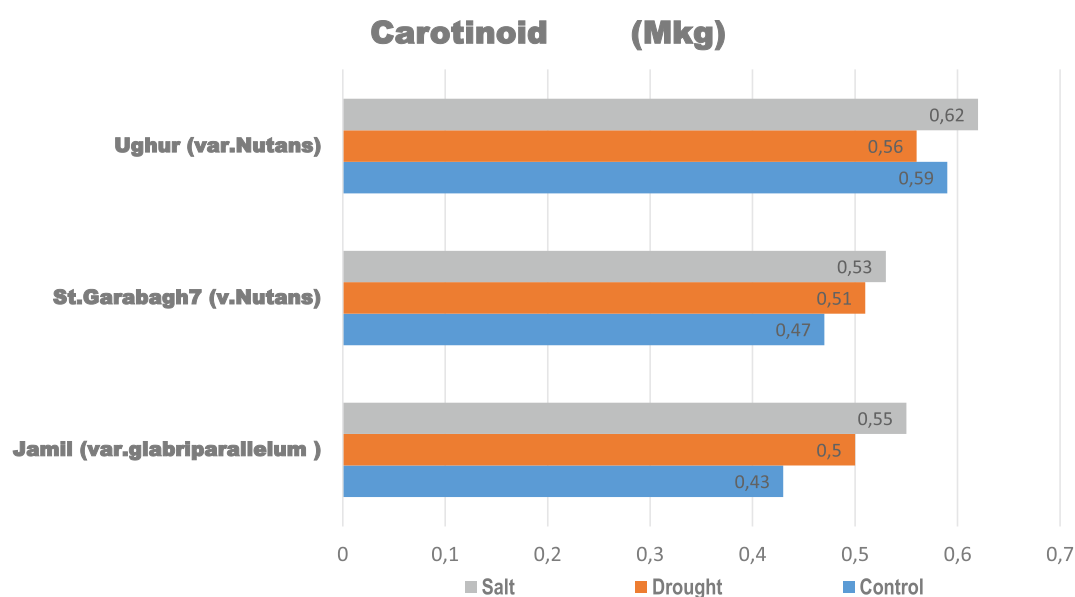
Carotinoid (Mkg)

Fig. 3. Determination of resistance to stress factors of drought and salinity due to variability in carotenoids in 3 samples of barley

We noted that a comprehensive study of stress resistance in several methods allows for more accurate information on resistance. Using these methods in the study, we tried to give an opinion of the salt resistance of Jamil, st.Garabagh 7 and Ughur varieties.

In the study, the ability to germinate seeds in 0.2, 0.3, 0.4, and 0.5% NaCl solutions compared with 100 samples in each sample, the height of plants, the tolerance index by plant height, the amount of proline amino acid, and the increase of proline control to the increase of salt density was comparatively studied with the standard variant [Table 1].

It is known that salt stress negatively affects the germination of seeds due to osmotic limited water intake. During germination the seeds are exposed to high osmotic effects of the environment, and many physiological properties of the plant are determined by the suction force of the seeds [2]. Therefore, in laboratory conditions, the ability to germinate of plant seeds in NaCl solution is considered as the primary indicator of the salt resistance of plants. Of the studied samples, the seeds of Jamil barley variety germinated 98%, 96% in the st Garabagh7 and in the Ughur varieties. The number of seeds germinated in different percentage salt solution varied.

Thus, the number of germinated seeds of the Jamil barley variety was more than the varieties of Ughur and St Garabagh7. For example, in 0.2% NaCl, the number of germinated seeds of Camil barley variety was 83, while in st Garabagh 7 this indicator was 69 and in Ughur varieties was 67. In the 0.5% NaCl solution, the number of seeds germinated in the Camil barley variety was 41, in the st. Garabagh 7 variety was 30, and in the Ughur variety it was 32. Compared to the standard variant, the higher number of seeds of Camil variety in salt solutions give initial information about the salt resistance of this variety.

We have noted that stress factors affect certain physiological and biochemical processes of plants, making certain changes in these parameters, and as the effects of stress increase these changes are indicated saliently. Therefore, we measured the height of 20 plants from each of the three barley varieties germinated in different salt solutions and average figure was found. In experimental and control variants, a tolerance index by plant height was found based on the percentages of growth ratios in plants.

As can be seen from the table, the Camil barley variety was 18 cm in height and the other two varieties was 16.7 and 16.4 cm, respectively. In the 0.2% solution of salt, the height of the germinating plants remained unchanged compared to control. However, salt solutions of 0.3-0.4 and 0.5% had a significant effect on the height of the plants, as the salt content increased; the height was shortened as well.

In the 0.5% salt solution, height of Jamil variety is 10.7 cm tall, in st Garabagh7 is 6.8 cm and 5.6 cm in Ughur variety. The tolerance index of plant height was 59 cm in the barley variety of Jamil, 40 cm in the st Garabagh 7, and 34 in the Ughur variety.

According to the literature, the converse effect of high salt concentration on the plant is explained by a decrease in the amount of cytokine hormone stimulating growth of the plant and an increase in the absorption of the salicyl acid. In addition, high salt saturation and water deficiency inhibits the cell's growth, affecting cell division and differentiation processes. The weakness of the plant grow this its adoptive hormonal response to salt stress [6].

In the plant cells exposed to stress accumulate osmotic preservatives that help regulate osmotic potential, and one of the most osmotic preservatives is proline [5].

It should be noted that during the effect of stress factors the non-used proline amount is accumulated, and this amount may also vary depending on the degree of stress. Our study also found interesting results regarding proline [Table].

The research was carried out on plant leaves, which were harvested in salt solutionsof different percent. As can be seen from the table, each controlbarley variety has specific proline content. This amount is sometimes much higher than the standard (Ughurbarley variety) and sometimes less (in the Jamil barley variety). However, the small and large amount of proline in the control form does not justify its continuity and is specific to each variety. However, there have been various changes in the amount of proline as compared to the control over the change of stress thickening. Thus, as the thickening of saltstress increased, the amount of accumulatedproline increased too.

However, this increase is different in different quantities for each species, for example, the rate of change of proline amino acid in comparison with control due to increased stress response in st.Garabagh 7 barley varieties is 1.4 in 0.2% NaCl solution, 4.1 in 0.3% NaCl solution, 0.4% 7.6 in NaCl solution and 9.9 in 0.5% NaCl solution.

It was found that the increase in prolineamount is gradual. Also, as the salt saturation in the Ughur barley variety increased, the rate of change of proline amino acid was 4.6% in 0.5% NaCl solution, while 1.6% in 0.2% NaCl solution. Correlation of theprolineamino acid with the control was most commonly observed in the Jamil barley variety. This increase was due to the gradual characterization of 0.2% NaCl, 0.3% NaCl and 0.4% NaCl solutions, but increased from the effect 0.5% saltsolution to 16.5%. (Chart).

This increase in the amount of proline indicates that as salt concentration increases, it slows down in metabolic processes, accumulates without consuming proline, and protects the plant from dyeing.

Determination by different diagnostic methods of salt resistance of three barley varieties

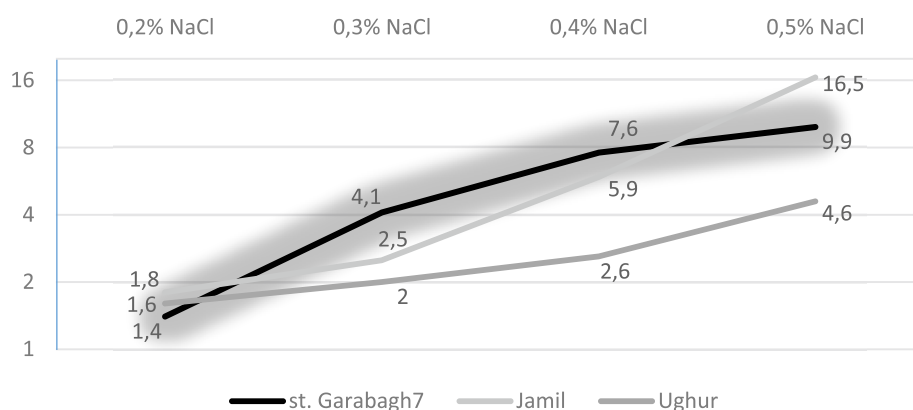| Variants	Germination ability of seeds (pc)	Plant height (cm)	Tolerant index by the plant height, %	Amount of proline amino acid, Ml/mg	Correlation of proline amino acid to control,%
St. Garabagh 7	96	16,7	-	0,16	-
0,2% NaCl	69	16,5	98	0,22	1,4
0,3% NaCl	57	14,5	86	0,64	4,1
0,4% NaCl	36	9,0	53	1,2	7,6
0,5% NaCl	30	6,8	40	1,5	9,9
Jamil control	98	18,0	-	0,10	-
0,2% NaCl	83	18,0	100	0,17	1,8
0,3% NaCl	65	16,8	93	0,25	2,5
0,4% NaCl	51	12,5	70	0,59	5,9
0,5% NaCl	41	10, 7	59	1,7	16,5
Ughur control	96	16,4	-	0,33	-
0,2% NaCl	67	15,5	94	0,55	1,6
0,3% NaCl	55	14,0	85	0,68	2,0
0,4% NaCl	43	7,8	47	0,86	2,6
0,5% NaCl	32	5,6	34	1,5	4,6

Chart. Correlation of change of proline amino acid with control, in %

The literature indicates that there is a positive correlation between proline levels and plant resistance. Thus, we can say that among the three varieties of barley studied, Jamil barley is more resistant than st.Garabagh 7 variety and st.Garabagh 7 variety is more resistant than Ughur variety[7].

A comprehensive study of the salt resistance of the three barley varieties showed that the Jamil variety of barley had exceeded st.Garabagh 7 variety due to its many resistance indicators (seed germination, plant height, proline levels). This also suggests that Jamil barley variety is highly resistant to salt stress. According to the studied indicators Ughur barley varieties was rated as moderately resistant to salt stress, compared to the of st. Garabagh 7 variety.

Conclusion

1. The high salt tolerance of studied barley samples is explained by the more active salt resistance genes in barley plants.

2. Several diagnostic methods have revealed that Camil barley variety is highly resistant to salt and drought.

References

1. Aliyev R.T., Abbasov M.A., Rahimli V.R. "Adaptatoin of stress and plants" Baku-Elm" 2014. P. 343.

2. Aliyev D. R. effect of different thickening of NaClto some morphological indicators of wheat (Tr.durumDesf) genotypes, in amount of malondialdehidevə activity of cataloza enzyme. NewsofANAS (Biology and medicine sciences). 2015. v. 70. № 3. P. 12-18.

3. Udovenko G.V. Study of the physiology of plant resistance to adverse conditions among.Works on applied botany, genetics and selection. Leningrad, 1975. Vol. 56. Issue 1. P. 151-161.

4. Bates L.S., Woldren R.P., Teare L.D. Rapid determination of free proline for water stress studies. IIPlant.Soil. 1973. V. 39. № 1. P. 205-207.

5. Kuznetsov V.V., Shevyakova N.I. Proline stress: a biological role, metabolism, regulation. Plantphysiology. 1999. V. 46. P. 321-336.

6. Ivanov A.A. The combined effect of water and salt stress on the photosynthetic activity of young leaves of different ages. Physiology and biochemistry of cult. plants. 2013. Vol. 45 No. 2. P. 155-162.

7. Kolupaev Yu.E., Weiner A.A., Yastreb T.O. Proline physiological functions and regulation of the content in plants under stressful conditions. Visnik Kharkivka National Agrarian University Biology Series, 2014. VIP. 2. (32). P. 6-22.

8. Ivanov A.A. The combined effect of water and salt stress on the photosynthetic activity of wheat leaves of different ages. Physiology and biochemistry cult. plants. 2013. V. 45, No. 2. P. 155-163.

EXOEMISSION SPECTROSCOPY OF LI AND CU DOPED SODIUM FLUORIDES IRRADIATED WITH ELECTRON BEAMS OF ULTRA-HIGH DOSE

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The luminescence spectral properties of alkali metal fluorides and the influence of various impurity and intrinsic defects have been studied intensively for many years. However, research is still urgently needed on the mechanism of energy transfer to luminescence centers in thermostimulated processes, particularly in systems with pair activation. This is important not only for an understanding of the mechanisms of localization, migration, and relaxation of electronic excitations, but also in a particularly practical aspect – for the development of new, effective thermoluminophores, scintillators, and active optical media. In this area of research, the broad-band ionic dielectric NaF (Eg = 11.7eV) is noteworthy. A working substance NaF:Li,Cu has been proposed for thermoelectronic dosimetry of high-energy electron radiation. The results of thermally stimulated luminescence have been presented. The TSL and TSEE measurements were performed on an automated exo-emission spectrometer in a vacuum of $\sim 10^{-4}$ Pa. It has been shown that NaF:Li,Cu can be used for Thermally Stimulated Exoelectron Emission (TSEE) dosimetry. The results of the study can be used to develop thermoluminescent dosimeters operating at low temperatures. NaF:Li,Cu dosimeters can be used for high-dose dosimetry of high-energy electron radiation (up to 10 MeV). Such dosimeters can be used in technology centres for the radiation modification of functional materials (metals, alloys, ceramics), as well as for sterilization of medical equipment and materials. Such dosimeters can be used in technology centres for the radiation modification of functional materials (metals, alloys, ceramics), as well as for sterilization of medical equipment and materials.

Keywords: fluoride crystals, coactivators, thermo luminescence, dosimetry, ionizing radiation, thermally stimulated exoelectron emission (TSEE), fading

Nowadays, we observe rising demand for high-level TL dosimetry materials due to the development of new radiation technologies applicable in materials testing, sterilization and processing, nuclear medicine, etc. Some of them are based on using electron and ion beam facilities as irradiation sources. It was recently shown that LiF based TLD may be prospective for application in extremely wide dose range of up to twelve orders of magnitude ([1-3]. This inspired us to test thermally stimulated processes of NaF and LiF doped with Li and Cu irradiated with ultra-high dose of electron beam.

Termostimulated luminescence (TSL) is a very sensitive indicator of defects in non-metallic crystals. For dosimetric measurements it is possible to empirically select the material with high radiation sensibility and stability, therefore many dosimeters exist which are based on various substances. A great number of dosimeters are based on sodium fluoride with different admixtures. A very important sub-discipline of dosimetry is the dosimetry of super-high doses, especially at low temperatures.

The work [1, 4] proposed the working substance, which can be used for accumulation of dosimetric information at room temperature. For reading such information, a method of termostimulated exoelectron emission (TSEE) is used. The drawback of such a working substance for TSEE dosimetry is that it is applicable only for registration of low-energy electron radiation up to 150 keV [5-7]. Its application for TSEE dosimetry of higher energy electron radiation (up to 10 MeV) is still not known. There are many different thermo-stimulated dosimeters operating at different temperature conditions and with different types of ionizing radiation [8, 9]. At low temperatures, the sensibility of TSEE dosimeters is higher than that of TSL that is why the former are used more often. The crystals of sodium fluoride with various additives are used as such dosimeters.

To improve properties of TSL dosimeters developed on the basis of basic matrix NaF:Cu, a new working substance was created for TSEE dosimetry of high-energy electron radiation (up to 10 MeV) at high-dose radiation loads (up to 2 MGy). Such a substance should have the increased intensity of TSEE peaks, increased integral output of exoelectronic emission, and, respectively, a heightened sensibility of a dosimetric tract for reading in the dosimetric information.

Our researches of exoemission activities (during thermal stimulation) of a number of

new compositions of a type of NaF+activator (except for activator U, which leads to many TSEE peaks), showed very high emission activity of NaF:Cu and NaF:Li,Cu compositions. This fact opens up the prospect of creating on their base new efficient thermoelectronic sensors for high-dose dosimetry of electron beams with energy of 10 MeV.

Samples and equipment

Studied crystals were grown in air [10] by the Kyropoulos method in in a platinum crucible from NaF of special purity. The melt was doped with 1.0 mol% of Li and 0.1 mol% of Cu. The grown crystals had a cylindrical form having several centimeters length. To measure TSEE, the crystal plates of standard size 5x5 mm were punched of these crystals.

All samples of sodium fluoride with impurities were irradiated by 10 MeV electron beam on the electron accelerator (microtron) at the Department of Experimental Physics UrFU. The target with samples in a form of plates was located 3 centimeters from the exit window of the accelerator. At that distance, the samples received a dose of 15-16 kGy per minute, which was determined using standard film dosimeters of a type SO PD(F)R-5/50. Since such film dosimeters (based on a copolymer with a phenazine dye) are suitable for measuring the doses only up to 50 kGy, higher doses of samples irradiation, the doses of 0.75 and 2 MGy, were provided by selecting necessary exposure time: 50 and 133 minutes.

The TSEE measurements were performed on the automated exoemission spectrometer in vacuum of $\sim 10^{-4}$ Pa, which has a thermostimulation channel providing linear heating of samples in a range of 25–530 °C in a standard heating rate range of 0.1–1 degree/s. For electrons detection, the vacuum electronic multiplier VEM-6 was used. The spectrometer has a computing control system made in the CAMAC standard [11].

Experiment and discussion

Experimental curves (Fig. 1 and Fig. 2) of TSEE of NaF:Li and NaF:Li,Cu crystals irradiated by electron beam dose of 750 kGy are shown in Fig. 1 and Fig. 2.

As can be seen from Fig. 1, in the case of crystals NaF:Li, the maxima of TSEE bands are located at 163, 228, 254, 285, and 322 °C. The bands of 228 and 254 °C are manifested in TSEE spectrum as a single peak at 237 °C, which, as is clearly seen in Fig.1, is dominant.

In the case of crystals NaF:Li,Cu in Fig. 2 the band at 237 °C remains dominant in TSEE

curves (it consists of two bands at 226 and 251 °C), its intensity significantly increases from 10 000 to 30 000 relative units. The intensity of a higher TSEE temperature peak of NaF:Li,Cu crystals at 338 °C is no more than 25 % relative to the intensity of the main TSEE peak at 237 °C. Thus, the composition of NaF:Li may be of interest as the working substance for TSEE dosimetry (of high energy and high doses), having a position of the main TSEE peak at 237 °C.
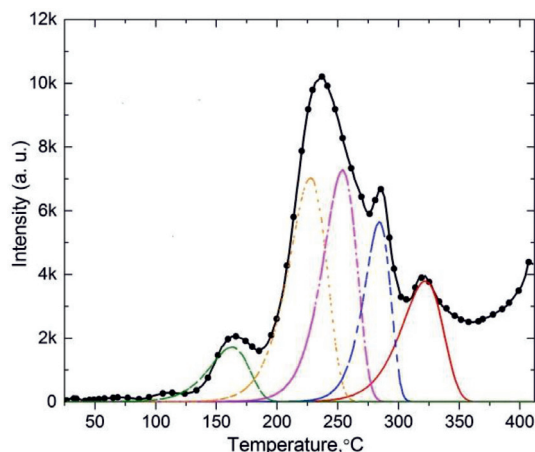
Fig. 1. TSEE glow curves for NaF:Li crystals, dose 750 kGy

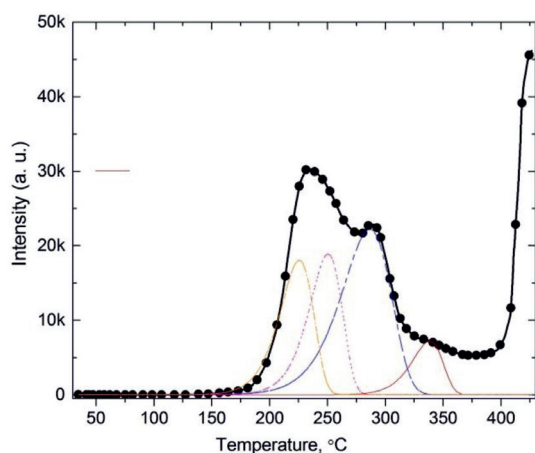Fig. 2. TSEE glow curves for NaF:Li,Cu crystals, dose 750 kGy

The effects of higher-dose electron radiation, namely of 2 MGy were verified for NaF:Li,Cu crystals. The curves of TSEE are shown in Fig. 3. At a dose of 2 MGy, in curves TSEE the intensive band is observed shifted (compared to the dose effect of 0.75 MGy) in area of higher temperatures: 250–350 °C with maximum at 330 °C. It is stipulated

by a number of traps associated with TSEE peaks at 281, 303 and 330 °C. Thus, at high doses of electron irradiation in NaF:Li,Cu crystals, the traps are repopulated in favor of a deeper one which is responsible for a high-temperature band at 330 °C. Small traps (TSEE bands at 195 and 218 °C) are weakly manifested during thermal stimulation; their share in TSEE does not exceed some percent.

The experiments have shown that the crystals of NaF:Li,Cu are not convenient enough in practical terms for registration of doses of radiation exposure (2 MGy) due to a high-temperature position of a TSEE peak (330 °C, Fig. 3) because they require additional time for dosimetric information reading.

However, they seem to be more convenient TSEE sensors in practice when registering moderate doses up to 0.75 MGy because dominant TSEE bands are located almost a hundred degrees lower at 237 °C.
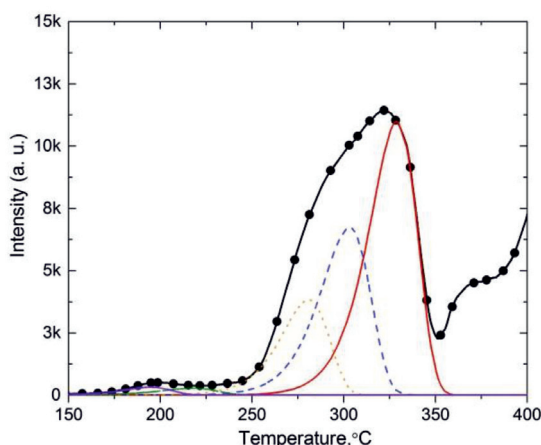

Fig. 3. TSEE glow curves for NaF:Li,Cu crystals, dose 2 MGy

The dosimeter [12] based on sodium fluoride with lithium and copper admixture has one rather intense peak of thermo luminescence (Fig. 4). The peak is at 198 °C. The fading is quite small: the peak intensity decreased by 9.7 % for 28 days. The linearity is from 500 kGy to 2.5 MGy.

Thus, the substance NaF:Li,Cu is suitable for TSEE dosimetry of electron radiation and can be used for high-dose dosimetry of electron radiation (up to 10 MeV) used in technological centers for radiation modification of functional materials (metals, alloys, ceramics), as well as for medical equipment and materials sterilization.
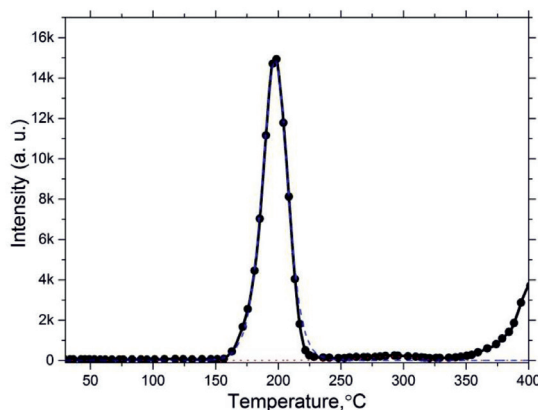
Fig. 4. TSEE glow curves for NaF:Cu crystals, dose 2 MGy

Conclusion

In conclusion, well-defined and regular-shaped single crystals of NaF:Li, NaF:Li,Cu, NaF:Cu were successfully synthesized using the Kiropoulos method and irradiated with ultra-high dose electron beams of 10 MeV. All the samples revealed good radiation resistance and sensitivity to the irradiation doses applied. The results of TSEE and TL measurements suggest complicated structure of defects in the crystals that can hardly be modelled with the commonly applied model of first-order process. In connection with the observed TL and TSEE glow curves, it is possible to tentatively propose application of the crystals for application in ultra-high dose TL and TSEE dosimetry. This proposition, however, should be further supported by in-depth investigation of TL and TSEE response of the crystals depending on dopant concentration, dose and energy of electron beams.

References

1. Kazakbaeva Z.M., Ogorodnikov I.N. et al. Thermostimulated luminescence of activated crystals NaF-(Pb, U) // Journal of Applied Spectroscopy. 1992. V.56. (1). P. 34-38.

2. Slesarev A.I., Uporova Y.Y., Cherepanov A.N., Kidibayev M.M., Joldoshev B.K. Luminescent materials and solid-state detectors of ionizing radiation // Abstracts of the IV Ural seminar TTD-2008. Yekaterinburg: UGTU-UPI. 2008. P. 105-106.

3. Riggin M., Radhakrishna S., Whippey P.W. Thermoluminescence of X-irradiated alkali fluoride crystals // Phys. Status Solidi. 1976. A 37. P. 51-56.

4. Mariani D.F., Alvarez Rivas J.L. Thermoluminescence in KI, KBr, NaCl and NaF crystals irradiated at room temperature // J Phys. C: Solid State Phys 1978. P. 3499-3509.

5. Berger T., Hajek M. TL-efficiency – overview and experimental results over the years // Rad. Measur. 2008. P. 146-156.

6. Zimmerman D.W., Rhyner C.R., Cameron J.R. Thermal annealing effects on the thermoluminescence of LiF // Health Phys. 12 P. 525-531.

7. Zimmerman J. Thermally stimulated processes in Li and Cu doped alkali fluorides irradiated with electron beams of ultra-high dose // J. Physics C: Solid State Phys 1971. 4 P. 3277-3291.

8. Stoebe T.G., Watanabe S. Thermoluminescence and lattice defects in LiF // Phys. Status Solidi 1975. A 29. P. 11-29.

9. Kortov V.S., Isakova G.V., Slesarev A.I. et al. // Flaw detection 1996. N1. P. 50-59.

10. Alybakov A.A., Gubanova V.A., Denisov G.S. et al. Influence of oxygen centers on the thermo-luminescence of NaF crystals // Physica status solidi (b). 1984. V. 124 (1). P. K75 – K78.

11. Koroleva T.S., Pedrini H., Moretti P., Shulgin B.V. et al. The effect of ion beams on luminescent optical properties of sodium fluoride and lithium monocrystals // Intercollegiate collection of scientific works. Yekaterinburg: GOU VPO UGTU-UPI. 2003. Issue 15.

12. Mamytbekov Zh.K., Tcherepanov A.N., Slesarev A.I. et al. Thermally stimulated processes in Li and Cu doped alkali fluorides irradiated with electron beams of ultra-high dose // IOP Conf. Series: Journal of Physics: Conf. Series 830. 2017. 012143.

PROBLEMS OF STATE MANAGEMENT OVER FOREST COMPLEX AS A FACTOR OF IMPROVING ECOLOGY AND WAYS TO THEIR SOLUTION: DOMESTIC AND FOREIGN EXPERIENCE

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This article presents the role of forest complex in economy of a country, reflects basic problems of state forest complex management, influence of forest complex upon improvement of ecology, concept of usage and reproduction of forest resources. Considering the fact that activity of forest industry if based upon usage of replenished forest recourses, we should devote our attention to questions of ecology. The main attention must be devoted to the necessity of using forest in complex fashion, as it serves as foundation of preserving natural complex and, therefore, increasing stability of social-economic development of territories. The work also touches upon main problems of forest complex and services, included into it. References are presented to key approaches and specific features of forestry management system in USA, Canada, Finland, and Italy. It is shown that modern system of state forest usage in Russian Federation is defined by Forest code of Russian Federation and based upon the principle of distributing responsibilities between levels of state authority, first of all, between Russian Federation and subjects of Russian Federation. In the conclusion of this material we formulate the concept of successful measured that will provide for development of forestry in economy that are possible only at the foundation of complex approach in two areas: forest usage and forest industry that will have a positive effect upon overall improvement of economy.

Keywords: forest complex, state regulation, restoration of forest resources, ecology

Within economy of a country forest complex occupies and important position. It includes forestry and sectors of forest industry on procurement and procession of wood, plays a significant role in social-economic development of many regions, and defines export positions of a country at the world market.

The intensified influence of human upon natural territorial complexes, particularly destruction of forest in industrial scale, started the worldwide processes of change in climate, water balance, depletion of flora and fauna. Along with growth of ecological problems, forest become not only a factor of production, but also an important factor of stability in social-economic development of countries and territories. This phenomenon defines the necessity to draw attention of scientists and practicians towards complex usage of forest as a recreational resource and foundation of preserving natural complex.

However, in our opinion, insufficient attention is devoted to aspect of managing complex forest usage in terms of transition towards postindustrial economy, developing instruments of motivating business subjects to use forest resources in complex and develop technologies of function for this mechanism in practice of managing forestry. Supposedly, complex usage of forest resources will enable increase in intensity of forest complex development in a region and stability of social-economic development of territories.

As we know, the conception "forest complex" was used for the first time in 1972 in works by All-union conference "Usage and reproduction of forest resources in Far East". During the period from 1976 to 1992 a number of works was published, and they contained different opinions on the content of this conception.

Besides, forest complex includes different services that carry out protective, sanitary-aesthetic, water supplying, recreational function of forest that are not all organized as sectorial operators, but their significance in national business complex grows continuously.

Significance of forest industry in the country, economy is determined not only by huge deposits of wood and local prevalence of forest resources, but also by wide integration of it with different sectors of economy – construction, industry, transportation, agriculture, and communal service.

Russia is one of the largest forest empire of the world, it concentrates almost ¼ of the world's wood deposits. In 2018 in combination with forest it formed 883 million ha, embracing 776,1 million ha, or 45 % of the country territory, wood deposits were estimated as 82,1 billion m^3.

Within the structure of industrial production of Russia forest industry complex occupies the seventh place in output volume, and fifth – in amount of export. At the same time the most important part forest sector plays in economy of European North, many-forest

regions of Eastern and Western Siberia, at Far East this sector is the least popular one – industrial fuel and base metal.

Forest complex represents a totality of activity and production types in the area of business environment, a single object of labour (forest resources), and consecutive implementation of production processes according to their usage, reproduction, and protection.

The existing concepts and definitions touch upon various aspects of usage and reproduction of forest resources. The main concept of forest sector must reflect conditions, required to organize stable forest usage. Therefore, the main objective of forest complex is "procurement of forest product in maximum amount with minimal costs at the foundation of rational usage of forest resources" [4].

Forest industrial complex is a complex that includes: wood procurement subjector – procurement of wood, its initial procession, rafting and wood procession; wood procession – production of wood, plywood, wooden boards, carpenting objects, wood storage, etc.; cellulose-paper industry; furniture and wood procession industry [6].

Efficient management of forest structure requires a strict system of rules and principles.

Nowadays forest complex includes:

– Considering assortment of forest industry, subsectors (forestry, wood procession, cellulose-paper industry, hydrolysis), industrial, and wood processing industry;

– Production of wood materials (collection and procession of byproducts, hunting and fishing);

– Export of wood;

– Regarding scientific-research institutes of forestry and training staff for sectors of forestry;

– Construction works;

– Repair services with elements of machinery [7].

Besides, forest complex includes various services that maintain protective, sanitary-aesthetic, water managing, recreational function of forest. Not all of them are organized as sectorial operators, but their role and significance in national business complex grows continuously.

Russian forest industry is presented by such sectors as wood procession and paper industry, wood procurement, and wood procession. These sectors form around 4 % of total volume of industrial product output in Russian Federation (4 % of export revenue, 8 % of staff number, and 2,3 % of basic assets cost [5].

Within structure of forest we can outline the following complexes: forestry, forestry,

and each of them should be studied as an independent system of management.

Forest complex provides multiplication, protection, and usage of forest recourses. The leading component is forest reproduction of trees and bushes. Forest output power is defined by annual growth of wood that can be used in production of wood materials. It is related closely with production of wood that terminates reproduction process in forestry. Forest production creates a foundation for preparation of woodcutting materials [3].

Forest complex also includes forest hunting business. Forest hunting is the most efficient, therefore, in order to establish rational usage and reproduction of not only vegetative resources, but also animals, complex forest hunting campaigns are organized frequently.

Production in field of utilizing waste, related to procurement of turpentine, occupies a middle place between forestry and forest industry. It is usage of lively pine tree standings and includes production of stump resin. Regarding wood processing industry within forestry, subsidiary of a company bears auxiliary nature and is primarily designed to process low-value wood [2].

Forest sector is a source of forest resources. This form of nature usage plays a special role in preservation and improvement of ecology. Particularly, forests play a critical role in processing carbon dioxide and maintenance of planet's oxygen deposits, collection of fresh water resources, protection of soil from wind and water erosion. Forest have an effective impact upon temperature and wind conditions of territories, amount and unity of fallout, mass of air, clean from dust and hazardous admixtures.

The existing sectorial structure of forest complex in Russian Federation is incomplete, as it is directed towards procurement and procession of mainly large wood materials. However, not all sales have been discovered in regard to fine wood. It is related to the fact that cellulose-paper and hydrolysis industries, being the major consumers of fine grain wood, are not sufficiently developed. For the same reason waste of wood procurement and wood procession is not used sufficiently [1].

In this regard experience of Italy is interesting, as there most forestry authorities have been transited to local level of government [8]. Unlike Canada, where most of forest areas are private property (no less than 60 %, rest of forests are in ownership of local authorities). Forest usage in Italy is defined by extreme stability, particularly due to the fact many problems are

regulated by documents, accepted 200 years ago. Management is carried out within plans, confirmed and developed by municipalities with minimal finance from state budget. The major function of local executive authorities is comparable with staff composition and structure of former Russian forestry. Besides, within structure of forest management body it is possible that one of forest police specialist will carry out functions of controlling usage of forest resources [8].

In USA the structure of state forest usage really emerged in early 1920-ies, during centuries before that, until 1905, forest service has been founded at the level of federal government. Until then problems of reproduction and protection of forests were almost ignored at the level of governments and authorities, and forest resources were considered as almost inexhaustible. The key feature of forest management system in USA is active and legally-fixed participation of citizens and various institutions of civil society in making key decisions in the area of managing forestry. Particularly, it is necessary to discuss with citizens and social organizations problems of preparing documents on planning measures targeting usage, protection, and reproduction of forest resources.

Nowadays Forest service of USA is under jurisdiction of federal ministry of agriculture. Particularly, authorities of this service include:

– preserving productivity of forests;
– protecting wildlife and recreation areas;
– protecting cargo [8].

Most of forests in USA are under private property (no less than 75 % as per 2016) [8].

Experience of Finland in organizing state forest usage is considered exemplary among experts. Finland achieved a significant progress in this area of national economy.

Structure of forest management in Finland includes only 6 organizations of different legal-organization forms. Ministry of forestry and agriculture is the main institution within structure of managing forestry in Finland that is responsible for developing state policy strategy, and programme in field of managing and using forest resources. Ministry of forestry and agriculture includes 13 regional centers and specialized organizations, Center of developing forestry Tapio. Practical realization of state policy of Finland in the area of forest usage is delegated to territorial branch of Ministry of regional forest centers, created by 13 parts [8]. These centers mostly create possibilities for improvement in quality of forest sites, support forest owners, prepare plans for their usage and

exploitation, and also maintain control and supervision functions.

State forests are under jurisdiction of a special state trust, called "Forest service". This service also provides economic exploitation and usage of state forests and organizes and maintains operation on processing and reproducing forest resources. At the same time the trust has different sources of income and financing in its activity. The most work on protecting and reproducing forest resources is financed from the revenue of exploiting forest resources in state ownership. Besides, it received subsidies for realizing separate authorities in the area of protecting and preserving forests.

In Finland 60 % of forest are under private property. There are 735 thousand forest owners in the country, average size of territory equals 30 ha, the sate owns 25 % of forests and only 10 % of large enterprises. Area of forests that must be assigned annually for procurement of wood, forms 550 thousand ha, area of forest reproduction – 160-170 thousand ha, natural afforestation – 37 %, this data is confirmed by regional forest government.

On the whole, modern system of state forest usage in Russian Federation is defined by Forest code of Russian Federation and based upon the principle of dividing authorities between levels of state power, first of all, Russian Federation and its subjects.

Delegating authorities in managing forestry of Russian Federation is designed for establishing a system wihtin which subjects of Russian Federation will play a specific role in standard state system of managing forestry. According to this solution by founders of Russian Federation, there are subjects of Russian Federation, authorized to manage 93 % of all forests in Russian Federation, including:

– organization of state protection of forests and forest control;
– development and review of plans and rules within forestry system
– organization of forestry, forest resources, and forest usage;
– organization of forest usage system and forestry at the territory of Russian Federation.

Activity of forest industrial complex is based upon usage of reproduced forest resources, therefore, when we speak of managing forest industrial complex, we should address problems of ecology. Successful realization of measures, designed for development of forestry in economy, is possible only within complex approach in two areas – forest usage and forest industry, and will have a positive effect on overall improvement of ecology.

References

1. Isayev A.S. Urgent problems of forest policy in Russia / A.S. Isayev, G.N. Korovin // Forestry. 2004. № 3. P. 9–12.

2. Kozhemyako N.P. Managing strategic development of forest sector in Russian Federation according to principles of private-state partnership / N.P. Kozhemyako: textbook. Moscow: Federal state unitary institution "State scientific center of forest industrial complex", 2017. 160 p.

3. Concept of developing forestry in Russian Federation for the period 2003-2010: decision by government of Russian Federation dated 18.01.2003. Moscow: All-Russian scientific-research institute of forest management and mechanization of forestry. 22 p.

4. Forest complex of Russian Federation and foreign countries: statistic collection. Moscow: State educational institution of higher professional education Moscow state university of forest. 2017. 233 p.

5. On affirmation of Resolution of maintaining state forest control and supervision: decision by Government of Vologda region dated 22.06.2007 № 394. Moscow, Os', 2014. 36 p.

6. On affirmation of strategy of forest complex of Russian Federation during the period until 2020 [Digital source]: decision by Government of Vologda region dated 28.12.2016 № 406 – Access regime: http://Strategiya_razvitiya_lesnogo_kompleksa.pdf.

7. On prior investment projects in the area of forest usage [Digital source]: decision by Government of Russian Federation dated 30.06.2007 № 419 – Access regime: http://base.garant.ru/12154618.

8. Shmatkov N. Examples of foreign experience of stable forest management and forest usage: collection of articles / ed. by N. Shmatkov; Worldwide wildlife fund (WWF). Moscow: INFRA, 2012. 180 p.

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SPECIFICS OF STATE MANAGEMENT OVER FOREST COMPLEX

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The article presents the role of forest complex and strategy of its development, the necessity to improve organizational structure of forest management, explains directions of innovative development of forest complex. It demonstrates the necessity to maintain the system of rules and principles in order to provide for efficient management over forest complex, within which each complex should be considered as an independent system of management. The article presents in detail elements of forest complex. It is also explained in this work that the existing sectorial structure of forest complex in Russian Federation is incomplete, as cellulose-paper and hydrolize industry, being the major consumers of fine-grain wood, are not sufficiently developed. For the same reason, waste, produced by wood-procuring enterprises, are used in insufficient amount. Specifics of managing forest complexes are also shown in this work. The article contains an example of implementing Strategy of developing forest complex that corresponds to international law and forest legislation of subjects of Russian Federation in unity with legislation that regulates usage, preservation, and replenishment of forests. Improvement of organizational structure of managing forests is defined by an organization of a designated body of state forest management at federal, regional, and municipal level of government and empowered with the required jurisdiction to fulfil its objectives and realize National policy of forest management. Considering the specifics and requirements towards improvement of ecology, we can speculate on transition of forest complex from regime of activity to regime of development.

Keywords: forest complex, strategy of development, organization structure, national forest policy

As it is pointed out in bibliographic sources, successful management of forest complex requires a strict system of rules and principles.

Nowadays forest complex includes the following elements:

– Considering the assortment of wood industry, subsectors (forestry, wood procession, cellulose-paper industry, hydrolize), industrial, and wood processing industry;

– Production of wood materials;

– Export of wood;

– In relation to scientific-research institutions of forestry – training of staff for forestry sector;

– Construction works;

– Repair service with elements of machinery.

Russian forest industry is represented by such sectors as wood procession, paper industry, wood procurement, and wood procession. It forms around 4% of the whole output volume of industry of Russian Federation (4% of export revenue, 8% of work places, and 2,3% of cost of basic assets [5].

Within structure of forest we can outline complexes of forestry, and each of them should be studied as an independent system of management.

Forest complex includes scientific-research and project organizations and institutions, involved in solution of scientific-research and engineering-economic problems that present certain interest for industrial complex.

Forest complex provides for multiplication, preservation, and usage of forest resources. The leading function is restoration of trees and bushes. Power capacity of wood production is defined by annual growth of wood that can be used in preparation of wood materials. It is related closely with production of wood that terminates restoration process in forestry. Wood production creates foundation for procurement of woodcutting materials.

Forest complex also includes forest-hunting sector. Forest hunting is the most efficient type of hunting. Therefore, in order to provide for rational usage and restoration of both flora and fauna resources, complex hunting campaigns are implemented frequently.

Enterprises of utilizing wastes, related to procurement of turpentine, occupies a middle position between forestry and forest industry. It embraces a life-time usage of pine tree standings. This production can also include production of stump resin. As for wood procession industry within forestry, a subsidiary of the main company can bear assisting functions and is aimed to process low-value wood.

Forest sector of economy is a source of wood resources. This form of nature usage plays a special role in preserving and improving life environment. Forests are the main consumers of carbon dioxide and they support planetary deposits of oxygen, accumulate fresh water resources, protect soil from wind and water erosion. Forests have an effective impact upon temperature and wind conditions of terrain, amount and distribution of fallout, mass of air, clean from dust and harmful additions.

The existing sectorial structure of forest complex in Russian Federation is incomplete, as it is directed towards procurement and procession of mainly large wood materials. However, when it comes to small wood, not all transactions that took place in the country, were discovered. It is related to the fact that cellulose-paper and hydrolize industry, being the major consumers of fine-grain wood, are not sufficiently developed. For the same reason, waste, produced by wood-procuring enterprises, are used in insufficient amount.

Activity of forest industrial complex is based upon usage of restored forest resources, therefore, when we speak of managing forest industry, we should consider problems of forest usage. A typical feature of management over forest industry is the fact that it combines both sides of activity.

Thus, successful realization of measures that provide for development of forestry in economy, is only possible in case of implementing complex approach in two areas – forest usage and forest industry. This underlines the urgency of managing forest complex.

Under managing forest complex we usually understand a purposeful influence of government bodies (business subjects) upon administrative object that provides for achievement of strategic objectives of forest complex with consideration of specific conditions of different regions.

Specifics of managing forest complexes consists in the fact that it embraces two aspects of activity. First of all, it is the fullest possible and most efficient fulfilment of demand of society for various wood resources. The second objective is defined by necessity not only to preserve, but also improve quality of this important restored resource.

Thus, forest usage of a complex is closely related with two directions in forestry and wood processing activity that define their objectives, problems, and different forms of property [3].

The foundation of forest legislation is set in the first regulations of Soviet government – "on soil" and "on forests". In these documents, all forests were claimed as state property. In 1923 the first Forest code of the country was accepted, and it defined the single legalized system of organizing and managing forestry all around the country. Therefore, state regulation of forest relations received an adequate legal foundation for provision of rational forest usage, preservation and restoration of them [6].

Acceptation of Forest code in 2006 is an important step in process of developing forest complex. It suggests new mechanisms of interaction between subjects of forest relations as well as continuation of institutional upgrades within the system of managing forests, directed towards decentralization of it [4].

Forest code is a normative legal act that regulates relations with forests and organization of forest usage in Russian Federation.

Acceptation of it resulted in the most significant changes in state system of forest usage in history of Russia.

We should underline that for a long time normative acts on forests that were directed towards intensive usage and exploitation of forest resources did not make a strong emphasis upon the basic principle of managing waste which is the priority in protection of natural objects before their usage.

At the national level a policy of Russian Federation that corresponds to interests of state, business, and society, is being formed and accepted. Normative-legal foundation is being developed in order to establish implementation of Strategy of forest complex development that will correspond to international law and forest legislation of subjects of Russian Federation in union with legislation that regulates usage, protection, and restoration of forests.

Improving organizational structure of forest management is defined by organization of special authorized body of state forest regulation at federal, regional, and municipal level of government that will be empowered with authority of state forest management, managing and controlling service weapons, arms, and defense system in accordance with legislation [5].

Federal level:

– Developing policy of developing forest complex;

– Regulating within sector of forestry;

– Supervising implementation of authority by subjects of Russian Federation;

– Inter-regional management of fire protection in forests;

– National Forest Cadaster;

– Providing cadaster accounting of forest sites;

– Monitoring forest usage, forest fires, and forest pathologies, monitoring radiation condition of forests;

– Organizing production of forest seeds;

– Coordinating activity of regional forest authorities that include executive bodies of founding authorities of Russian Federation;

– Optimizing forest science and forest education;

– Realizing international responsibilities of Russian Federation in the sector of forestry;

– Organizing inter-regional cooperation in case of forest emergency.

An important element of forest usage is organization of forest usage. Nowadays about

40% of forests, included in Forest inventory for period over 10 years in total value of over 3 million ha, that previously belonged to agricultural organizations, have not been accounted for forest inventory [1].

The major part of management functions has been transferred to regions. They are also authorized to act as owners of forest territories, carry out executive and administrative, control, and certain regulatory functions.

Decentralization of managing forestry implies creating at the level of Federation subjects independent management structures and authorized bodies of executive power in the area of forest relations – regional bodies of power [7].

Regional bodies of power will carry out functions on providing state services and managing state property in the area of forest relations, along with bodies of law-enforcement activity at the territory of Russian Federation. Regional authorities that carry out state management and realization of a subject's jurisdiction in the area of forest relations directly or via jurisdictional state enterprises and institutions of Russian Federation. Financing activity of regional authorities is carried out with means of budget of Russian Federation.

Further we present you regional structure of forest management.

Territorial authorities of federal institution of forest management include bodies of managing forestry in subjects of Russian Federation and forest sites of federal authority of forest management [8].

Federal management of forestry and national parks in amount, required for maintaining state administrative activity in the area of implementing, protecting forest resources and restoration of forests.

Exploitation of forests undergoes in order to maintain their multi-functional, rational, continuous, stable usage, along with development of forest industry. Forest usage is carried out in accordance with their purpose and realized their useful functions.

According to civil law of Russian Federation, all forest sites and forests, located within territories of defense, are federal property. Civil law and Forest code of Russian Federation guarantee to citizens their right to be at the grounds of forest fund and in forests, not included into forest fund. Citizens and organizations, located at the territories of forest fund, can be guaranteed of rights of usage: permanent (expressed) usage, lease, granted expressed usage [2].

The main condition of managing regional forest complex is balance of ecological, economic, and social objectives; economic responsibility of forest relations in dependence of their authorities; maintenance financial variants of their implementation; economic interest of forest relations in creation of stable management of forest complex.

Therefore, the objective of regional authorities is to create conditions, required for innovative development of forest complex.

The main conditions and requirements towards management of forest complex should be those that are related objectively to processes that undergo in state and economy.

Particularly, they include:
– changes in system of economic relations;
– distribution of forest complex management between priority national projects;
– foundation and preparation of the required normative base.

These conditions play the part of initial premises for economic relations in forest complex.

However, as domestic and foreign experience shows, the foundation of managing forestry consists in complex problem of defining and learning principles, among which the main attention is devoted to the existing conditions and conditions that still exist. In this case we speak of transition of forest complex from regime of activity to regime of development. Therefore, concept of regional forest usage should be studied as one among many stages of continuous process of forest usage development.

References

1. Dmitriyev D., Alekseyev M. New trends in development of forest industrial complex // Lesprominform. 2017. № 8. P. 37–41.

2. Kozhemyako N.P. Managing strategic development of forest sector of Russian Federation at the principles of private-state partnership: textbook. Moscow, Federal state institution "State scientific center of forest industry complex", 2017. 160 p.

3. Korchagov S.A., Mironov A.V. Problems of using and reproducing forests at territories of forest fund of Vologda region // Forest magazine. 2016. № 173. P. 14–16.

4. Naduyeva Y.A. Financial-tax mechanism of developing forest industry complex: monograph. Moscow, Infra-M, 2015. 32 p.

5. On confirmation of strategy of forest complex in Russian Federation for the period up to 2020 [Digital source]: decree by Government of Vologda region dated 28.12.2016 № 406 – Access regime: http://Strategiya_razvitiya_lesnogo_kompleksa.pdf.

6. Public report on results of activity of Department of forest complex of Vologda region in 2018

7. Shmatkova N. Intensive forestry of Finland through the eyes of tutors in Russian universities // Stable forest usage. 2012. № 2. P. 21–30.

8. Shmatkova N. Examples of foreign experience in efficient forest management and forest usage: collection of articles / ed. by N. Shmatkov; World wildlife fund (WWF). Moscow, INFRA, 2012. 180 p.

PROBLEMS AND PROSPECTS OF DEVELOPING FOREST COMPLEX OF VOLOGDA REGION AS A METHOD OF IMPROVING ECOLOGY

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The article presents the role of forest complex that represents a totality of types of activity and production in the sector of land business area. The work studies problems of forest complex of Vologda region, reveals system of rules and principles, designed for efficient management of it, draws our attention to social-economic development of the region, explains the growing significance of regional investment fund of innovative development of forestry. One of many directions of regional investment fund is broadening the scale of forest replenishment via mutual funding of important programmes and projects that are realized through private companies within the frame of state-private partnership and include intensive forestry activity. In long-term perspective quality and productivity of forests can be improved through optimization of income and costs of forest management. The result of our research is the suggested algorithm of Fund creation. We also conclude that a number of unanswered questions remains, and they refer to provision of mandate fulfilment at regional level and creation of optimal management structure, implementation of federal forest supervision and enforcement of law legislation. Nowadays improvement of existing forestry legislation and normative acts bears a special significance. It is important to ensure timely preparation, qualification improvement, and re-training of forestry staff, attraction of young specialists.

Keywords: forest complex, social-economic development of region, investment fund

Vologda region is one of the richest regions of Russian Federation. Forests of the region are significant for economic development not only the region itself, but also fulfilment consumers' demand in terms of Union and export of wood. Close proximity to major consumers of wood production – forests with deficit, located in Central, Southern, and Western economic region pre-defined the priority of Vologda region in implementing measures, aimed to improve usage of forests and labour productivity. This fact requires further, more specific study research of these forests, their function, reconstruction, and usage in terms of establishing a clear orientation of forestry towards basic parameters of its management in both short- and long-term perspective [3].

Social-economic development of the region is closely related to broadening and regional management of natural resources, the main one of which if wood. In terms of wood provision the region occupies one of the leading positions in Russia.

Vologda wood processing complex consists of wood procurement, wood processing, and cellulose-paper industry.

Forest resources cover 11,7 million ha, it forms 81% of the region surface, including pure forests in the area of 10,03 million ha, or 69,4%.

At the region territory lands are protected by natural territories – 121 thousand ha, and lands of defense and security – 62,9 thousand ha, the share of forest areas in land fund of the region forms 1,3 million ha. The total area of forest fund under jurisdiction of ministry of forest complex of Vologda region forms 11,5 million ha, including lands, covered by forest standings – 9,8 million ha [4].

According to their purpose forests of Vologda region are divided into protective and exploitation:

– The area of protective forests forms 1781,0 thousand ha (15,5% of the total area);

– The area of exploitation forests forms 9692,3 thousand ha (84,5% of the total area). Overall standing deposit in the region equals 1614,2 million m^2, including deposits of ripe and overgrown standings – 1062,7 million m^2.

According to the prevailing species, territories, covered with forest are divided in the folloing correlation:

– Prevalence of pine – 2226,4 thousand ha, 386,8 million m^2;

– Prevalence of spruce – 2799,3 thousand ha, 430,4 million m^2;

– Prevalence of birch – 3676 thousand ha, 591,5 million m^2;

– Prevalence of asp – 961,1 thousand ha,182,1 million m^2.

Apart from the mentioned species, the largest forest masses are presented by osier, black alder, grey alder, masesen, and cedar. Mature and grown gardens prevail in age groups – 48,8% of territory, covered with forest, the youth forms 19,8%, standings of middle age – 19,4%, and 12% is formed by sprouts [3].

Forest industry of the region plays a significant role in volumes of production in forestry of North-Western federal district.

A number of measures provided for decrease in number of illegal cuttings. In comparison to 2017, number of illegal cuttings dropped by 17%, and amount of damage decreased by 51%, and amount of damage – by 25%. The work, aimed to prevent illegal cuttings, will remain a priority in 2019.

Forest industry complex is being developed constantly and occupies the leading positions among regions of Russia. The level of main product output increased last year.

The product of forest complex occupies the third place in totality of region's export and is exported to more than 50 countries of the world [1].

A positive dynamic in production growth is registered in wood processing industry.

The amount of timber production formed 1,7 million m^3 (+6%). Technology of chip production increased by 11%. 389,6 thousand m^3 of technological shiver was produced.

In 2017 production of HDF plates grew by 12%, chipboard plated – by 6%, fuel brick cakes – by 66%.

Production of glued plywood remained at the same level as in 2016 – 345,2 thousand m^3 (99,9%). An insignificant decrease is related to the implemented modernization of existing productions at the leading plywood combinates of the region (JSC "CFMK" and NAO "SVEZA Novator") [2].

By the end of 2018 17,7 million m^3 of wood was procured (112% in comparison to 2017).

According to the report of forest complex department of Vologda region, in 2018 production of wood in the region grew (by 6,2%), and production of plywood grew by 3,9%. Income, generated by forest sector and credited to budgets of all levels, formed 4,3 billion rubles. From it, federal budget received 775,62 million rubles which is 110,15 million rubles more than in 2016. Investments in budget of the region equaled 662,15 million rubles, a 267,69 million growth in comparison to the previous year.

This growth can be achieved with the high power of Vologda forest-industrial complex through implementation of large investment projects, development of the existing enterprises, and their operation in foreign markets.

Production of forest complex occupies the third place in region of export and is exported to more than 50 countries (Finland, Estonia, Egypt, Germany, Sweden, etc.)

With purpose of developing deep wood processing and creation of work places the department works actively with potential investors to create a new, modern wood processing company.

Vologda region occupies the first place in Russia in number of priority investment projects in the area of developing forests. Totally in Russian Federation the registry of priority investment projects includes 148 projects, 22 of them are realized at the territory of Vologda region. Total amount of investments, assigned for priority projects in the area of developing forests, forms 16,2 billion rubles, actually invested – 16,1 billion rubles.

Nine projects are realized and acknowledged by Ministry of industry and trade as finished: JSC "Cherepovetskiy FMK" (two projects), LLC "LDK № 2", JSC "Sokolskiy DOK", LLC "Kharovskiy les", LLC "BioLesProm", NSC "SVEZA Novator".

Seven projects of total value equaling 3,9 billion rubles completed their investment stage and began exploitation of all production objects, implied by concepts of investment projects.

In order to implement projects forest masses were selected, their annual estimated area forms 5,1 million m^2 per year.

In 2018 federal budget received 1333,2 million rubles, by 464,3 million rubles more than in 2017. Budget of Vologda region equaled 123,5 million rubles. Growth by 321,6 in comparison to the level of previous year. Local budgets of municipal formations of Vologda regions received 15,6 million rubles.

On the whole, income from forest complex in 2018, credited to budgets of all levels, equaled around 6,0 billion rubles.

Total investments into forest-industrial complex of the region in 2017 equaled 1002,6 million rubles, a 10% growth in comparison to 2013. At the same time, 86,4% of the investment was directed to forest procurement and wood processing enterprises, and only 13,6% of the total investment amount was directed to cellulose-paper and forest-chemical production.

Export of wood products, its volume and structure have a significant influence upon financial results of forest complex. Amount of NGL products export in 2017 equaled USD 214,8 million, and it exceeds the level of 2013 by 33,4%. During recent years export shifted towards increase in supply of products with higher level of added value. Thus, in 2017 share of round wood in currency revenue equaled 13,8%, and in 2013 – 61,9%.

Production of forest complex occupied the third place in the export region, and it is exported to more than 50 countries (Finland, Estonia, Egypt, Germany, Sweden, etc.). In order to develop deep wood processing industry and create new work places, the department works

actively with potential creative investors at the territory of Vologda region to create new, modern wood processing company.

Vologda region occupies the first place in Russia in number of priority investment projects in the area of developing forests. Totally in Russian Federation the registry of priority investment projects includes 148 projects, 22 of them are realized at the territory of Vologda region.

Total amount of investments, assigned for priority projects in the area of developing forests, forms 14,4 billion rubles in 2016.

In 2016 a law on forest usage was accepted in Vashkinskiy forestry station at the area of 116,7 thousand ha that was subsidized from state budget, and at the leased area of 130,5 thousand ha, which damaged occupants. Measures of forest management are implemented according to principles of state-private partnership at account of state budget and forest fund occupants (without leasing of territories at state account, and leased areas at account of forest fund occupants). On total, in 2018 forestry works at the territory of 390,6 thousand ha were carried out at account of occupants [5].

During the recent 5 years average annual growth rate for the whole forest-industrial complex equaled 219 %, and labour efficiency – 6,7 % [4].

A huge influence upon increase in labour efficiency have dynamic and quality of main production funds, as well as fulness of usage of productive assets. Thus, wear of major funds by types of economic activity by the end of 2018 equaled:

– In forest procurement – 59,5 %;

– In processing wood and producing objects from it – 31,4 %;

– In cellulose-paper production – 56,0 %.

The established amount of annual forest usage in 2018 equals 29,7 million m^2 throughout the region, including pine forestry – 12,6 million m^2. 875 land sites of the total area of 6,5 million ha were leased, including 486 sites of the total area of 6,3 million ha for wood procurement. The established annual amount of wood procurement by forest sites, leased for wood procurement, equals 17 million m^2 (57 % of the estimated region's cutting area.

Apart from wood procurement, forests of the region are used for:

– Building and exploitation of linear constructions – 5,58 thousand ha;

– Building of hydroconstructions – 0,074 thousand ha;

– Developing deposits of raw minerals – 0,54 thousand ha;

– Maintenance of hunting grounds – 162,13 ha;

– Recreational activity – 0,088 thousand ha.

Nowadays modernization of major productive funds of forestry enterprises is going on, and it is aimed to attract investments, including that from foreign sources.

Deposits of forest recourses, located in the region, provide not only for fulfilment of current and future demand for wood and projects of its procession on behalf of the region's households, but also expand significantly export of highly-profitable wood products.

Creation of forest cluster is aimed to unite forestry, wood procession, and cellulose-paper industry of the region together with other business subjects in order to increase competitiveness of the region's product.

Territorial-aerial planning and development of the territory allows us to consider national interests, perspectives of developing infrastructure, environment, and natural resources of the territory, transport and trade flows, flows of actives while projecting and constructing new enterprises.

Creation of comfortable zone for development of forestry business in the region provides for realization of large megaprojects, including development of infrastructure of cities and districts of the region, improvement in level of social security.

Improving efficiency of usage of the existing forest resources provides for multiplicative effect in development of mutual areas.

Major functions of the regional level of executive authorities in the area of forest relations between organizations and forest usage consists in protection, preservation, replenishment, undertaking federal state forest supervision (forest protection), federal state fire supervision in forests, maintenance of state forest registry, and investment policy in terms of forest relations.

On the whole, our analysis showed that forest industry of the region is in stable condition, most of the revealed trends are positive. It should be underlined that positive shifts in structure of wood production export remain the most export-directed priority.

Realization of the main objective in development of forest complex within the period up to 2020, as well as requirements of Forest code of Russian Federation in terms of insufficient budget assignations for replenishment of forests and restoration of the basic capital of business subjects in possible at the foundation of state-private partnership.

The objective of this alliance is to realize social and socially-significant projects in all areas of activity (from development of strategical sectors of economy to provision of state services in scale of separate territories or the whole country).

For this we suggest:

1. Creation (refreshment, Refreshment – Monzales, Sokolskiy cellulose-paper combinate) of capital investment object, realized in interest of society (carrying out state functions), territorial, city-building, and sectorial development, defensibility, private partnership on terms of contract (for example, provision of state services);

2. Implementation of projects with attraction of private financing of capital investments in full or in proportion to project costs that can be replenished through revenue, received by private partner during commercial exploitation of an object, or paying for service, that is calculate with usage by a buyer, or leasing an object at account of budget;

3. Realization of priority projects in area of processing wood of leaf species, especially at enterpises, involved in forestry business. Today almost all wood processing enterprises of Vologda region are directed towards usage of pine material, at the same time, part of lands under pine standings, continues to decrease, and from the beginning of 2017 it formed only 56,4%, or 56,2% in root deposit. In case of further broadening of powers, assigned for procession of pine wood, a risk of insufficient exploitation of them arises.

Although forest lands are state property, cooperation in preserving forests as ecosystems and raw materials that serves as foundation for industrial enterprises, should be accepted by all participants of forest relations who receive revenue from usage of forests and water resources. Regional investment fund of innovative development of forestry can serve as mechanism of collecting financial actives (further – RIFIF).

One of the directions is broadening scale of forest replenishment through mutual financing of important programmes and projects, implemented by private companies in terms of state-private partnership, that include intensive forestry activity. In long-term perspective quality and productivity of forests can be improved via optimization of incomes and costs of forest usage.

The suggested algorithm of creating the Fund includes three stages. Each stage has its specific purpose, that is fulfilled through certain problems and measures.

We consider that legislation should be amended in accordance with requirements for replenishment. Department of forest complex is forming an initiative group. This group carries out all the work on creation of fund up to creation of non-commercial Directorate.

After making decision on creation of RIFIF, Department of forest complex founds non-commercial organization, designated to manage RIFIF. The Direction manages RIFIF. Members of initiative group can join direction of the fund if they wish. In its activity, the Direction is guided by the Charter and special regulation on the Fund, established by the Department of forest complex. Coordinator of RIFIF fund is the Department of forest complex. Control over formation and usage of the Fund's money is carried out by bodies of financial control. Control over fulfilment of agreements on broadened replenishment of forests can be assigned to the corresponding services of the Department with attraction of independent specialized organizations (forest-management, forest certification, social, and scientific agencies). The fund RIFIF is formed of assignations from revenue, received from realization of wood products by all participants of forest relations that base their activity upon usage of forest resources. Rates of assignations to the fund RIFIF are unified for all subjects, involved in forest sector of economy.

RIFIF should be enriched by concession. It will provide for ability to correct certain disadvantages of leasing relations. It is necessary to review sequence and procedure of providing privileged terms to subjects in process of conducting leasing contracts with them in terms of implementing priority investment projects through conducting additional agreements, directed towards provision of broadened replenishment of forests at the foundation of innovative technologies, with breakdown of periods of forest usage into 5-10 years. In case forest maintenance measures, planned by agreement for every specific period, are not fulfilled, privileges will be rejected.

Projects, directed towards procession of leaf wood, should be supported actively. Managing leaf standings in combination with restoration of cuttings with valuable species will slow down process of change of species. Apart from investment projects, realization of private-public partnership mechanism can be achieved in small business sector at municipal level in form of the agreement between parties on providing services of fulfilling municipal order while sharing the right for produced goods.

According to the conducted contract, municipality (or requester) provides forest area to small business enterprise (or contractor) for usage on condition of sharing the goods at price, defined according to commodity structure of tree standing, taxation deposit, and minimal rate, established for budget assignation. The contractor bears responsibility of fulfilling municipal order of producing assortment, defined by the requester (or other consumer) at market price. The difference between minimal rate and market price of resources can be returned to municipality from RIFIF. Introduction and balanced development of innovative system of managing the whole forestry activity does not solve efficiently problems, related to storing and broadened replenishment of forests as an object of property, problems of stable forest usage, and receive economically-explained maximum amount of services and products from each hectare of forest. The cost of measures: the cost of fund creation, consisting of 3 members with total wages equaling 100 thousand rubles per month. Every month the money, earned for introduction of innovations, will exceed costs of the fund maintenance. Thus, monthly budget of the region can be complimented (1 contract will cost a minimum of 50 thousand rubles). By the moment of conducting 10 contracts per month, total income will form 500 000 rubles. Measures, aimed to increasing efficiency: increase of budget through introduction of RIFIF can be used for forest replenishment.

References

1. Forest complex of Russian Federation and foreign countries: statistical collection. Moscow, state education institution of higher professional education Moscow State University of Forest, 2017, 233 p.

2. Forest industry complex of Russia and its place in the world [Digital source]: official web-site. Access regime: // http://www.vlant-consult.ru/consulting (date of access 01.10.2019)

3. Public report on results of activity of Department of forest complex of Vologda region during 2017.

4. Public report on results of activity of Department of forest complex of Vologda region during 2018.

5. Federal agency of forestry [Digital source]: official web-site. Access regime: http://www.rosleshoz.gov.ru.(date of access 05.10.2019).

THE TRANSACTIONAL ASSET PRICING APPROACH (TAPA): APPLICATIONS OF A NEW FRAMEWORK FOR VALUING ILLIQUID INCOME-PRODUCING ASSETS IN THE PROFESSIONAL VALUATION CONTEXT

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This Paper aims to provide an overview of the Transactional Asset Pricing Approach (TAPA) to valuation of capital assets, as relevant to the Professional Valuation (PV) practice. It sketches out the numerous inconsistencies which arise when an attempt is made at by-analogy application of the notions borrowed from the field of Investment-Financial Valuation (IFV) to the PV practice which deals with assets of less-than-perfect liquidity where the Law-of-one-price is liable to a breakdown. Such inconsistencies are illustrated using the example of misguided applications for the Capital Asset Pricing Model (CAPM) in the PV context. We also sketch out the way out of such a theoretical impasse for the PV valuation methodology by highlighting the promising methodological implications and value capitalization models coming out from the dynamic TAPA research field. The explicit advantages of such TAPA models are that they possess apparent counter-cyclical properties by not failing to account for the cyclicality of market pricing via an in-built time-variable discount rate mechanism. Thus, TAPA methodology stands out as an important innovation in pricing capital assets on a fundamental countercyclical basis to address challenges of financial crises and waves of liquidity-driven capital destruction.

Ever since A. Marshall brought about the neoclassical synthesis in Economics and I. Fisher developed theories of capital valuation and interest in the early part of XXc., valuation theory has not been static. A particular spurt of activity has been observed in the 1950-1960th when the theory of pricing financial assets has been elaborated starting from works by H. Markovitz W. Sharpe, J. Lintner, as well as Modigliani & Miller. All these works were exploring the brave new world of big financial data, crunching which has suddenly become possible by then newly introduced computer technology, therefore, predicating a valuation theory on distributional statistical concepts of average returns and standard deviations, in the framework of the market efficiency assumption and the homogeneity of market participant expectations, has allowed to frame the standard valuation toolkit of the Modern Portfolio theory (MPT) – which Financial and Business assets valuers (as well as sometimes even Property valuers!) subsequently borrowed for their practical work. After this process of borrowing for the MPT valuation thinking has become assimilated to the actual valuation practice in 1980s and 1990s, the fact that the underlying pricing models perform poorly even in the context of efficient public capital markets, such as in the US, is just relegated to the sidelines of our professional vision (e.g. witness the multitude of ad hoc empirical adjustments, such as premia for company size at odds with the initial underling MPT reasoning, etc., we are forced to put into CAPM to make it work somehow).

But the principle concern for us as Professional valuers is that we usually work with different types of assets than those for which the MPT type of valuation thinking has been originally proposed. The differentiating feature of the assets in this context is their liquidity. Security analysts working with public capital markets –e.g. those people that write buy/hold/sell recommendations for public shares – may find the MPT type valuation theory amenable to their needs in their preoccupation with the issue of long-term fundamental values of liquid (publicly-tradeable) assets. The public markets in which they work may have spot efficiency (i.e. no-arbitrage, the observance of the economic law of one price), but their inter-temporal efficiency is often called into question (i.e. bubbles due to performativity and other "irrationalities"). We, as Professional valuers, whether of businesses or properties, have to admit that we are simply engaged with a different universe of assets. Most asset types covered in the IVSs 2017 –i.e. Property and interests therein, interests in closely-held (non-traded) companies, machinery and equipment, intangibles – are assets with less than perfect liquidity, for which often the current (spot) price is not known (hence, the professional valuers are called to estimate it in the first place!), much less the law of one price is observed. This shows that the use of the MPT pricing models in our Professional valuation (PV) context is an exercise in "by-analogy" thinking fraught with many leaps into the dark: If a valuation of a, say, Romanian village enterprise with some

betas and a CAPM model comes to the perusal of a court, the valuer in charge of such a valuation may find hard-pressed to explain himself and give a rationale for the use of the CAPM model in instances where the shares in question are not traded on the public stock exchange, especially if the opposing counsel chips in with a question to the valuer to ask him to explain how the CAPM model of Sharpe and Lintner, implying a single-period forecasting horizon and a homogeneity of market participant expectations, fits into the context of a multi-period DCF analysis deployed, where the expectations of transacting agents on the market with respect to the enterprise cashflows could be different (forming, indeed, the very motive to do a transaction!)?

In my actual courtroom practice of asking such hard questions on the underlying theory of valuation, the valuers blush a lot and default to just saying that it is the current state of professional valuation practice as used. The smarter ones say that the questions are largely justified but that they use the public capital markets pricing mechanism and then introduce a liquidity discount to account for the differences in the pricing approaches as between the unobserved universe of illiquid private assets and the observed universe of liquid public-market related assets. In most instances, such a defense also crumbles when it is found that the valuation report cites some illiquidity discount studies from the American capital market and there are no means to prove that the transference of those discounts to the domestic market context is justified. I have yet to hear a valuer defend himself by alluding to the performativity effect of professional valuations – in that if most valuers follow some accepted valuation practice (doesn't matter whether a "right" one , or a "wrong" one) the results of valuations will get incorporated into the transaction prices and, overtime, transactions with even illiquid subject assets will converge to mirroring the pricing logic from the public capital market. Alas, this performativity effect would be disconfirmed by the availability of such research as conducted by Robert Slee in his 2004 book on private capital markets [1] and subsequently undertaken empirical Pepperdine University private capital market surveys [2].

Thus, we, as Professional valuers working with less than liquid assets priced on private capital markets (They are also "private" markets in that only a minority of transactions concluded in their context becomes available for research and as a public-domain data in all the essential details. Thus, the notion of a direct

and immediate usage of statistical techniques becomes a purely hypothetical one. What is a beta of your apartment?), are essentially left without an uncontroversially applicable valuation theory germane to our environment, instead we are forced to rely on a lot of "by-analogy thinking" borrowed from the procyclicalities-fraught contiguous areas of valuation analyses, such as the valuation of securities on liquid public capital markets.

In the latter area the exclusive reliance on either the market approach or income valuation models based on the static toolset, such as CAPM, create occasionally very strong procyclical negative feedback loops that drive prides of the assets away from their fundamental values.

Is it possible to re-create a valuation theory specifically fit for the context of pricing assets with less than perfect liquidity – without recourse to the pricing models used in the liquid public capital market with which the MPT has richly endowed us? The construction of many such *empirical* pricing models has been attempted, including the cited attempts by Robert Slee and the Pepperdine University, but so far no comprehensive *analytical* models have been proposed to re-construct the valuation theory in the required private capital markets context. Because it is really so that unless we develop general *analytical models* for valuation of illiquid assets, we will be forced to have the ultimate theoretical recourse to the pricing models established –at one, and rather unbridgeable, remove from us-- for the public capital market.

We have been attempting to remedy this situation with the development of the so-called Transactional Asset Pricing Approach (TAPA) over the past decade. In this we proceeded from the meta-assumption that the "unit of analysis" for illiquid asset valuation is a particular transaction (or, sometimes, their set –as in the sales comparison approach), but not the overall general market universe assumed in equilibrium (as in the MPT approach). Thus, we attempt to deduce the analytical model of valuation from the behavior of assumed transacting agents in a particular transaction (and the way they should negotiate their respective economic interests to achieve the balanced transaction), not from the implications of competition between all market agents in the market universe, each possessing the uniformity of expectations about the future. This transaction-based view of asset pricing gave our research program the name "Transactional" in its title.

Our TAPA model has one normative element that incorporates the principle of equity

in transaction. This principle is lacking in any formulation for any of the modern pricing models, but in fact has a rich filiation going back through the economic essays of J. Ruskin to Aristotelian "Catallactics' (the science of exchange) expressed by him in Book V of the Nicomachean Ethics. There were modern-era attempts to reconstruct the investment decision-making and valuation theories based on this principle (for the latest attempt, see e.g [3]). Our formulation for this principle is more dynamic and thus has been given a name of the "inter-temporal principle of transactional equity" (or the fair transaction equilibrium principle). The underlying idea for this principle is that neither of the transacting agents in a priced transaction with an asset should be worse off in consequence of effecting the transaction than their counterparty – by the end of any analysis/forecast period chosen. Analytical decomposition of this principle using the formulas of compound interest with dual rates of return (one for the investment opportunity set of the buyer, and the other – for the investment opportunity set of the seller) allows to provide a general transactional asset pricing model (also featuring dual rates of return with reference to the buyer and the seller). Interested readers are invited to study the analytical derivations in depth by consulting our Paper [4].

The well-known general DCF analysis framework obtains as a specific case of this more general transactional asset pricing model formulation, given the assumption of the equality of discount rates between the buyer and the seller of subject asset. Previously, the DCF analysis framework has been regarded as an artefact resulting from the investor-specific view of asset valuation, as developed in the works of Irving Fisher at the turn of the XX century. Now, TAPA research has made it possible to provide a justification for the DCF analysis on the basis of the inter-temporal principle of transactional equity.

However, there is still one principal – and often overlooked – inconsistency between the explicit multi-period forward-looking orientation of the DCF analysis and the theory of discount rates we use in its context. Most often, we use time-invariant (single-period) discount rates derived from (averaged) historic series of returns (sometimes refracted through the prism of the single-period CAPM or its derivatives). Such a conjunction of the flexible DCF framework, which might well assume the time-variable pattern of performance for the subject asset returns, with the inflexibility of fixed discount rates creates tensions and rigidities in the prac-

tical use of the DCF analysis. Indeed, a stand-by court question to a defendant-valuer readily suggests itself here: "In the numerators of the DCF analysis you assume variable returns for your subject asset, what makes you think that the assumed market benchmark of your valuation (Obviously, any valuation under the income approach assumes a certain reference point, or a benchmark. In that sense, income approach valuations are also comparative valuations. The return properties of the valuation benchmark assumed are reflected through the use of a specific discount rate. That is, if the discount rate selected is based on the returns/ equity premia of some market index (e.g. S&P 500), then the valuation benchmark assumed in the valuation is the universe of S&P stocks), the performance of which is reflected through the selected discount rate in the DCF denominators, will be characterized by the constancy of returns (the fixed discount rate you use) over the forecast period?" An answer to this question may not always sound convincing, as oftentimes the increased returns for the subject asset in the DCF are projected on the basis of the market surveys or expectations that suggest an improved performance in the market benchmark of valuation (I.e. we may expect an increase in the subject asset returns precisely because the market against which we value such a subject asset is expected to perform better and thus have higher returns over the forecast period selected).

Thus, an important building block for TAPA is its theory of flexible, i.e. time-variant, discount rates. Since the DCF analysis generally assumes a variability in the profile of subject asset returns, it is only fitting that the rates of return for the benchmark adopted in the valuation (i.e. the discount rates) should also be capable of being projected in a time-variable manner (discount rate_s_, that is, not _the_ discount rate). In fairness, modern researchers in the area of Financial Economics have long recognized the issue and are doing something to reform the analytical and valuation practices in this regard. For example, Cochrane's presidential address to the American Finance Association in 2011 diagnoses the issue right in that most of the changes in asset valuation are due to changes in the market discount rates, not due to changes in the asset's cash flows. He does a very stellar work in illustrating the matter empirically, but neither he, nor other researchers that subsequently took up his lead in the matter so far succeeded in developing an operational comprehensive analytical model of asset pricing with time-variable discount rates. TAPA,

on the other hand, provides such a model of discount rates for the multi-period, multi-asset setting – and in that relies, like CAPM, on the portfolio principle. However, TAPA (unlike CAPM) doesn't contain any normative assumptions as to how the transacting agents' portfolios should be formed. This adds to a degree of freedom in actual TAPA-based valuations, because the use of CAPM in any valuation analysis, among other things, implies that the subject investor's portfolio is composed on the MPT theory principles (i.e. represents a combination of the overall market portfolio with a "risk-free" asset), where it might not actually be the case.

The combination of TAPA discount rate theory with its approach to deriving the DCF framework allows to develop what we call TAPA Basic Pricing Equation (TAPA BPE), which possesses an analytical novelty of tying in the residual value in the DCF analysis (i.e. the terminal value) with the present value of the subject asset being sought (i.e. introducing a circularity element into the DCF framework). Luckily, modern-day spreadsheet capabilities allow for easy solutions to circular equations, thus, we have made TAPA BPE framework easily available for use by Valuers by operationalizing it on an Excel spreadsheet, which anyone can download via this link (https://drive.google.com/open?id = 0B8hVnKfTz9_2 aElVTGt2OHNBNTg) and use in their actual property or business valuation practice.

We hold out TAPA as a comprehensive asset pricing framework under the income approach because under certain novel assumptions it reduces to all the known income capitalization formats. For example, TAPA BPE transforms itself into the direct income capitalization format (DIC) (see Table) when we are justified in assuming that the performance of the subject asset (both in terms of its future income and capital value) will exactly mirror the dynamics for the respective valuation benchmark selected. That is, according to TAPA, the Direct income capitalization method is a valid income capitalization technique when the valuer believes that the performance of the subject asset will be exactly the same as that of the market in the context of which it is being valued (over an implicit holding, or forecast, period assumed in the valuation). In a similar vein, TAPA BPE is capable of being reduced to a version of the Gordon formula, with the assumption required to achieve such a reduction being somewhat different from that used in the conventional derivations of the Gordon model. According to TAPA, the derivation of the Gordon formula doesn't require an assumption of the infinite holding/forecast period, and the formula as presented will be valid in the context of any holding period, provided that the required TAPA assumptions are met: that is, if the subject asset performance, over a forecast period selected, is expected to be identical in terms of its income growth and capital value, but distinct from the performance for the valuation benchmark assumed (That is to say, there is no reason to think that Gordon formula should be used exclusively for valuation of going-concern business entities, the TAPA version of Gordon model is equally applicable to valuation of assets with finite economic lives, provided their income and capital value are assumed to grow or decline at a uniform rate over the selected forecast period). TAPA BPE can also be reduced to Inwood and Hoskold income capitalization formats as shown in the Table [see [4–6]).

By Taylor-expanding the TAPA BPE we also developed what we have called the "quick income capitalization model", for which there is no precedent in the valuation literature. It is a curio, as we suggest that the full TAPA BPE spreadsheet be used in instances where it is not proving possible to select valuation assumptions, which would reduce the TAPA BPE to specific simple income capitalization formats described above.

Thus, TAPA framework is very productive in explaining in alternative terms when certain income capitalization formats should be used. Additionally, by allowing for time-variant nature of the discount rates, which obtain as TAPA BPE outputs, the TAPA approach can be used as a discount rate forecasting model in its own right—something which seems to be much demanded by the market, given the plethora of empirical surveys on discount rates, such as the Pepperdine University survey already mentioned above. So far, these surveys lack analytical instruments to check their findings for logical consistency. TAPA provides such a tool, as well as serves as a methodology for researching into the fundamental values of capital in the context of cyclical asset valuation.

To summarize our overview of TAPA, TAPA is an explicit model of a comparative valuation under the income approach. The forefront notion of a valuation benchmark is much more fine-tuned in TAPA compared to the traditional DCF applications used by valuers, where it is much more vague (although the discount rate derivation in those also has to allude to some notion of a benchmark, which is often inchoate and exists in the very background of valuation).

Assumptions required to reduce TAPA's Basic Pricing Equation to some known income capitalization formats

Model	TAPA assumptions:			Conventional assumptions:
	Subject asset net income over time	Subject asset residual value at the end of the projection period (n-th year)	Benchmark assumptions	
	$u_o(i)$ – projected income growth for the subject asset for period i,%; (i = 1..n) where n is a duration of the model forecast period	where $v_o(i)$ – projected capital value growth for the subject asset for period i. (i = 1..n)	where, u(i) – projected income growth for the valuation benchmark for period i, %; v(i) – projected capital value growth for the valuation benchmark for period i, %. (i = 1..n), where n is a duration of the model forecast period	
Direct income capitalization (DIC) $PV = \dfrac{NOI}{R}$	Changes synchronously with the income for the benchmark used $u_o(i) = u(i)$	Changes synchronously with the benchmark capital values $v_o(i) = v(i)$	$u(i)$ can be independent from $v(i)$, both can be time-variant (i.e. different for different i)	*Strictly:* Perpetual income annuity without growth. *In actual practice:* a lot of implicit factors also assumed within R, thus confusing market yield with the notion of the cap rate.
Gordon $PV = \dfrac{NOI}{r - v_o}$	$NOI \cdot (1+v_o)^{i-1}$	$PV \cdot (1+v_o)^n$	Constant discount rate: r = R + v, holding when u = v	Perpetual Income Annuity with the fixed rate of growth
Inwood $PV = \dfrac{NOI}{r + F3(n,r)}$	Constant	= 0	Constant discount rate: r = R + v, holding when u = v	*Assumption of the actual use of the sinking fund, accumulating according to the third money function F(3)*
Inwood – extended $PV = \dfrac{NOI}{r + V \cdot F3(n,r)}$	Constant	$PV(1 - V) > 0$	Constant discount rate r = R + v. holding when: u = v	*Assumption of the actual use of the sinking fund, accumulating according to the third money function F(3)*
Ring $PV = \dfrac{NOI}{\frac{1}{n} + r}$	Decreasing: $NOI_i = NOI \cdot \left(1 - \dfrac{\frac{r}{n}}{r + \frac{1}{n}}(i-1) \right)$	= 0	Constant discount rate r = R + v, holding when: u = v	*Assumption for the actual no-interest bearing sinking fund. According to [8], the assumption of "income foregone", but no assumption for the actual decline of NOI(i) from the subject asset*

Where: $F3(n,r) = \dfrac{r}{(1+r)^n - 1}$ – Sinking fund factor.

Additionally, TAPA is a multi-period dynamic model of asset values that proceeds from the initial assumption of the bargaining parity between the transacting agents (the TAPA principle of transactional equity). This assumption allows to generalize the DCF approach and recast the traditional DCF framework as a special case of the suggested more general TAPA framework.

Could it be that TAPA is a step in a right direction towards a suitable unified foundational theory for the Professional valuation specialisms, including business and property valuation? Since the departure point for TAPA is the dynamic modelling of a transaction, and not of a general market universe, TAPA can be regarded as an analytical valuation theory for the valuation of assets with less than perfect liquidity and having regard to the explicit cyclical nature of the assets (see [7]). Are not such assets – whether in business, property or intangibles valuation specialisms – the basic subject matter of the Professional valuation? At least it can be said that where a valuation explicitly requires the adoption of a transactional-based view, as in instances of estimating Equitable (as per IVS 2017 definition), or Fair (as per EVS 2016 definition) Value, TAPA provides the readily available methodological approach for valuing income-producing assets, which can be considered and eventually applied by valuers.

References

1. Slee R. (2004), Private Capital Markets: Valuation, Capitalization, and Transfer of Private Business Interests, Hoboken: John Wiley & Sons.

2. Everett. C. "2017 Private Capital Markets Report. A Pepperdine Private Capital Markets Project Survey" (https://bschool.pepperdine.edu/institutes-centers-research/centers/applied-research/content/private-capital-markets-report-2017.pdf, Accessed 10.01.2019).

3. Galasuyk V.V. Fair Exchange Value for Objects in Purchase-sale, Gift and Exchange Transactions. Art-Pres Publishers, 2018, Dnipro: 203, ISBN: 978-966-348-413-6.

4. Michaletz V.B., Artemenkov A.I. The transactional asset pricing approach: Its general framework and applications for property markets. Journal of Property Investment and Finance 37(3):255-288 DOI: 10.1108/JPIF-10-2018-0078.

5. Michaletz V., Artemenkov A. The Transactional Assets Pricing Approach and Income Capitalization Models in Professional Valuation: Towards a "Quick" Income Capitalization Format. The Journal of Real Estate Management and Valuation, Volume/Issue: Volume 26: Issue 1 Apr 2018 DOI: 10.2478/remav-2018-0008.

6. Michaletz V., Artemenkov A. The Transactional Assets Pricing Approach: Its Application in Professional Business Valuation and Fair Value Theories. ANEVAR Valuation Journal #2, 2017.

7. d'Amato M., Siniak N., Mastrodonato G. Cyclical assets" and cyclical capitalization. Journal of European Real Estate Research, Vol. 12 No. 2 (2019), pp. 267-288. DOI: 10.1108/JERER-05-2018-0022.

8. Ellerman D. New Results on the Straight Line & Hoskold Methods of Capitalization. Real Property Perspectives, 1994. no. July: 29–36, 80–81.

PHENOMENON OF AUTOCRACY IN RUSSIA

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The article considers the autocracy as a monarchical form of government in Russia, in which all power, including in the legislative sphere, belongs to the Tsar or the Emperor. The features of autocracy that distinguish this form of government from other European monarchies are considered. Also, the authors actively use examples from the history of the Russian state, namely the events of the dependence of the Ruu lands on the Golden Horde, and also link the reasons for the emergence of autocracy in Russia with difficult climatic conditions. According to the authors, the turning point in the formation of autocracy in Russia was the wedding of Ivan IV to the kingdom in 1547, which helped to confirm the idea of the continuity of monarchical power given by God. So the process of sacralization of the supreme ruler of Russia was completed, which implied the assignment of special features to the tsar, by virtue of which he began to be perceived by the people as a supernatural creature endowed with divine qualities. The article discusses the historiography of the problem of autocracy. The authors note that until now there is no official unambiguous understanding of the term "autocracy". In conclusion, the authors note that it was autocracy that contributed to the transformation of the Moscow Duchy into a powerful state.

Autocracy is a monarchical form of government in Russia, in which all power, including in the legislative sphere, belongs to the Tsar or the Emperor. Competences of the autocrat in the field of management strive for inclusiveness.

In this connection, we would like to note several features distinguishing the Russian autocracy from any other similar phenomena of Western or Eastern history. The fact is that the ability of the Russian person to work, in particular the Russian peasant, is largely determined by natural geographic conditions. Having a long winter, spring and autumn, often similar to winter and too short summer, the Russian peasant is forced to work with great intensity in order to grow and harvest at least some kind of harvest. A peasant, unable to produce marketable bread, often sells the product he needs, so he does not "live", but "survive". That is why Russia has for centuries fought the threat of famine, which was exacerbated by the slightest socio-economic or political destabilization. That is why, in need of an aggregate surplus product, the state in Russia had to become very strong, similar to oriental despots. This is the economic reason why autocracy is Russia's specifics.

Certainly, the presence of 300 years of dependence on the Golden Horde, the current institution of "hostage", the long-term presence of members of the princely family in the khan's headquarters, as well as the penetration of Eastern traditions into Russian culture, the destruction of the urban veche system, contributed to turning away from democratic manifestations system of ancient Russia, and had a strong influence on the formation of a new form of power relations and the emergence of a regime of unlimited power in Russia XVI-XX centuries. Here we agree with the opinion of S.A. Kislitsyna, G.N. Serdyukova, I.O. Ionov, that the relations between the Russian princes and the Mongol khans were built according to the type of citizenship and service, i.e. "Ministeriality", and not according to the type of contractual relationship, i.e. "Vassalitet", which later turned into a "despotic autocracy". The state organization of the Golden Horde, without encroaching on the foundations of the spiritual life of the Russians and Orthodoxy, became a kind of model for creating a powerful state. V.V. Shulgin believes that "Russia borrowed from the Mongols their highest achievement and their strongest weapon, namely, the khanat, that is, autocracy. The eastern hordes, assembled in one hand, could not be opposed to the gnawing system of specific-feudal eternity among themselves" [14].

And, of course, it would have been impossible to build up autocracy without that special type of mentality that existed in the Russian community. In Russia, there was no characteristic emphasis on personalities and personal origins for the West; there were no ambitions associated with private property. There was a "world" in Russia, and the Russian peasant thought in the category "we". The community consent was higher than the law, higher than the personality, as Aksakov and others said. But, I would like to note the ambivalence inherent in the community. On the one hand, the community had protective functions: there was social responsibility, collectivism, a certain relation to the poor, the impoverished, the arrested, the orphans who suffered from natural disasters, etc. On the other hand, it was the community that monitored the payment of taxes and fees, the execution of punishments and the like. Feudal lords were afraid to encroach on a certain autonomy of the community, but

it was beneficial and necessary for the system. The community, helping to improve the position of the peasants, at the same time weakened the pressure on them, between the peasants and from the peasants. It was included in the state system: the community was the state mechanism of influence on the peasant, the intermediary between power and man. This provided conservatism and community vitality. And in the future, this communal mentality, this feeling of self not as "I", but as "we" was easily transferred to the state and attitude to it.

Perhaps, this idea is confirmed by the fact that the state would not have been able to withstand the conditions of the deepest crisis of the Troubles, if not for the support of the people. An important feature of the emerging ideology was patriarchalism and state awareness of the highest value, compared with which the fate and freedom of a single person did not matter. On the other hand, the people constantly sought protection from the state, which was personified in the figure of the sovereign. Indeed, in spite of the large number of uprisings, the peasants and the people were not against the sovereign or the state, but against the boyars, landlords, officials, etc. The very emergence and spread of such an institution as "imposture" testifies, as noted by many researchers, not about the decline, but just the opposite, about the growth of authority of the royal power. In the tsar, the people saw a true defender, directly addressing him with petitions: for example, in 1606 to Falsdmitry, in 1648, in 1662 to Alexei Mikhailovich. The very fact of such appeals to the tsar testifies to the existence of a certain notion of the indissolubility of the authorities and the people, on the one hand, and the impossibility of limiting the power of the tsar, or something else, on the other. Thus, there is an evolution in the direction of the king – "autocrat" and autocracy. In the autocrat, the people wanted to see a defender capable of repulsing an enemy who does not pay tribute to anyone who does not depend on anyone, i.e. who is sovereign. However, the autocrat not only ensures external security, but also internal order, justice and related judicial and legislative issues.

The people do not believe in the force of law, they expect more from the autocrat than the law can give them. People need truth, and the law is not capable of becoming an expression of truth. Folk proverb says: "The law is that the pole: wherever you turn, there it went". Also, the power of the autocrat is inextricably linked with the power of God. Representing God's power before the people, the autocrat represents the people before God.

The turning point in the establishment of autocracy in Russia was the wedding of Ivan IV to the kingdom in 1547, which promoted the idea of continuity of monarchical power given by God. Thus, the process of sacralization of the supreme ruler of Russia was completed, which implied that the tsar was conferred with special features, due to which he began to be perceived by the people as a supernatural being endowed with divine qualities.

Russian sovereigns in the XVI century, XVII century and the XVIII century titled themselves autocrats. So, for example, in 1716, in the interpretation of the 20th article of the Military Code, it was noted: "His Majesty is an autocratic monarch who should not give anyone in the world an answer in his affairs; but power and authority has its own states and lands, like a Christian sovereign, to govern by his own will and grandeur" [3, p. 50]. A little later, in the "Spiritual Regulation" compiled by Feofan Prokopovich, it was stated: "Monarch power is autocratic, which God Himself obeys for conscience" [4].

We agree with the opinion of pre-revolutionary historians that the autocracy in Russia was thus primordial. N. M. Karamzin found signs of "autocracy" already in the Kiev state and, accordingly, in the Moscow state since its inception [6]. The historian S. M. Soloviev speaks of the existence of an absolute monarchy in Russia. The historian believes that the formation of an absolute monarchy takes place during the reign of Peter I. The merit of S. M. Solovyov is the scientific justification of the historical necessity of Peter's reforms. Peter's reforms for the researcher were seen not as a violent break with ancient Russia and the introduction of foreign practices and customs, but as a natural and necessary development of Russian history [9].

The student of S. M. Solovyov, V. O. Klyuchevsky, unlike his teacher, found autocracy under Ivan IV, and possibly even under Ivan III [7, p. 125-126].

And historians are monarchists at the beginning of the 20th century. distinguished autocracy from eastern despotism and western absolutism. "The autocracy ... lived among the people and in the Church. Absolutism has risen above both of them. Absolute, i.e. The Sovereign, estranged from the people, is obscured by an absolute bureaucracy, which, having created an infinitely complex state mechanism, under the name of the Tsar, under the sacred slogan of autocracy, works according to its program, growing and growing and entangling both the Tsar and the people …" [5, p. 760]. Thus, the

authors of the turn of the XIX-XX centuries. nevertheless agreed that in the XVIII century. Russian monarchs had absolute power.

In the 1920-1930s. the problems of the history of autocracy and absolutism were discussed through the prism of the views of the historian M. N. Pokrovsky. Mikhail Nikolaevich associated the establishment of absolutism with the name of Ivan the Terrible. An important reason for the emergence of absolutism in Russia, according to M. N. Pokrovsky, was the economic development of the country in the XVI–XVII centuries. "A modification of feudal economy under the influence of commodity economy was absolutism, more precisely, the bureaucratic monarchy" [8, p. 498]. After the death of M.N. Pokrovsky, a lively criticism of his views developed.

Most Soviet scholars also did not share the concepts of "absolutism" and "autocracy". So, for example, Professor S. V. Yushkov argued that the terms we have designated are synonyms [15]. Another researcher S.O. Schmidt believed that absolutism in Russia took shape during the era of the Moscow kingdom, under Ivan the Terrible, but ceased with the death of the tsar, after which it was revived in the 17th century. During the reign of Mikhail Fedorovich [13, p. 311]. The look of L.V. Cherepnin is also peculiar. He allowed the simultaneous coexistence of two forms of state under Ivan the Terrible at once: autocracy in the oprichnina and estate-representative monarchy in the zemstvo [11, p. 182].

It should be noted that among the Soviet historians there was a rather sharp discussion on the pages of the journal "History of the USSR". The discussion as a whole turned out to be quite fruitful. A significant array of new sources was introduced into scientific circulation, the main approaches to identifying the social and political essence of the Russian autocracy, the stages of its formation and development were determined.

In particular, A.Y. Avrech distinguished the following features of the Russian autocracy that brought him, in the researcher's opinion, closer to Asian despotism: the predominance of illegal methods of managing society and, above all, the personal arbitrariness of monarchs; the predominance of state ownership of land and communal land use; underdevelopment in Russia XVII – XVIII centuries. third estate [1, p. 81-89].

Another Soviet historian called the time of the appearance of absolutism in Russia of the XVIII century. – S.M. Troitsky. He argued that "the transition from a class-representative monarchy to an absolute one began in the 17th century and ended mainly in the first quarter of the 18th century" [10, p. 24] A.L. Shapiro also believes that the autocracy that has developed in Russia XVI-XVII centurie. – this is one, and absolutism of the XVIII century – something else [12, p. 69-82]. The modern historian E.V. Anisimov also does not separate the concepts of "autocracy" and "absolutism": "So in the course of the state reform, Peter I ..." strengthened "autocracy in Russia for a long period" [2, p. 292].

Thus, up to the present, there is no official unambiguous understanding of the term "autocracy". Also, the modern understanding of autocracy by Russian historians suggests a qualitative difference from the absolute monarchy, which is as follows. An absolute monarchy is characterized by the highest degree of centralization, a developed, fully dependent on the monarch bureaucratic apparatus, and a strong regular army. The army, in addition to its primary internal function of suppressing unrest and uprisings, performed other functions. Since Peter's time, it has been widely used in public administration as a coercive force. The practice of sending military teams to places to force the administration to better implement government orders and directions has become widespread. But sometimes the central institutions were put in the same position, for example, even the activity of the Senate in the first years of its creation was under the control of guard officers. Officers and soldiers were also involved in the census, collecting taxes and arrears, etc.

Along with the army, absolutism also used punitive bodies specially created for this purpose – the Preobrazhensky order, the Secret Chancellery, etc. to suppress their political opponents.

In the first quarter of the XVIII century the second pillar of the absolute monarchy also arises – the bureaucratic apparatus of state administration.

The establishment of an absolute monarchy in Russia was accompanied by a wide expansion of the state, its invasion in all spheres of public, corporate and private life. Peter I pursued a policy of further enslavement of the peasants, which assumed the most severe forms at the end of the 18th century.

Summing up, we note that it is the religious consciousness of the Russian people that is associated with the state consciousness in general, and the development of autocracy, in particular. And autocracy, in turn, contributed to the transformation of the Moscow Duchy in a powerful state.

References

1. Avrech A.Y. Russian absolutism and its role in the affirmation of capitalism in Russia. // History of the USSR. – 1968. – № 2.

2. Anisimov E.V. State transformations and autocracy of Peter the Great. – St. Petersburg, 1997.

3. Military articles of Peter I. – M., 1950.

4. The spiritual regulation of 1721. // URL: http://lib.pravmir.ru/library/readbook/1340 (accessed: 05.04.2019).

5. Kazanskii P E. Power of the All-Russian Emperor. – Odessa, 1913.

6. Karamzin N.M. History of the Russian state. – Prince I. – T. II. – M., 1988.

7. Klyuchevsky V.O. Works. – T. II. – M., 1988.

8. Pokrovsky M.N. About Russian feudalism, the origin and nature of absolutism in Russia // Russian history in the most concise outline. – M., 1933.

9. Soloviev S.M. Readings and stories on the history of Russia. – M., 1990.

10. Troitsky S.M. Russian absolutism and the nobility in the XVIII century. – M., 1974.

11. Cherepnin L.V. Issues of the methodology of historical research. // Theoretical problems of the history of feudalism. – M., 1981.

12. Shapiro A.L. About absolutism in Russia. // History of the USSR. – 1968. – № 5.

13. Schmidt S.O. Formation of the Russian autocracy. A study of the socio-political history of the time of Ivan the Terrible. – M., 1973.

14. Shulgin V.V. Three capitals. // In search of its own path: Russia between Europe and Asia. A reader on the history of Russian public thought of the XIX-XX centuries. – Part 2. – M., 1994.

15. Yushkov S.V. On the question of the political forms of the Russian feudal state until the 19th century // Questions of history. – 1950. – № 1.

REGIONAL SPECIFICS OF ONCOLOGICAL PATHOLOGY FORMATION IN ADULT POPULATION

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Kazakhstan, likewise many developed countries of the world, is characterized by tendency to steady increase in cases of malignant tumor morbidity and mortality resulting from it. A significant level of mortality from malignant tumors is due to such factors like the prevailing lifestyle features of the population; the high prevalence of behavioral risk factors, the development of chronic non-communicable diseases, including cancer; a change in the age structure of the population with an increase of the older age groups in the population proportion; late appeal of citizens for medical assistance; insufficient tumor detectability at early stages; faults in the patient routing with detected oncological disease or suspicion of it, other faults in providing a specialized assistance. The priority direction in solving the problems of prevention and early diagnosis of malignant tumors is the improvement of oncological alertness and thematic training in clinical oncology and preventive medicine of healthcare system's primary care physicians. Formation of oncological alertness in the population is also of great importance for the early diagnosticating of oncological pathology. Among the causes of neglect, the first place in frequency is occupied by citizens untimely seeking medical assistance. Systematically conducted screening aimed at early detection, timely diagnosticating and standardization of treatment tactics will reduce the mortality rate from malignant tumors in our country.

Keywords: population health, morbidity, screening, oncopathology, prevention, early cancer diagnosticating

Materials and research methods

Indicators of the oncological service of the Republic of Kazakhstan and Almaty region, data on the incidence of malignant tumors, the results of the screening program, data analysis, statistical processing of indicators.

Research results and discussion

Kazakhstan, likewise many developed countries of the world, is characterized by tendency to steady increase in cases of malignant tumor morbidity and mortality resulting from it. The priority problems of public health and healthcare at the present stage include the issues of incidence, disability and mortality caused by malignant tumors. In the structure of mortality of the population of our country, malignant tumors rates are the third after cardiovascular system diseases.

High morbidity, disability and mortality rates, the difficulties of diagnosticating, the need for mass preventive measures, complex and expensive treatment allow refer malignant tumors to the socially significant problems of contemporary society.

According to world statistics, up to 89 % of new cases of malignant tumors are diagnosed among people aged 50 and older, of which 43 % – aged 70 and older, 28 % – aged 60-69 and 18 % – 50-59 years old. In the USA more than 60 % of all cancer cases and 80 % of their deaths occur in patients who are 65 or older. In the structure of mortality in the European Union countries, malignant tumors rank second after blood circulatory system diseases (38 %), causing 26 % of deaths in the population and being the main cause of death in the age group from 40 to 74 years. Among those who died between the ages of 55 and 69, the proportion of deaths from malignant tumors reaches 44–45 %. In 28 European countries, chiefly in the western part of the region, tumors have already taken the place of blood circulatory system diseases as the leading cause of premature death [3,4].

High rates of mortality from malignant tumors are one of the negative trends in the dynamics of the health status of the country population. According to the Statistics Committee of the Republic of Kazakhstan in 2017, in the mortality structure, malignant tumors ranked third (83.9 per 100,000 population) after blood circulatory system diseases (174.83 per 100 thousand people) and respiratory diseases (92.22 per 100 thousand population) which is higher than mortality from injuries and poisoning (69.38 per 100 thousand population). In 2016, 15,763 people died, of whom 48.3 % are persons of working age [5].

A significant level of mortality from malignant tumors is due to such factors like the prevailing lifestyle features of the population; the high prevalence of behavioral risk factors, the development of chronic non-communicable diseases, including cancer; a change in the age structure of the population with an increase of the older age groups in the population proportion; late appeal of citizens for medical assistance; insufficient tumor detectability at early stages; faults in the patient routing with detected oncological disease or suspicion of it, other faults in providing a specialized assistance.

The most important factor in increasing the life expectancy of the population, improving health, preserving the working capacity and active longevity of the population is the prevention of diseases. The reorientation of healthcare to the path of prevention already today allows us to provide the population with technologies based on an individual-mass approach to detect precancer and malignant tumors, their pre-nosology diagnostics and timely correction of the functional state. In this regard, special attention should be paid to the implementation of the National Screening Program, which plays an important role in the early detection of both the diseases themselves and the risk factors contributing to their development [6].

For the first time in 2009, the first three screenings were introduced in Kazakhstan – for early diagnosis of arterial hypertension, breast cancer and cervical cancer. Within the framework of the state program "Health", developed for 2016-2019, a set of measures for health protection and prevention of diseases is being implemented. For the early detection of diseases among the population, The National Screening Program is being implemented, which includes 7 types of preventive medical examination of the target population groups. These are examinations of the child population, which are held annually under the age of 18 years; identification of behavioral risk factors (smoking, alcohol consumption, low physical activity, poor diet) – performed 1 time in 2 years among the population aged 30-70 years; cervical cancer screening is carried out with a frequency of 1 time every 4 years; women between the ages of 30 and 70 years must undergo the examination; breast cancer screening, which is conducted with a frequency of 1 time every 4 years for women aged 40 to 70 years; screening of arterial hypertension, coronary heart disease and diabetes are carried out with a frequency of 1 time in 2 years; men and women aged 40 to 70 years are subject to the medical check-ups.

The National Screening Program is a large innovative health-care project in Kazakhstan [7].

An important component that provides the organizational and economic mechanism for the development of the industry is the introduction of innovative projects and the transfer of advanced technologies of medical care to the General Health Care System. In the new principles of social policy of Kazakhstan, defined by the strategy "Kazakhstan-2050", health care is the main national priority due to its special status of preservation of human capital [8]. In-vestment in health care is a contribution to the future of the country and this is due to the fact that the country's health care system affects all members of society, it is an important factor in the growth of economic development and national security of the state, the role of preserving public health in the successful development of the country rapidly multiplies.

Properly managed clinical examination can provide a significant, up to 30%, contribution to reducing the overall population mortality, including mortality from malignant tumors.

Combining preventive and therapeutic orientation, preventive medical examination is most effective for diseases for which, considering the principles of evidence-based medicine, methods of early diagnosticating using high-tech methods of research and screening, have been developed and recommended by international medical expert communities.

The main focus in fighting chronic non-communicable diseases is the formation of a healthy lifestyle. According to various estimates, if we take the level of health for 100%, then the state of human health depends by 50-55% on the way of life, by 20% on the environment conditions, by 18-20% on genetic predisposition, and only by 8-10% on health [7-8].

The priority direction in solving the problems of prevention and early diagnosis of malignant tumors is the improvement of oncological alertness and thematic training in clinical oncology and preventive medicine of healthcare system's primary care physicians. Formation of oncological alertness in the population is also of great importance for the early diagnosticating of oncological pathology. Among the causes of neglect, the first place in frequency is occupied by citizens untimely seeking medical assistance.

Despite advances achieved in the world for reducing morbidity and mortality rates due to malignant tumors a tendency for the increase in morbidity cases still maintains in Kazakhstan.

Unitary Enterprise based on the Right of Economic Management 'Almaty regional oncological dispensary' serves the territory of Almaty region in the Southern area, 10 rural districts with total population number of 1,357,507 people. The number of cancer patients registered in 2018 is 8,473. In total, there are 105 female and 44 male patient examination rooms in polyclinics of the central district hospitals. The total number of women who visited polyclinic in 2018, of whom 136,568 visited female patient examination rooms makes 670,280 the number of women examined with the application of cytology made 87,323. Male patient

examination rooms were visited by 96,907 men out of total 427,864 who visited polyclinic. The precancer was detected in 4,458 men, cancer was detected in 29 cases, and in 9,221 men other diseases were detected.

According to the analysis of the screening programs implementation in 2018, in the southern area of Almaty region breast cancer (15,0%) is disease number in the malignant tumor morbidity structure, lungs cancer (10,0%) is the second to it, then goes stomach cancer (8,0%), and cervical cancer which ranks fourth making 7.1% of all localizations.

On average, over the 3-year study period, the level of detectability of uterine cervix premalignancy in the southern region of Almaty region is slightly lower compared to the national indicator (by 0.9%). This fact indicates a high level of alertness and diagnosticating in the polyclinic, as well as a high level of cancer incidence of the attached population caused by risk factors. Target groups coverage by screening types equals to: mammographic – 53,016 people (99%), cytological – 68,911 people (97%) and colorectal – 59,081 people (100%). Colorectal screening is one of screening types which has proven its efficiency in multiple randomized studies.

Colorectal screening results allowed to detect positive hemoculture test in 504 persons in 2018, in 477 cases colonoscopy was carried out, out of which colorectal carcinoma was histologically verified in 23 cases, including 10 cases of I and II stages respectively, 2 cases of III and 1 case of IV stage.

According to the results of mammographic screening in 52,535 women, a study was conducted within the target group, out of which breast carcinoma was histologically verified in 58 cases including 27 cases of stage Ia, 19 and 7 cases of respectively II a and II b stages, 3 and 2 cases of III and stage IV.

In 2018, in general, in the southern area of Almaty region, a cytological examination of smears was performed in 100% of the examined women, with pathological changes detected in 12.9% of cases, including:

– ASC-H – 2.1% cases;
– LSIL – 7.0% cases;
– HSIL – 3.8% cases;

Colposcopic studies were performed in 0.02% of the total number of women examined. A biopsy was performed in 0.14% of all cases examined. These studies allowed to detect:

– CIN I – 0.13%;
– CIN II – 0.21%;
– CIN III – 0.04%;
– AIS – 0%.

According to the ECCA (European Cervical Cancer Association) in Belgium, about 70% of the female population regularly undergo cervical cancer screening, in Denmark this rate is 75%, in France – about 60%. High percentages indicate the responsible attitude to their own health in Europe. And through conducting breast cancer screening in the developed world in 80% of cases, the disease is diagnosed at an early stage, when a complete cure is possible. All types of screening are carried out in the absence of any symptoms of the disease – just to be confident about their health status [11].

Analysis conducted by age groups indicated that the greatest detectability of uterine cervix premalignancy is observed at the age of 40-49 and 35-39. Analysis of the structure of the identified cervical cancer by stages indicated that 53.3% fall at stage I, while 46.6% – at stage II.

Thus, in the Southern area of Almaty region there is an annual increase in cancer patients, so in 2016, 7,272 patients were registered, in 2017 – 7,916, in 2018 – 8,473 patients. Increase in notification rate is equal to 4.8%, decrease in mortality index – by 1.6% and the number of newly diagnosed patients with I – II stage increased by -1.8%. A decrease in the number of newly diagnosed patients is noted with malignant tumor stage IV: if the absolute number of patients in 2017 was 203, then in 2018 it was 191.

Conclusion

To improve the accessibility of oncological assistance to healthcare institutions providing oncological assistance to the population of the Republic of Kazakhstan, the efficiency of functioning examination rooms shall be enhanced, the number of which should correspond to the number of existing Primary Health Care Institutions. In the first turn, this is the work with primary medical and sanitary staff, when already at the level of the district physician the first signs of cancer are determined, after which the patient is referred for a more detailed examination to a specialist physician. Training of specialists is also one of the tasks, the solution of which will speed up the stages of the patients' examination and reduce the burden on working oncologists. Various educational events are organized for Primary Health Care specialists regularly, for example, 'Pink Ribbon', during which women at various medical organizations undergo an unscheduled examination of specialists such as a mammologist, oncologist, gynecologist, and self-diagnostics of breast pathologies.

In general, the inculcation of healthy lifestyle to the population, raising non-smoking, no-alcohol abuse attitude in the population is one of the main ways to combat cancer.

Accurate fulfillment of functional duties by physicians, interaction of all participants of the screening program will improve the effectiveness, acceptability, safety and effectiveness of the screening program in Kazakhstan. In the long term, mammographic screening should reduce breast cancer mortality in our country by 25% and reduce the difference in five-year survival rates between regions and areas of the Republic of Kazakhstan by 5%.

Thus, to date, established focus groups provide screening studies and proves its effectiveness: in the country has been increased the diagnosis of malignant neoplasms at the early stages, as well as precancerous conditions, arterial hypertension and ischemic heart disease; approved Rules for conducting preventive medical examinations of target groups of the population, approved by orders of the Ministry of Health of the Republic of Kazakhstan No. 685, No. 145 indicate sufficient standardization of screening research processes.

The issues of effective pre-tumor diseases prophylaxis were included in The National Screening Programs. Compared to the cost of intensive chemotherapy for an advanced cancer case using a large number of drugs, screening is a cheaper measure. According to this, in order to reduce the number of neglected cases of malignant neoplasms in Kazakhstan at the level of PHC, a system of additional payment to the salary (stimulating component to the per capita standard) for certain indicators has been introduced. Funds from the national budget are allocated for this motivation of primary health care specialists. One of the main indicators is the neglected cases of malignant neoplasms of visual localization of stage 3-4. The majority of the population (up to 95%) with the revealed diseases are further subject to medical examination with carrying out active medical and preventive measures. At the same time, it should be noted that the quality of preventive examinations does not always ensure the detection of all patients in the early stages of the disease and probably differs in the regions of Kazakhstan.

Systematically conducted screening aimed at early detection, timely diagnosticating and standardization of treatment tactics will reduce the mortality rate from malignant tumors in our country.

References

1. Odintsova I.N., Pisareva L.F., Khryapenkov A.V. Epidemiology of malignant tumors in the world. Siberian Journal of oncology. 2015; 5: 95-101.

2. Dolzhikov A.A., Dmitriev V.N., Sukhoterin I.V., Zhernakov E.V. Age features of the oncological process in elderly patients: problems of diagnosis, treatment, prognosis (literature review). Oncogynecology. 2014; 1: 64-72.

3. Population health EC-28, 2011-2013 Demoscope Weekly. 2015; (647648). [Internet]. Available at: http://demoscope.ru/weekly/2015/0647/barom01. php. (Access date 28.10.2016).

4. The European health report 2012: a course for well-being. [Internet]. Available at: http://www.euro.who.int/ru/publications/abstracts/ European-health-report-2012. (Access date 13.04.2016).

5. Indicators of oncological service of the Republic of Kazakhstan for 2016. Statistical materials. – Almaty. 2017.

6. The Decree of the Government of the Republic of Kazakhstan No.395 of 29.06.2018 'Comprehensive plan for fighting cancer in the Republic of Kazakhstan for 2018-2022'.

7. International classification of functioning, life and health limitations. Geneva: World Health Organization. 2001. Research's Practical Medicine Journal. 2017, V. 4, No.1, p. 74-80

8. Adress by the Head of State to the people of the country, December 2012, Development Strategy of the Republic of Kazakhstan until 2050.

9. Kasimov I.R. Healthy lifestyle as a socio-cultural phenomenon: cultural and activity-oriented approaches. Bulletin of the Kazan State University of Culture and Arts. 2013; 1: 111-115.

10. Early diagnosis of cervical cancer at the level of primary health care. Cytological screening: Methodical guidelines / Eds. D.M.S. Nurgaziyev K.Sh. – Almaty, 2012.

11. Andreas Ullrich, Paul Garwood, Patricia Clayes. WHO`s Action Plan Against Cervical Cancer/ Entre Nous. European Journal of Sexual and Reproductive Health. No 64. 2007. P. 4-7.

12. Early diagnosis of colon cancer at the level of primary health care. Colorectal screening: Methodical guidelines / Eds. D.M.S. Nurgaziyev K.Sh. – Almaty, 2012.

13. Early diagnosticating of breast cancer at the level of primary health care. Mammographic screening: Methodical guidelines / Eds. D.M.S. Nurgaziyev K.Sh. – Almaty, 2012.

PATIENTS SATISFACTION AS A SYNTHETIC ASSESSMENT OF THE APPLIED CONCEPT OF A QUALITY MANAGEMENT SYSTEM EFFECTIVENESS

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Over the past 20 years, there have been qualitative changes in the health care system in the world, including the development of the so-called patient-oriented approach based on the principles of respect and orientation to the individual interests of the patient, his needs, values, as well as openness and involvement in the decision-making process regarding the provision of medical care. Services quality control is one of the quality management system's elements, therefore, the greater popularity acquires the system based on the systematic approach to management which allows ensuring continuous improvement in any institution functioning. Improving patient satisfaction with the quality of medical care is one of the significant challenges facing any medical institution. Today in the search for new approaches to improve the quality of medical services, patients can be one of the criteria in the comprehensive evaluation of RES on REM "Almaty regional oncological dispensary". The results of the study of satisfaction with the quality of services provided accurately reflect the positive and negative trends in the dispensary can identify factors that reduce patient satisfaction with medical care. This allows you to take corrective measures on time and serves as an objective basis for decision-making by the management of the oncological dispensary. The satisfaction surveys of patients of oncological dispensary showed full satisfaction with the quality of rendering medical care, but there are still links for improvement on such factors as rationalization and increase of convenience of a preliminary examination, registration of source documentation, communication with the consumer and attention to relatives/accompanying persons. Having started the process of implementation and maintenance of the quality management system, oncology dispensary is still on the way to improve the management system of health provider organization, the quality of services, relationships with consumers and personnel. Thus, medical assistance quality characteristics, concerning the patient's satisfaction due to raising the level of his/her psychological comfort, immediately influence the population health.

Keywords: sociological study, medical assistance quality, questionnaire survey, patients' satisfaction, quality management system, quality management, efficiency

Currently, the satisfaction evaluation is chiefly performed based on sociological approach which consists in studying the patients' opinions on various aspects of the medical assistance quality using a questionnaire.

Services quality control is one of the quality management system's elements, therefore, the greater popularity acquires the system based on the systematic approach to management which allows ensuring the continuous improvement in the functioning of any institution.

Over recent years, the role of sociological polls of patients and medical staff has grown considerably concerning medical assistance quality management [1, 2].

According to the State Program for the Development of Healthcare of the Republic of Kazakhstan 'Densaulyk' for 2016-2019, the further development of Primary Health Care provides further actions aimed at developing universal, integrated, socially oriented, affordable and high-quality medical care at primary level. Social orientation of Primary Health Care will be ensured by integrating the work of Primary Health Care, social protection and public health services, the active involvement of primary health care specialists in activities within the framework of intersectoral interaction aimed at ensuring public health [3].

Accordingly, Primary Health Care will be considered as a primary medical and social care service, that includes the provision of comprehensive medical and social services involving psychologists, social workers, nurses, medical assistants, obstetric personnel and supporting staff. Social and psychological support and multi-profile patronage will be provided in cooperation with the social security authorities.

Over the past 20 years, qualitative changes have taken place in the health care system in the world, including, inter alia, the development of the so-called patient-oriented approach based on the principles of respect and orientation to the patient's individual interests, needs, values, and openness and involvement in the decision-making process regarding the provision of medical care [4].

This approach has several advantages: its use increases patient compliance, succession of treatment is implemented, and, consequently, public health indicators are improved [5, 6]. In addition, patients desire again to request assistance from that medical institution in which a patient-oriented approach is implemented, as well as advising it to friends and relatives, which produces favorable effect on the financial state of a particular medical institution [7]. It should be noted that development of this line

is impossible without an appropriate level of quality, and, therefore, the quality of care can be evaluated using an indicator demonstrating the level of patient-oriented approach implementation.

This indicator is the level of satisfaction with medical assistance quality, reflecting the degree of compliance with the expectations, interests, as well as the patient's needs, his/her ideas as to how a medical institution should function. Due to the widespread introduction of this parameter measuring, it became possible to implement the optimal development of medical institutions in areas that are actually relevant for the population [9, 10].

For patients served in a particular medical institution, the quality of care is determined by the extent it meets their needs and expectations, whether it is timely and how polite and attentive medical staff who provides this assistance. In general, the patient needs the symptoms elimination, and disease prevention or cease. His/her opinion is very important, as patients whose expectations are met, take doctor's prescriptions more seriously.

In accordance with the implementation of the 'Comprehensive plan for fighting cancer diseases in the Republic of Kazakhstan for 2018-2022', approved by the Government of the Republic of Kazakhstan on June 29, 2018 No. 395, monitoring of public awareness of the first signs of cancer and advanced methods of their diagnosis and treatment is underway [8]. A survey of the population is conducted, the questionnaire 'Evaluation of oncological diseases awareness level' includes three questions: *What do you think, which of these symptoms are characteristic of a malignant tumor? What diagnostic methods can be used to detect cancer? What do you think, what treatments are used in the treatment of cancer?*

The total number of monitoring participants was 2% of the attached population over the age of 18, evenly distributed within a year. Following the results of oncological alertness monitoring in the first quarter of 2019, 122 medical institutions participated in the republic in the monitoring, where the number of respondents was 37,762 people, including 9,648 men (25.5%) and 28,114 women (74.5%). In the Almaty region, the number of respondents was 2,839 people, of whom 381 were under the age of 30, 1,104 were at the age of 30-49, 976 were at the age of 50-64, and 378 were 65 years and older.

Following the results of the monitoring, 87,8% of respondents are aware of 5 symptoms of oncological diseases. Low awareness level (that is, being aware of less than 4 symptoms of oncological diseases out of 15 presented) makes 12.2%, besides, the awareness level decreases over time from 91.5% to 83.8%. High level of awareness about symptoms (0-4 symptoms) of oncological diseases in noted in the Almaty region – 38.0%, where 44.4% were answered by respondents aged under 30, aged 30-49 years – 25.5% of respondents, aged 50-64 – 41% of answers, and persons of 65 and older – 59.8%.

Awareness level of the population about oncological diseases advanced diagnostic methods, equal to 96.9%. The level of being completely ignorant makes 3.1%. Low awareness about oncological diseases treatment methods or being completely ignorant as to oncological diseases diagnostic methods refers to 17.5% of respondents in the Almaty region, among whom 36.6% aged under 30, 3.4% aged 30-49, 16.5% – people of 50-64 age range, 43.9% of respondents are people of 65 and older.

Population awareness level on contemporary methods of oncological diseases treatment at large in the Republic made 97.5%. The level of being ignorant about any treatment method makes 2.5%. Low level of awareness about oncological diseases treatment methods, or complete ignorance as to any oncological diseases' treatment method was demonstrated by 33.6% in the Almaty region, of whom persons aged 30 make 20.3%, aged 30-49 – 3.5%, aged 50-64 – 15.5%, aged 65 and older – 31.3%.

Increase in patient satisfaction with the quality of assistance is one of the significant challenges facing any medical institution. Today, in the context of searching for new approaches to improving the quality of medical services, the opinions of patients can serve as one of the criteria for a comprehensive assessment of the Unitary Enterprise based on the Right of Economic Management activities 'Almaty regional oncological dispensary' (hereinafter – AROD). The results of the study of satisfaction with the quality of the services provided accurately reflect the positive and negative trends in the dispensary functioning and allow to identify the factors that reduce patient satisfaction with medical assistance. This allows to timely take corrective measures and serves as an objective basis for the adoption of decisions by the AROD management.

One of the most important criteria for the effectiveness of the medical institution's activities is patient satisfaction with the level of medical care, which was the purpose of our research.

The object of the study was represented by the patients over the age of 40, who received treatment and gave voluntary informed consent to participate in the study. A statistical method was employed in the analysis: continuous and selective. During the material collection, 240 hospital questionnaires were completed. Questionnaires were made on paper carriers. The survey procedure guaranteed complete anonymity of information about the persons who filled out the questionnaire.

The analysis was carried out subject to the results of a patient survey in a comparative aspect between such two departments as surgical and chemotherapeutical department. Having analyzed the answers of our respondents, the following results were obtained:

To the question: Are you satisfied with the duration, waiting conditions and the attitude of the oncological dispensary in the waiting room? The results were: 97.5 % of the respondents' answers in the surgical and 95.0 % in the chemotherapeutic departments were fully satisfied with the duration, waiting conditions and the attitude of the dispensary personnel in the emergency room [fig. 1].

To the question: Are you satisfied with politeness and attention of physicians when being prescribed examinations and carrying out treatment? The following answers were received – 96.67 % of the respondents in the surgical and 88.33 % in the chemotherapeutical departments gave the 'excellent' answers, which means complete satisfaction with the politeness and attention of the medical staff when prescribing research and treatment [fig. 2].

To the following question: Are you satisfied with the courtesy and attention of a nurse or other dispensary center staff? The answers indicate that 83.33 % of respondents in the surgery department and 88.33 % in the chemotherapy department are completely satisfied with the care [fig. 3].

To the question: Are you satisfied with nutrition when staying at the in-patient hospital? 95,83 % respondents in surgical department and 90,0 % in chemotherapeutical department answered that they are fully satisfied with nutrition when staying at the in-patient hospital [fig. 4].

To the question: Are you satisfied with the quality of cleaning, lighting of rooms, and temperature regime? 96.67 % of the respondents in the surgery department and 95.83 % in the chemotherapy department answered that they are completely satisfied with the quality of cleaning, lighting of rooms, and temperature regime [fig. 5].
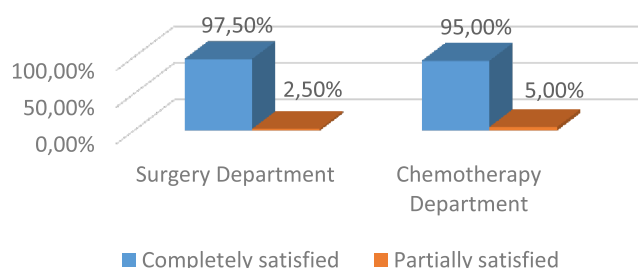

Fig. 1. Are You satisfied with the duration, waiting conditions and attitude of the hospital personnel in the waiting room?
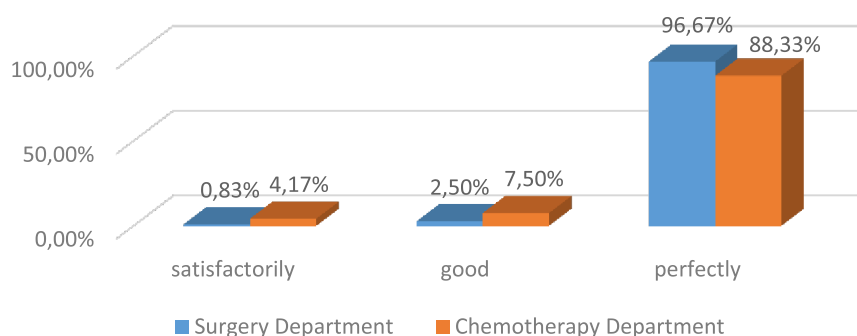

Fig. 2. Are you satisfied with the courtesy and attention of doctors in the appointment of research and treatment?
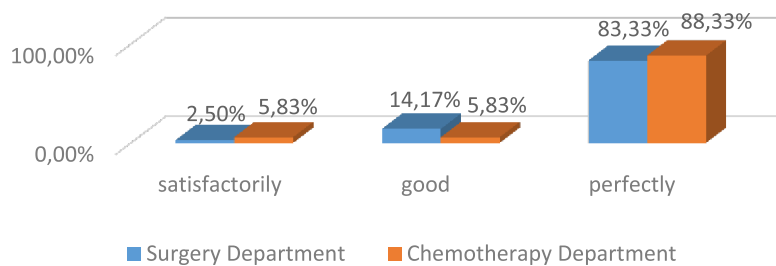
Fig. 3. Are you satisfied with the courtesy and attention of a nurse or other hospital care staff?
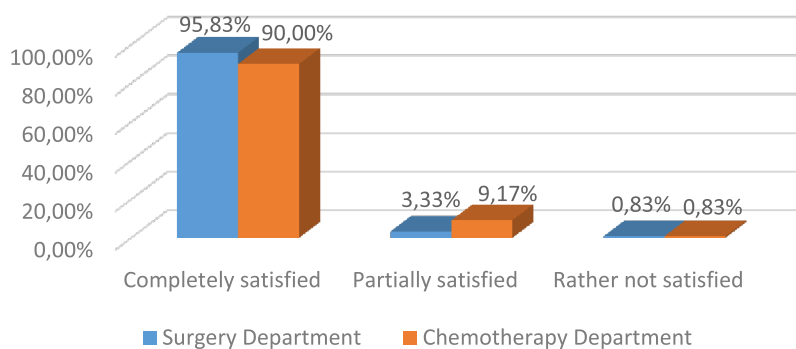
Fig. 4. Are you satisfied with your meals during your hospital stay?
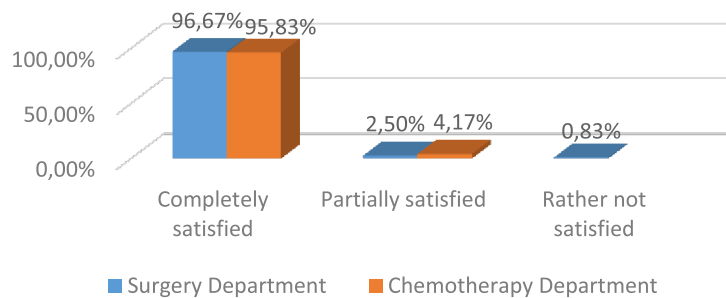
Fig. 5. Are you satisfied with the quality of cleaning, lighting rooms, temperature?
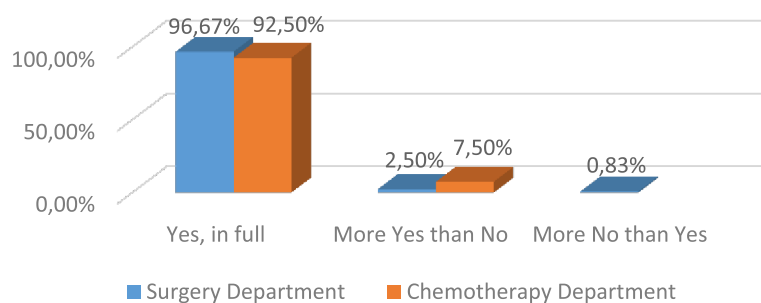
Fig. 6. Are you satisfied with the conditions of medical care?

To the following question: Are you satisfied with conditions in which medical assistance is rendered? The answers indicate that only 96.67% of the respondents of the surgical and 92.5% of the chemotherapeutic departments are fully satisfied with the conditions of medical assistance [fig. 6].

To the question: How long did you have to wait before the admission department doctor began to examine from the moment of admission

to the in-patient hospital? 92.5% of the surgical and 91.67% of the chemotherapy department respondents answered that the doctor examination started at the time of admission to the hospital. And only 5.83% and 4.17% of the respondents' answered they had to wait for an examination for up to 30 minutes [fig. 7].

Respondents answered the question: Are you satisfied, in general, with the medical assistance rendered to you in the in-patient hospital? Patients are completely satisfied with the medical assistance rendered in the in-patient hospital.

To the question: How much time passed from your receipt of a referral to in-patient hospital to the time of hospitalization (for patients admitted for inpatient treatment in a planned manner)? 95.83% surgical respondents and 96.67% in chemotherapeutical departments answered: up to 3 days and only 3.33% had to wait for up to 10 days [fig. 8].

To the question: Are you satisfied with the qualification level (professionalism) of your attending physician? The respondents' answers indicate complete satisfaction with the level of qualification (professionalism) of the attending physician.

And to the question: Would you recommend this medical institution to your friends and relatives? 100% of the respondents answered 'Yes'.

At the end of the survey, patients were asked to rate the quality of medical assistance using a five-point scale – 96.67% of surveyed surgical and 93.33% chemotherapy department respondents rated it by 5 points, 4 points evaluation refers to 3.33% of surgical patients and 6.67% – to chemotherapy patients [fig. 9].

Making a general conclusion on the results of the questionnaire at Unitary Enterprise based on the Right of Economic Management 'AROD', there were no comments from the patients, there are wishes and thanks to the medical staff of the clinic for courtesy, attentiveness, polite manners and for the quality of medical assistance.
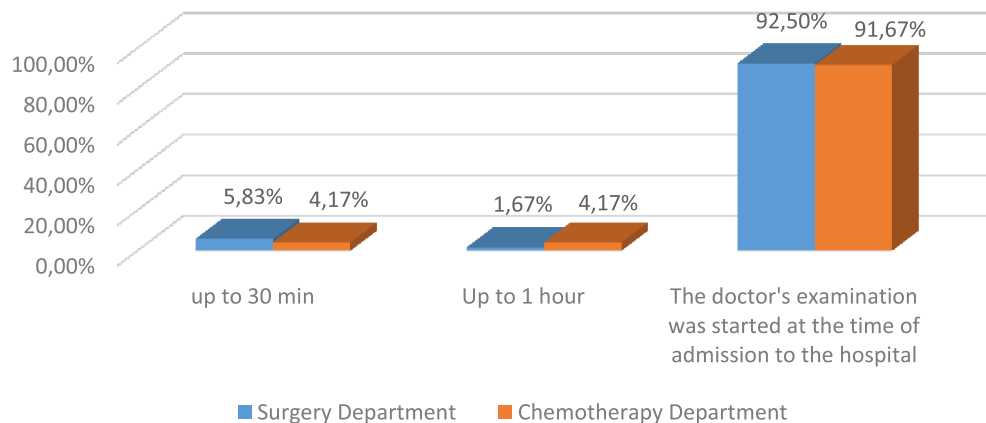

Fig. 7. How long did you wait before the doctor has began the examination in the emergency room from the moment of admission to the hospital?
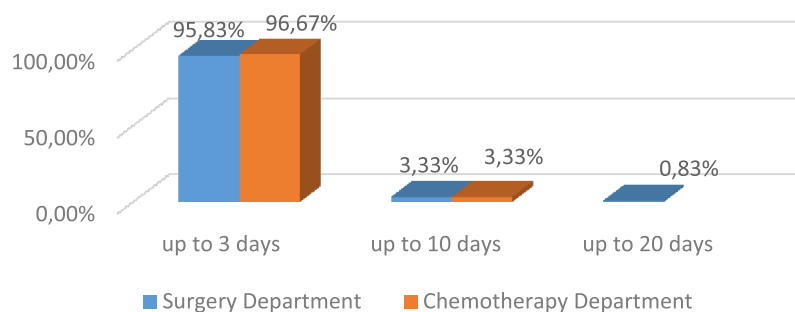

Fig. 8. How much time has passed from receiving your referral to the hospital to the moment of hospitalization (for patients admitted to hospital treatment in a planned manner)?
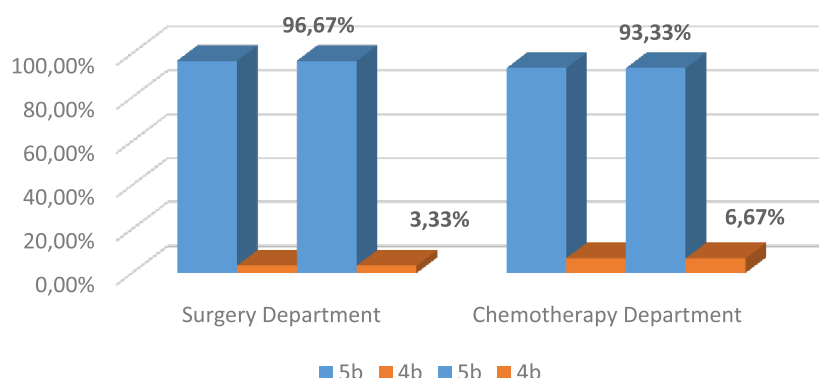
Fig. 9. Evaluate the quality of medical assistance rendered to you using the five degree scale

The evaluation of the reliability of the results obtained was carried out using the reliability coefficient (t). Consumer satisfaction indices were considered statistically veracious, as they exceeded their error by more than 2 times $(t > 2)$.

Thus, the analysis of patient satisfaction of the oncological dispensary revealed the following:

In general, patients are satisfied with the quality of medical assistance in the oncological dispensary, but there is still a need for improvement in such indices as rationalization and improvement of the convenience of a preliminary examination, execution of source documentation, communication with the consumer and attention to relatives/accompanying persons. Waiting time and promptness of service were evaluated by patients as very good.

It should be noted that, as such, the implementation of a quality management system does not have an endpoint; it is an iterative process of continuous self-improvement and perfection. Thus, the Unitary Enterprise based on the Right of Economic Management 'AROD', having started the process of implementing and maintaining the QMS, is still on the path to improving the management system of the medical institution, the quality of services, and relationships with customers and staff.

References

1. Yevstigneyev S.V., Vasilyev V.V. 2015. Sociological monitoring as a tool for medical assistance quality management. In book: Nauka i praktika (Science and practical experience): partnership for the implementation of national healthcare strategy in the region. Proceedings of the interregional scientific-practical conference dedicated to the 25th anniversary of the Chair of Public Health and Healthcare of the Institute of Professional Education (Samara, December 1, 2015). Samara. 325–327.

2. Petrov M.V., Polyukova M.V., Dronova A.A. 2012. Sociological surveys as an important tool for quality management of medical assistance. Issues of economy and law. 2: 116–120.

3. 'Densaulyk' state program for the development of healthcare of the Republic of Kazakhstan for 2016–2019.

4. Committee on Quality of Health Care in America. Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. Washington, DC: National Academy Press; 2001.

5. Stewart M., Brown J.B., Donner A. The impact of patient-centred care on outcomes. J. FamPract. 2000; 49(9): 796–804.

6. Street R.L. Jr, Makoul G., Arora N.K., Epstein R.M. How does communication heal? Pathways linking clinician-patient communication to health outcomes. Patient EducCouns .2009; 74(3): 295–301.

7. Epstein R.M. andStreet R.L., Jr. The Values and Value of Patient-Centred Care. Ann Fam Med. 2011 Mar; 9(2): 100–103.

8. 'Integrated approach to fighting oncological diseases in the Republic of Kazakhstan for 2018-2022', the Decree of the Government of the Republic of Kazakhstan of June 29, 2018 No. 395.

9. Tazhibaeva K.N., Buleshov M.A., Buleshova A.M., Zhanabaev N.S., Buleshov D.M., Ivanov S.V., Grzhibovsky A.M. Evaluation of the quality of medical assistance for patients with cancer in outpatient-polyclinic institutions of the South Kazakhstan region of the Republic of Kazakhstan // Human Ecology. 2017. No. 3 – P. 49–55.

10. Iskakova A.M., Goremykina M.V. The results of a sociological survey of the opinion of the population of the town of Semey about the quality and availability of medical assistance // Nauka i zdravookhranenie (Science and Healthcare). 2013. No. 1 – P. 8–9.

INNOVATIVE METHODS OF TEACHING PROGRAMMING AND IT IN RUSSIAN UNIVERSITIES

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With the active development of information technology (IT), employers' requirements for personnel in the field of information technology and programming are increasing exponentially. For the release of sought-after specialists by higher educational institutions, the development and implementation of innovative methods in the educational educational process is necessary. The article deals with especially acute problems that the teaching staff and students of all forms of learning encounter while learning new material (algorithms, programming languages, etc.), among which it is important to note the weak connection of the studied disciplines with practical activities. The solution to this problem may be, proposed in our work, an innovative method of software development in a team using distance learning systems. The aspect of development of future algorithmic thinking and the ability to self-education using visualizing multimedia systems is also highlighted. Due to the rapid development of IT, the question is raised about the relevance of teaching aids and the ability to self-educate graduates, since students need to maintain their qualifications and keep up with progress throughout the labor process. Based on the study, the article proposes a solution to all of the above problems.

Keywords: computer science, programming, educational process, distance learning, electronic libraries, visualization, multimedia systems

Currently, information technologies are developing very quickly, this situation is due to the process of globalization and the improvement of information communications.

From this, one of the most important problems arises when trying to train qualified specialists of IT specialties in higher educational institutions: almost every week new technologies are created that are worthy of placement in a previously planned semester-long course. The curriculum in higher education institutions often still adheres to the old format, unacceptable to constant changes due to the specifics of the subject.

Purpose of the study

Thus, it becomes obvious that the rapid development of IT requires the introduction of innovative approaches to the methods of teaching students information disciplines.

How can innovative methods increase the effectiveness of higher education institutions in training exemplary IT specialists?

Materials and research methods

The fundamental method for the ongoing research is a theoretical analysis and synthesis of scientific literature in order to identify the most effective implementation of innovative technologies in the process of teaching students programming.

Progress in the IT sphere directly affects the educational process of any specialty one way or another connected with IT. It becomes obvious that training IT specialists without taking into account modern developments will not satisfy a modern employer. Thus, first of all, the training program should focus on the needs of the market, as well as be adapted to the constant change in content, flexibly adapting to the situation on the labor market. Only when these factors are taken into account when training novice specialists, it is possible to ensure their relevance and competitiveness upon graduation from a higher institution, as well as guarantee their employment [1, 2].

The term programming defines the process and skill of writing programs on computers using a variety of programming languages. In other words, programming is like coding algorithms in a particular programming language. To summarize, programming is the process of writing programs, in other words, developing functioning software [3].

As a rule, first-year students who have just graduated from school or any other secondary specialized institution are almost completely familiar with rare exceptions with complicated models and techniques, which are often used in current programming. Therefore, many readings of theoretical material – lectures – are required. Despite the large amount of material, it still turns out to be insufficient for an in-depth understanding of the topics and successful independent work on home or laboratory tasks [4].

Particularly acute is the problem of insufficient basic training for most students who have just graduated from school. This is manifested in such signs as:

– not honed knowledge of mathematics in the school curriculum;

– poorly developed or not developed at all logical and abstract thinking;

– the inability to distinguish important aspects from the material proposed by the lecturer, to divide into main provisions and consequences;

– often the lack of writing skills, reading lecture materials presented by students is sometimes a difficult task for themselves: they are written in sloppy handwriting, fragmentary and logically unconnected [4].

Why does the problem of insufficient development of logical and abstract thinking skills arise during the period of schooling programming? One of the obvious problems of teaching programming as part of the school curriculum is the lack of a systematic approach. The essence of the problem lies in the fact that the school does not teach you how to solve problems using a certain programming language, but rather they only teach the syntax of this programming language. The task of an informatics teacher in secondary educational institutions is to instill in students the fundamental principles of the language without an applied solution to real problems through programming [5].

To correct the problem described above, during the period of higher education, teachers began to use multimedia when lecturing. Multimedia tools – a community of tools that allow you to use all kinds of forms of information – text, numbers, graphics, sounds, animations and videos [6].

At the moment there is a huge number of various kinds of multimedia manuals in which you can find assignments for students of all courses and levels of knowledge. In such publications, a variety of methodological techniques are used. With their help, you can complete training, monitor the level of knowledge received by students and prepare a list of teaching aids [7]. Using multimedia tools, students should work independently on assignments using the interactive resources of the multimedia complex and choose their sequence of study on their own.

Interactivity is one of the most important properties of multimedia tools because with its help students can sort information by relevance for them, as well as edit the pace of studying the material individually. In other words, students play an active role in the educational process itself. With the capabilities of multimedia tools, the opportunity opens up not only for independent work, but also for group training, forming such an important skill for a programmer as teamwork, which we will discuss in more detail later [8]. For a programmer, the skill of working in a team is critical, since

a specialist alone is not able to ensure the creation of high-quality and complex software.

The introduction of multimedia tools into the curriculum makes it possible to greatly facilitate the students 'perception of the taught material in higher educational institutions for several reasons: firstly, visualization increases students' interest in the subject being studied, and secondly, visualization makes it possible to assimilate material much more easily, appeal to representations which are comfortable for visual observation and analysis, as well as generally improve the quality of education [9].

Now education in the field of information technology is faced with the problem of constantly changing training methods and requirements for a modern specialist. The development of more and more new software, the invention of new programming languages and the complexity of the old ones exacerbate this problem. Regular software complexity requires changing existing approaches to their development. Software development is subject to many regulations, international standards and corporate practices.

Another problem facing programming teachers is the impossibility of relying on time-tested methods, techniques and tools. As a rule, printed didactic materials on programming and information technology become irrelevant and become outdated in 2-3 years. That is why paper editions are less and less used for training in this area, and most prefer digital sources of information.

Electronic library (EB) is a digital platform that reliably preserves and fruitfully uses large collections of electronic documents (such as text, graphic, sound, etc.) placed in the system, as well as those that can be accessed through telecommunication networks [10].

The obvious advantages of digital libraries (we can cite the electronic library of the Moscow Polytechnic University – elib.mgup.ru as an example of a typical electronic library) are:

– Since almost any literature related to programming languages is edited every 2-3 years, you do not need to spend money on a new paper edition of the book – just delete the old version and download the new one.

– The literature of university electronic libraries is most often free and provided by the state, like all services provided by electronic libraries.

– An e-book, unlike its paper version, cannot be damaged.

– Most books on programming languages are heavy, which means you cannot carry them with you in large numbers. Digital editions can

also be stored on removable media weighing several grams.

Therefore, EB at the moment should play an important role in the life of a student studying in IT specialties, by and large, already from the first course of study in a higher educational institution.

The basic concepts that are used in modern programming (popular algorithms, branches, and so on) should not cause difficulties for specialists in this field. During the educational process, it is students who focus on them, since they are used everywhere. When teaching such structures, students develop a special skill – algorithmic thinking. Algorithmic thinking is the ability to think in special patterns, which allows you to solve various problems with the help of compiling algorithms. Thinking of this type is one of the important components of the formation of a full intellectual education of a person [11].

An effective method for the development of algorithmic thinking of students in the study of one of the languages of object-oriented programming is teaching design skills and the practical application of algorithms for solving numerous and diverse classes of problems. It should be noted that with this approach, a number of difficulties also arise due to the huge number of teaching methods. It becomes obvious that the more modern and better pedagogical technologies are used, primarily during the teaching of programming, the stronger is the interest among students in solving the tasks set by the teacher with the help of algorithmic thinking and programming languages.

The main task of teaching any discipline is not so much the memorization of theoretical material, but rather the acquisition of the ability to successfully apply it in practice. This explains the need to focus students on examples of tasks to be solved. Typical tasks given by the teacher as an example will help students see practical benefits in them.

As S.I. Marajabov noted in his work, "the study of object-oriented programming languages requires the development of new methods of teaching and teaching. Therefore, it is necessary to use the latest teaching methods in the classroom (lectures, practical and laboratory work) on programming, to use more convenient, widespread and affordable programming systems" [12].

Algorithmization is an important stage in solving a problem using a computer. Thus, the formation of algorithmic thinking is the main task in the study of programming, since even simple algorithms are difficult for freshmen to understand, and therefore, difficult to learn [13]. In pedagogy, to facilitate the process during training, universally use the previously mentioned multimedia tools, for example, presentations, which provide visualization of the material told by the teacher; auxiliary videos and animations that illustrate the work of the studied algorithms [14, 15].

Recently, more and more attention has been focused on the need to develop self-education skills in the study of programming languages. The resources of electronic libraries, the Internet help in acquiring these skills, and distance learning plays an equally important role in this matter.

Distance learning, or e-learning, allows students to gain knowledge while away from a higher educational institution using the latest information technology and improve their ability to independently learn programming languages [16].

There are many forms of e-learning:
– Portals with video lessons (for example, interneturok.ru, ted.com and so on)
– Portals with lessons consisting of text-based thematic material, supplemented by videos
– Educational forums open for discussions of topics of interest
– Online tests and a variety of test tasks
– Portals of webinars, lecture broadcasts of teachers with interaction with students through a microphone, chat and so on.
– Interactive educational games.

However, it is worth noting that, unlike standard educational practice, when the teacher has the opportunity to change the content of his lectures, depending on the new requirements for a specialist in this field, accepted standards and the invention of new innovative techniques in programming languages, the lectures are recorded in video or audio at a time format change becomes more difficult. To solve this problem, it is necessary to break the audio and video lectures into logically connected fragments, which allow you to easily and simply edit the necessary parts from the many hours of recording, as well as add new fragments as necessary. Thus, this method allows students to provide relevant educational content during distance learning [17].

Nevertheless, it is necessary to take into account the difficulty of achieving intellectual and personal interaction between a teacher and a student or between a student and a fellow student, which can easily happen during classroom instruction. Adaptability, which allows using this software to various groups of students is no less important, that is,

the coverage should be greater than that of the standard "single-user" educational application. The software that was developed for one type of student (with a certain body of knowledge) may turn out to be completely irrelevant for other students, which may have lagged behind their peers for any reason [18].

The principle of team work on creating software is based on the organizational principles of projects: the responsibilities of each team member (leader, designer, programmer, and so on), the stages of the project and its life cycle. Each of the roles performed by employees in a team has a basis that should be formed during training at the school and higher educational institutions. Therefore, at present, employers demand from specialists not only impeccable programming skills, but also the ability to take part in the team in the development of complex software systems, respectively, the teaching staff is faced with the task of creating the necessary skills for students in social and professional work together with technical skills sphere [19]. In this regard, it is necessary to add to the curriculum related to programming and information technology in general, subjects that develop students' team skills, such as: leadership, social and business communication skills and team management.

Several attempts at collective teaching of programming in European universities have already been realized [20]. At the Complutense University of Madrid (Spain), a group of teachers conducts a programming course based on the NUCLEO distance learning system. This system was created with a focus on the socio-pedagogical approach to the formation of communication experience in Problem Based Learning. A feature of the problem teaching methodology is that the students' activities are organized in such a way that information is absorbed by them by solving various problems in the emerging problem situations. Thus, NUCLEO can simulate active teamwork: interpersonal communication, disagreements and their solutions. The concept of this system is based on the theory of activity, which is practically implemented in a special virtual environment. NUCLEO allows you to control and study the stages of personality formation based on the collected data.

The teacher's task for the successful operation of such a training system is to model the behavior of the subject in the social environment. Scientists advise using NUCLEO to develop teamwork skills in software development. The interaction itself in the social environment is carried out using two different schemes: competitiveness and cooperation.

These two schemes should increase motivation and teach different group dynamics depending on the game context planned by teachers. The NUCLEO system has a system of awards and rewards that are awarded depending on the achievements during the educational process of students [21].

Research results and discussion

We can conclude that one of the most effective innovative methods for improving the educational process of students in the field of IT is to borrow foreign experience in developing students' teamwork and introduce this experience into a modern educational program to provide the necessary skills for specialists to be in demand in the modern work market.

In lectures, obviously, students will perceive much more information when using visualization to explain the algorithms. Indeed, visualization is no longer an innovation in the educational process, since most teachers and teachers actively use visual multimedia materials in the process of explaining new material.

Visualization of algorithms is used to facilitate the educational process, clearly depicting the operation of the algorithms. Visualization is a universal methodological tool, since it is used both in high school and in higher education institutions in the initial stages of programming.

The electronic library, as it turned out, should play an equally important role in the life of a student of an information specialty from the first year of study at a higher educational institution. Since it makes it easy to update educational publications, it is compact, convenient to use, and in most cases free.

Conclusion

There are still many obstacles to the successful and effective teaching of programming in higher education. In a way, a programming teaching system is similar to what it was fifty years ago. One of the obstacles is the lack of a clearly defined unified approach, which is able to fulfill all the mental, social and business requirements of students, as well as provide high-quality technical training [22].

The solution to this problem may be the introduction of a problem-semiotic technique – a kind of successful synthesis of the above innovations in the article: the union of problem and semiotic approaches, including their positive aspects, but not having their individual flaws.

References

1. Ukuev B.T. The experience of introducing innovative teaching methods for bachelors and masters in information technology // Open Education, 2018. No. 3. P. 83-90.

2. Talgatovna Ya.V., Bogomolova O.I. Use of the collective development method in distance learning of programming in a technical university // Educational Technologies and Society, 2014. No. 4. P. 655-661.

3. The concept of programming. Types of programming languages [Electronic resource]. URL: https://studopedia.ru/8_31160_ponyatie-programmirovaniya-tipi-yazikov-programmirovaniya.html (accessed: 10/13/2019).

4. Ivanova G.S. The use of multimedia teaching aids when giving lectures on information technology // Mechanical Engineering and Computer Technology, 2018. No. 3. P. 373-386.

5. Experience in teaching students programming [Electronic resource]. URL: https://habr.com/en/post/179307/ (accessed: 10/14/2019).

6. What is multimedia [Electronic resource]. URL: https://www.kakprosto.ru/kak-80350-chto-takoe-multimedia (accessed date: 10/14/2019).

7. Prokin A.A., Bogatyrskaya V.A., Sergushina E.S., Klipikov V.Yu. Fundamentals of developing an effective WEB site // E-Scio, 2018. No. 3 (18). P. 12-17.

8. Akimova O.B., Vetlugina N.O. Possibilities of using multimedia in the educational process // Discussion, 2014. No. 9. P. 92-96.

9. Sadulaeva B.S. Methodological features of the use of multimedia in the lessons of computer science and ICT // Society: sociology, psychology, pedagogy, 2017. No. 1. P. 125-127.

10. What is: Digital libraries [Electronic resource]. URL: https://chpt.edusite.ru/DswMedia/chtotakoeyelektronnyiebiblioteki.pdf (accessed: 10/15/2019).

11. Sharipov F.F., Marajabov S.I. Theoretical model of the formation of algorithmic thinking of university students in the process of teaching object-oriented programming // Baltic Humanitarian Journal, 2017. No. 3. P. 313-316.

12. Marajabov S.I. Issues of teaching methods for object-oriented programming (OOP) in universities // Bulletin of the Tajik National University. Series of Natural Sciences, 2013. No. 1-1. P. 19-23.

13. Moglan D.V. Didactic potential of using algorithms visualization systems in the process of teaching programming // Open Education, 2019. No. 2. P. 31-41.

14. Gimaletdinova K.R., Muleeva A.Yu. The use of mental maps in computer science lessons // Innovative trends in the development of the education system: materials of the VI International Scientific and Practical Conference, February 19, 2017, Cheboksary. Cheboksary: Interactive Plus, 2017. P. 59-61.

15. Ivanov A.P., Fedoseyeva A.P. Development of a set of mental maps for the section "Algorithmization and Programming" of a computer science school course // Problems and prospects of physical, mathematical and technical education: a collection of materials of the All-Russian Scientific and Practical Conference. Tyumen: Tyumen State University, 2015. P. 91-95.

16. Features, advantages and trends of e-learning [Electronic resource]. URL: https://www.crmm.ru/knowledge_base/Osnovnyje_ponjatija_elektronnogo_obuchenija/Osobennosti__preimushhestva_i_trendy_E_learning (Accessed: 10/15/2019).

17. Bazhenova I.Yu. Peculiarities of teaching a programming language in the remote form of education // Modern Information Technologies and IT Education, 2014. No. 10. P. 190-196.

18. Kasyanova E.V. Methods and teaching aids in programming at a university // Educational Resources and Technologies, 2016. No. 2. P. 23-30.

19. Mozharov M.S. The use of modern technologies in the field of interactive teaching programming: trends and prospects // Bulletin of Tomsk State Pedagogical University, 2017. No. 5. P. 134-140.

20. Strijbos J.W. The effect of roles on computer-supported collaborative learning. Doctoral dissertation. Heerlen, The Netherlands: Open University of the Netherlands, 2014.

21. Nucleos [Electronic resource]. URL: https://nucleos.com/ (accessed: 10/18/2019).

22. Gafuanov Y.Yu. The problem-semiotic approach to teaching programming // World of Science, Culture, Education, 2018. No. 1. P. 215-217.

THE DEVELOPMENT OF AESTHETIC AND AESTHETIC TOLERANCE OF INNATE PHENOMENA OF KAZAKH LITERATURE IN SYNERGIES WITH UNESCO PRINCIPLES

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Modern philological science, being a part of humanitarian knowledge, is characterized by dynamics and by usage of new approaches. Modern science is developing researching tools taking into consideration interdisciplinary links in paradigm of humanitarian knowledge. Historical understanding of concept "world picture" approves these changes as the scientific reality cognition. The research paper has actuality as studying linguistic and literal world picture is one of the most important problems of modern humanitarian sciences. Observed problem has significant value in forming spiritual values of youths. The theory of linguistic world picture and literal world picture is based on methodology and cognitive theory which are under reformations in modern science. This reformation started at XX century when the cognitive standards became dependent on cognitive process, awareness of cognizer and on the type of cognizing objects.

The methodology is being based on social historic, anthropical, individual, cultural changes. Modern methodology studies dynamics of cognitive problems, cultural historic issues of cognitive tools, changeability of categories and concepts, formation of new cognitive orientations. The task of modern methodology is clarification, formation and transformation of mechanisms which integrated in individual daily experience. So the relevant studies are aimed on anthropocentrism which means that the study of language and its functions closely connected with human nature and human is a center of existence. Making researches in the sphere of linguistics or literature and their functions in human life it is possible to find out such linguistic functions which have not been investigated before or it is necessary to continue the researches in this direction. Linguo-anthropocentrical approach which is used in this research defines language as cognitive source for human and human activity as the source for language and its functions studying. Introducing anthropocentrical approach in linguistics allowed investigating the language function in new level which made possible to connect language activity in its functioning with human activity in society.

The concept "world picture" was introduced in physics at the end of XIX century and at the beginning of XX century. G. Gerts was the first scholar who used it refer to physical world picture. He introduced the term as a combination of internal representations of objectives logically using which it is possible to get behavior characteristics about these objects. According to G. Gerts internal representations or symbols of objectives, created by researches, has to be such that the "logically necessary consequences of these representations in their turn were natural representations of these objects" [1, 152 p.]. Created representations should be logical and represent natural proportions of the objects including all details. According to G.Gerts the way our brain creates representations determines the ways of their representations. The scientist tried to characterize simple thing picture in sensible world and processes in it, including to this picture the main principles of mechanics using which it is possible to introduce total mechanics without references to experience. He considered if we interpret differently the mechanical principles depending on its basic statements, "we get different world pictures" [1, 154 p.]. M. Planck also used concept "world picture" introducing physical view of actual nature regularities. In his view the content of this representation, based on principals of energy conservation and transformation, as on increasing entropy principles, enriches releasing anthropomorphic elements during the physics development [2, 19 p.]. A. Einstein also used this term in his works.

Therefore, the first usage of this concept connected with scientific world picture. According to A.A. Melnikov "the status of this concept remains indefinite in the modern methodology and philosophy". Determine concept "world picture" through scientific and general scientific point of view, it has several interpretations which locate between science and world view as well as between science and philosophy: world picture is observed as world view which include in itself type of social practice; world picture is a type of philosophical

reflection (neonatural concept of scientific world picture); world picture is a type of scientific knowledge [3, 124 p.]. Then the term "world picture" started to use in culture and linguo-semiotic studies.

World viewing as a part of world picture was studied in cultural aspect. Firstly scientists investigated collective consciousness basing on materials of myths and folk literature through reconstruction of its structure. Scientists observed the term as primary and secondary modeling systems in semiotic direction of study. They considered the model in cybernetic meaning so the world was described as "passive automotive memory". Then concept "world picture" changed under the influence of gnoseological and general scientific meaning to an image of modeling object. According to A. Gurevich "every civilization, social system could be characterized by the way how they interpret the world. Accepting the main conceptual and spiritual categories as universal, we meant the fact that they are natural for a person at any stage of his life but their meanings change during the time [4, 7 p.]. In recent years many scientists, who are making researches in this sphere, have come to conclusion that "world picture" of each ethnic group should be studied separately. Accepting the concept "world picture" as "world view" is the main factor for researching linguistic world picture and literal world picture. Generation of the concept is closely connected with language and determined by language. It is called as linguistic world picture which reflects national world picture and found in linguistic units of different levels. Taking into consideration definite world picture of individual we can say that it is based on conceptual world picture forming it in its turn as any human-being can understand the world and himself only through language. Language includes general and national social historic experience so we can say that enrichment happens in two directions: 1) life conditions and welfare determine people's behavior and consciousness which reflect on language, especially in its grammar and semantics; 2) person understands the world through native language which determines his behavior and cognition [5, 204 p.].

It is necessary to note that the term "world picture" is metaphorical as "specific uniqueness of national language, which includes specific historic experience of definite nation, does not creates different world picture, it creates "national world picture" based on unique attitude to some things, events, processes showing uniqueness of specific national culture" [5, 204 p.]. E.D. Suleimenova emphasized "the linguistic world picture cannot be equated to world picture as we cannot equate language to cognition". So the distinction of the world picture and the linguistic world picture is definite as the distinction between the terms: language and cognition. However linguistic world picture as a term unit originated due to interaction of reality and language (without cognition) [6, 89 p.]. Linguistic world picture includes specific language figures: culture-specific concepts, categorical division of the world – the composition of categories and paradigms, quantization of semantic continuum, standard type of estimation, etc. The world picture is expressed in two ways: on the one hand, by language units (grammatical categories, morphemes, stable word combinations, phrasemes), on the other – by the way of their formation, syntactic constructions"[5, 87 p.]. Each ethnos language describes the world by its own way of conceptualization which means that it creates its own world picture model. According to the Humboldt's view, different languages are different worldviews and specificity of each particular language determines "linguistic consciousness of this nation" [7, 15 p.]. According to the functional aspect the concept "consciousness" can be divided into conceptual, linguistic and coordinative one" [8, 2 p.]. Linguists who study the problem of linguistic consciousness, national linguistic consciousness, operate with such terms as mentalistic language, mentality, cognition. The work of V. Humboldt, A. Potebni, I. Baudouin de Courtenay contributed to formation of these concepts which are closely connected to the concepts of world picture, linguistic world picture, literal world picture. Theorists of literature study literal semantic and literal figures in ethno-ethic features. Among recent researches it is necessary to mention: dissertation of Z.Gassanova "Caucasian mentality in the image of Russian literature of the nineteenth century", T. Belyaeva "Poetics of symbolic images in Mari drama", L.Cheltygmasheva "Ethno-poetic originality of Khakass prose of 1930-1990 period", among domestic researches: monograph of A.Tumanova "Contaminated linguistic world picture in literal discourse of bilingual writer", article of A.Karkanova "Reproduction of national world picture based on culture-specific concepts of the epic novel of M. Auezov "Abai way". There are not so many works dedicated to literal and linguistic world picture. Mainly authors write about problematic of space and time. Theorists of literature noticed the novelty of usage the concepts "world picture" in

philology: "New concepts of philology "world picture", "worldview" connected with modern developments in the science, which proved the existence of different cosmological models of the Universe. "As each century creates its own model, so human-beings of XX century should imagine the universe representation to answer – what is world and what kind of place has an individual in it. Art could not reflect new world model" [9, 17 p.]. Works of R. Barthes, K.Levi, E.Volodina, S.Bocharova open the next page in the development of new approaches in development of integrative trends in science. Philosophical categories of space and time, reflected in literature, devolved on philological categories of cognition and understanding of reality. The methodological novelty brought by M.Bakhtin, determined the role of space and time in literature, became literal world picture. The scientist suggested "time-space is a formal literal category, which genre varieties determined by time-space and it contains all narrative knots" [10, 101 p.].

The research in theory and methodology of literal and linguistic world picture is in the infancy stage. Scientific philological tools have been enriched by the concepts "linguistic world picture", "literal world picture", "linguistic literal world picture". Now there is an actual problem to distinguish these concepts in philology.

N. Goncharova, taking into account views of famous linguists, suggested: "linguistic world picture is a mental linguistic knowledge: information about surrounding reality created in individual or collective consciousness and is represented by language means" [11, 396 p.] .

It is worth to remind that the concepts "linguistic world picture" and "linguistic literal world picture" are not the same, they relate to each other as the general and the particular. Linguistic literal world picture means "syncretical knowledge which became the realization of literal images in speech and became cohesive, complex literal image created by the means of language. The main features of linguistic literal world picture are internationality, possibility to transform literal word and its synthetism, variety of meanings leading to unknowable linguistic literal world picture" [12, 6 p.]. There is no consensus in determination the concept "literal world picture", the evidence of this fact is absence of the completed theory. Scientists agreed that it relates to the secondary systems as linguistic world picture and refers it to author individual world picture. Y. Salnikova tried to understand the structure and sense of literal work, its place in literal process: "we

considered that the ratio between objective and subjective in the space-time structure of the text more clearly reflects the classification of P. Zobova and A. Mostepanenko [13, 21 p.], according which a literal work contains the following levels:

1. The real level: physical space and time, the literary text is an ordinary material object, a thing among other things.

2. Conceptual level: "model" reflection of reality, fable, objectified background of literal events. The conceptual space and time show the historic space and time in which actions happened in the book, not the time and space when the book was written.

3. The perceptual level is directly related to the formation of literal image. In this level the specific uniqueness of this literal text opens which differentiate it from others" [14, 28 p.].

There is variety of "world picture" definitions which connect language with literature but correctly relate the concept to the space-time continuum. "The problems of linguistic literal world picture only denoted and significant researches are needed in this sphere. Investigation of linguistic literal world picture is possible by means of coordinate systems though which person understands reality and built world view in cognitive space. They are called space-time categories" [12, 6 p.].

Thus, the space-time structure of literal text as a basis of literal and linguistic world picture is the link that merges conflicting scientific opinions. Plot is the link for literal world picture in literature science. Linguists are interested in phenomenological peculiarities of world picture and means of language representation, this approach cannot satisfy the theorists of literature, as it does not describe full scientific cognition of literal and linguistic world picture. The literal world picture is wider than any science or subject. It is imposed by inner properties of literature such as person and life reflections, variety of life stories and differences of human feelings. This no doubt that paradigm of literal text spreads from grammatical level to philosophically ontological reality. Modern philological science studies image content and language of literal text which are directed to development of special methods and scientific interpretations for meaning recognition of literal text. This fact made scientists research idea of identification meaning of literal word to "archetypes of the culture", which was proposed in the Humboldt concept of literal text perception as system object characterized by specific features and regularities.

G.G. Shpet's theory played great role in cognition and scientific description of the dialectic of creation, functioning and perception literal text. His famous essays on hermeneutics, "Phenomenon and meaning" (1914), "Aesthetic Fragments" (1922) are a major contribution to the development of literary hermeneutics. He observed "word" and "literature world" in the paradigm of microsystem and macrosystem relations. "Inner form", being medullary element of poetic world structure, forms literal world picture. Main idea of the theory is that the scientist obtained word perception as a structure, which reflects emotionally sensitive and cognitive character. According to G. Shpet supposed that interpretation of image to cognition is a "total emancipation" of poetic form. Character created by literal word cannot be interpreted as "concept" or just like "representation". So during reading process a reader understands character, concept and image of literal text through individual and collective comprehension by interpretation creative literal world picture [15, 68 p.]. Thus, reader and literal text each time interact with each other creating dialogue; this created relation is not regulated by the author's idea. The idea of literature perception as an ability to self-regulation is the main feature of an open dissipative system. This idea is accepted as innovative point of view to the well-established physical nature regularities.

A Nobel laureate I. Prigogine developed the system theory in the sphere of anthropology and engineering science. The most important aspect in his research was the comparative investigation of open dissipative systems with closed-ordered systems, which have not communicative characteristics. The comparative analysis of these systems has revealed variability, instructiveness, self-regulation of open systems. The fundamental idea is that the "human systems are considered not in terms of equilibrium or as "mechanisms, but as the creative world with incomplete information and changing values, a world in which the future can be represented in many ways. The social problem of values in a wide range can link with the non-linearity. Values are codes that we use to keep the social system in some line of development, which is chosen by history. Value Systems always resist the destabilizing effects of the fluctuations that are generated by this social system, it gives the process the features of irreversibility and unpredictability "[16, 36 p.].

So the system theory foregrounds in perception, comprehension, understanding of a literary text. The theory of open systems is related to the category of fractals – a term in-troduced by B. Mendelbrot, a mathematician and the author of "The Fractal Geometry of Nature" [17, 15 p.]. Fractal derivates from the Latin word "fractus" and denotes – uneven, broken. B. Mendelbrot used the terms "fractals" and "fractal objects" talking about ability to "self-similarity" expressed in the invariance and "irregularities" meaning non-linearity.

Synergetic study jointed in itself traditional approaches of literature study and new concepts based on the system theory and fractal literature, it also jointed humanitarian and basic scientific knowledge. Conceptual paradigm of the synergetic is the meaning self-generation.

It is not sufficient to use traditional scientific approaches for understanding hidden dialectical relations. System-synergetic approach became effective for the detection of multi-piece structure of the text, the relationship of its elements, direct and figurative works bonds with reality, meaning polyphony of text's verbal structure. It was restructured the traditional comprehension of gradation – author, text, reader. Subject, idea, author conception, characters system, structure, plot, reader's perception are the elements of literal and linguistic world picture according to system-synergetic approach. These elements are universal and unique at the same time. Historical reality, life and spiritual experience of a text author and a reader, psychology of creativity, the psychology of perception in evaluating the text as an open system are important components in the typology of the functioning of literary text. The works of H. Haken [18], V.S. Stepin [19], E.N. Kniazeva, S.P. Kurdyumov [20], and others are important for development of the synergetic theory.

Academician V.S. Stepin studied the philosophy of science. In his monographs "Theoretical knowledge" he explained the properties of self-organization systems as "a process that leads to the formation of new structures" [21, 204 p.]. The combination of a systematic approach and the synergetic principles in the annex to the humanitarian knowledge, such as literature, gives new possibilities for understanding the plot and the meaning of the literal text.The text perception as the open self-organizing system changes the view on the relationship between the text and the reader, the author and the reader. "Non-equilibrium relations are "sine qua non" condition for self-organization, but self-organization, in its turn, changes the role and meaning of these relations" [22, 135 p.]. The history of literal compositions functioning has examples when a story is comprehended differently dependently

on centuries. The books, which were read with great interest in one historical period, have become uninteresting in another period. But there examples of classic novels which are actual and interesting in each period by variedness of hidden meaning layers.

This factor depends on text autonomy from its author and reader's activeness in meaning understanding. It is appropriate to address to the Einstein's theory of relativity belong to time and space. New time and reality can cause new understanding of the meaning. Scientists V.G. Zinchenko, V.G. Zussman, Z.I. Kirnoze proposed the effectiveness of the system-synergetic approach in studying literary compositions as "an unstable system which are constantly in a state of transition from chaos to order and from order to chaos". They associated quality of nonlinearity with meaning self-creation: "Synergetic approach allows us to investigate the semantic aspect of the "literature" system relationship with the system of numerous contexts and with reality. There are many works in philology titled "Art and synergy", "text synergy" and others [23, 203-204 pp.]. Individual reader conception and linguistic world picture recreated by the author enter into complex relation determined by scheme of the system-synergetic method where the main triad is author, composition and reader. This triad is framed by traditions and reality. The direct and reverse associations between structure meanings play determinate role. Variety of structural elements is characterized by non-linearity and their openness that ultimately leads to the meaning self-creation of each individual reader.

References

1. Hertz G. Principles of Mechanics presented in a new form // Life Science. Anthology of Classical Science Fiction Stories. – Moscow: 1973. P. 246.

2. Planck M. Physical world picture. – Moscow: 1966. P. 326.

3. Melnikov A.A. Language and national character. The relationship of structure and mentality. – St. Petersburg: Speech--2003. P. 256.

4. Gurevich A.Y. Categories of medieval culture. – Moscow: 1972. P. 135.

5. Maslov V.A. Cognitive Linguistics. – Minsk, Tetra. Systems, 2004. P. 357.

6. Suleimenov E.D. The concept of meaning in modern linguistics. – Alma-Ata, 1989, P. 269.

7. Uryson E.V. Problems of linguistic world picture: Anthology in semantics. – Moscow: Languages of Slavic culture, 2003. P. 304.

8. Fefilov A.E. The nature of the interaction of language, consciousness, reality // Internet materials. 2004. P. 1-3.

9. Danchinova M.D. Literal world picture in the literature of Buryatia (1960-1990-ies): Spatio-temporal architectonics. Ulan-Ude, P. 138.

10. Bakhtin M.M. Seven Volumes collection. Volume 3 – Moscow: 2012, P. 238.

11. Goncharova N.N. Linguistic world picture as an object of linguistic description // Proceedings of the TSU. Humanitarian sciences, 2012, № 2. P. 396-405.

12. Zobov P.A., Mostepanenko A.M. The rhythm, the space and time in art and literature. Leningrad, 1974. P.1125.

13. Salnikov Y.V. Literal world picture in V. Belov prose: Abstract: Kand. filol. nauk. Voronezh, 2011. P. 28/

14. Aiupova S.B. Categories of space and time in linguistic literal world picture (based on I.S. Turgenev prose). The thesis for participation the degree of Doctor of Philology. – Ufa, 2012. P. 297.

15. Speth G.G. E.V. Pasternak prose. – Moscow. 1989.

16. Prigogine I. Nature, science and new rationality // Philosophy and Life. – 1991. – № 7. 36 p.

17. Mendelbrot B. Fractal Geometry of Nature. Moscow: 2002. 656 p.

18. Haken H. Synergetic Computers and Cognition. A. Top-Down Approach to Neural Nets. – Berlin: Heidelberg, 2004. 256 p.

19. Stepin V.S. Synergetic and system analysis // synergetic paradigm. Cognitive – communicative strategies of modern scientific comprehension. Moscow: Progress-Tradition, 2004. – 560 p.

20. Knyazev E.N., Kurdyumov S.P. Foundations of Synergy: synergistic vision of the world. Izd.3, 2010. 256 p.

21. Stepin V.S. Theoretical knowledge. Moscow: 1999. 237 p.

22. Prigogine I., Stengers I. Time. Chaos. Quantum. Moscow: Progress, 1994. 266 p.

23. Zinchenko V.G., Zussman V.G., Kirnoze Z.I. Literature and methods of its study. System – synergetic approach. – Moscow: Flint. 2011. 275 p.

SURVEY TO THE RESEARCH ON DEVELOPING MULTICULTURAL PERSONALITY OF LINGUISTIC MAJOR STUDENTS AT HIGHER EDUCATIONAL INSTITUTIONS

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The topicality of the multicultural education is caused by the specifics of the ethnic situation in the country, determined by the multiethnic and multiconfessional composition of the population. The survey to the research on culture, polylinguism and multiculturalism is given in this article. The authors share their experience in the study and development of multicultural personality. The definitionы of the basic notions such as "language", "bilingualism", "polylinguism", "culture", "multicultural education" are given. Based on the analysis of theoretical sources, a definition of "a multicultural personality" is given. The main criteria to assessing the level of multiculturalism are determined. In Kyrgyzstan and Kazakhstan much attention is paid to the problems of interethnic conflicts, cultural diversity, differences in languages, traditions and customs, lifestyle. In universities, however, disciplines on the formation of multiculturalism have not yet been introduced. The necessity to develop such qualities as empathy, tolerance and other features are revealed in the implementation of the academic course "Polylinguism and multiculturalism".

Keywords: education, culture, language, personality, polylinguism, multicultural education multiculturalism

In the light of the changes taking place in our country, many questions are raised with the introduction of the state program of multilingualism. In the era of globalization and intensifying cooperation and contacts in the economic, political and other spheres of human activity, the role of English as the international communication language has "burst out" in recent decades and is still increasing. English is the language in which computer programs, economic and legal documents are developed. We cannot imagine a society which is monolingual and homogeneous in its ethnic structure. Many countries are multiethnic and multilingual or at least bilingual.

So taking into consideration that the representatives of more than 100 nationalities and ethnic groups live in Kazakhstan, it must be admitted that multilingualism is a necessity and an objective reality. Language is a means of communication, information sharing.

Aim of the research is to study the ways to cultivate multiculturalism of higher education institution students.

Materials and methods of the research

The research was based on the study of the theoretical sources and experiment results conducted in Zhezkazgan Baikonurov University and Arkalyk State Pedagogical Institute. Methods of the research are related to the investigation (observing, interviewing, questionnaire, implementing new course in multiculturalism, etc.).

Results of the research and their discussion

As it is pointed out by the researchers, the relation between language and culture and the history of nations are multidimensional and diverse. Thus, the German scholar Wilhelm von Humboldt considered language as the combined spiritual energy of the people speaking it, as a kind of concentration of thoughts and feelings of each ethnic group [1], A.A. Potebnya saw the language as a way of spiritual consolidation of an ethnic group which is the characteristic of the nation [2; 172]. In the opinion of some researchers, bilingualism and multilingualism are the determining factor in the socio-political development of society in various countries of the world, which consist in the mass use of two or more languages in the process of communication, when a person, depending on the purpose, place, and recipient of communication switches one language to another [3].

As we have said, language and society, language and culture are inextricably linked and act as two interrelated sides of the same phenomenon. What is meant by the term "culture" in the definitions of scientists?

In philosophical and culturological studies, we can note the following main trends in the search for the leading principle in the definitions of this concept:

– definition of culture through the results of human activity;

– the definition of culture based on the process of this activity;

– definitions that consider culture as a communication system;

– systemic definitions. (A. Bystrov) [4; 33]

So, if you rely on the definition given in the "Philosophical Dictionary", "the concept of culture includes both the general difference of human life activity from biological life forms, and the qualitative originality of historically specific forms of this life activity at various

stages of social development, within certain eras, socio-economic formations, ethnic and national communities ..." [5; 292]

To reveal the phenomenon of heterogeneity, diversity of cultures in society, the terms "multiculturalism", "multiculturalism", "multiculturalism" (less often) are used.

Three interrelated, but nonetheless distinctive, referent of multiculturalism and its associated adjective can be distinguished in public debates and discussions.

Firstly, the term "multiculturalism" is used to denote the existence of ethnically or racially heterogeneous segments in a population of a society or state. According to this notion such differences have some social significance – primarily because of perceived cultural differences, although they are often associated with forms of structural differentiation. The exact ethnic groups that exist in the state, the significance of ethnicity for social participation in public institutions and the processes by which ethnic differentiation is built and maintained can vary considerably between individual states and over time.

Secondly, "multiculturalism" refers to specific types of programs and political initiatives designed to respond to and manage ethnic diversity. It is in this use that "multiculturalism" first received its evaluation and recognition after it was recommended in the report of the Royal Commission on Bilingualism and Biculturalism for 1965. This report recommended to replace by cultural policies based on British and French charter groups, around which the policy of ethnic diversity in Canadian society has been organized for over a century. Since then, its use has quickly spread to demographic-descriptive and ideologically-normative uses.

Thirdly, multiculturalism is the one that generates the highest level of debate, because it represents the slogan and model of political action based on sociological theorizing and ethical-philosophical consideration of the place of those who have culturally distinct identities in modern society.

Multiculturalism stresses that recognition of ethnic diversity and ensuring the rights of individuals to preserve their culture should be combined with ensuring full access to constitutional principles and values common in society, their participation and adherence to these principles. Recognizing the rights of individuals and groups and ensuring their equitable access to society, supporters of multiculturalism also argue that such policies benefit both individuals and the wider society by reducing the pressure on social conflicts based on adverse conditions and inequality. They also argue that multiculturalism is enrichment for society as a whole. The close parallels between this ideologically-normative use of multiculturalism and the United Nations views on cultural diversity are clear.

The goals and objectives of multicultural education, as a rule, differ between educational philosophers and liberal political theorists. Educational philosophers argue about preserving the culture of minorities, encouraging the development of autonomy in children and introducing them to new and different ideas. This form of exposure would help children think more critically and also encourage them to more open thinking. On the other hand, a political theorist may advocate a model of multicultural education that justifies social actions. Thus, students are equipped with the knowledge, values and skills necessary to induce and participate in social change, which leads to justice, that is, fair treatment of other affected and excluded from the process or ethnic groups restricted in their rights, involving them in educational process. With such a model, teachers will act as agents of such changes, promoting appropriate democratic values and enabling them to act. Multicultural education has many other achievements and goals that must be accomplished:

– Promoting the development of civil society

– Creating the correct historical evaluation

– Increase the self-esteem of students not related to the main trend / ethnic group

– Increase student contact diversity

– Minority culture preservation

– Development of autonomy of the individual

– Promoting social justice and equality

– Providing students with the opportunity to economically succeed in an integrated, multicultural world.

A multicultural personality is a person who is the subject of a polylogue of cultures, has an active life position, and has a developed sense of empathy and tolerance, emotional stability, the ability to live in peace and harmony with people as representatives of different cultural groups, capable of successful self-determination and productive professional activity in cultural diversity of society [6].

Multicultural education is a collection of educational strategies and materials that have been developed to assist teachers in many issues related to the rapidly changing demographics of their students. It provides students with knowledge of the history,

culture, and contributions of various groups; suggests that the future society is pluralistic. It is based on knowledge from various fields, including ethnic and female studies, but also reconsiders the content of the relevant academic disciplines.

Multicultural education, also seen as a way of learning that promotes principles such as inclusion, diversity, democracy, skill acquisition, research, critical thinking, the value of perspectives, and self-reflection. It encourages students to incorporate aspects of their culture into the pedagogical process and thus allow teachers to support the student's intellectual and social / emotional growth.

It was found that multicultural education effectively contributes to the achievement of educational success among immigrant students – this is especially important in the era of internationalization of education. Thus, this is also explained by the reform movement to transform education. Transformation in this context requires a change in all variables in the university, including politics, teacher attitudes, teaching materials, assessment methods, counseling, and learning styles. Multicultural education is also associated with students' contributions to effective social action.

To study the state of the problem under discussion, we conducted a diagnostic experiment. A research was conducted on the basis of the university in order to determine the formation of multicultural personality level, in which 171 students of the specialty "Foreign Language: Two Foreign Languages" took part. Why did we choose students of language specialties? Language and culture are inextricably linked. It is impossible to study the language, focusing only on the linguistic aspects, system, structure of the language, without studying the culture, literature and traditions of the country, which language they learn, in the cognitive process. When learning languages, there

is an exchange and dialogue of cultures. And the deeper students get into this process, the more effective the result will be. Knowing the language and culture of another country and its multinational country at the same time, becoming familiar with the culture and traditions of other nations, the person enriches inner world, broadens horizons, raises awareness levels, a feeling of empathy, tolerance, empathy, emotional perception of the world around.

We conducted a survey of students of language educational programmes from the first to fourth courses of the university. The results of the questionnaire in order to determine the level of students' awareness regarding the phenomenon of culture, features of the development of the global world, the principle of multiculturalism (cognitive level) indicate that only 26 % of respondents have high level of awareness, 31 % have average level and 43 % have low level.

A clear idea of the general level of multicultural orientation gives a set of criteria, among which the level of tolerance and empathic abilities of the individual. To diagnose empathic abilities, we used a test to diagnose social empathy [3].

Conclusion

Based on the data we obtained, it can be noted that 55 % of students of the specialty "Foreign Language: Two Foreign Languages" have low level of empathy, 31 % have average level and only 24 % of students have high level of empathy. The results indicate the inability of most respondents to show sympathy, empathy with the communicant and others. In most cases, they are not characterized by responsiveness and attention to other people's problems. As noted above, empathy underlies the affective component in the structure of a multicultural personality and thereby characterizes the general level of this quality development.
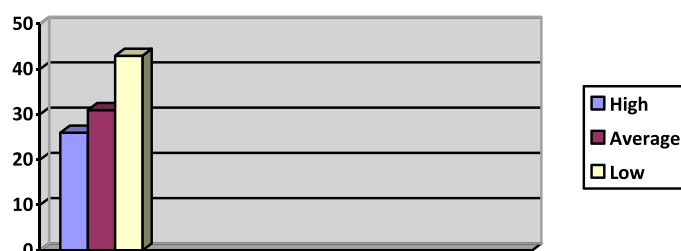

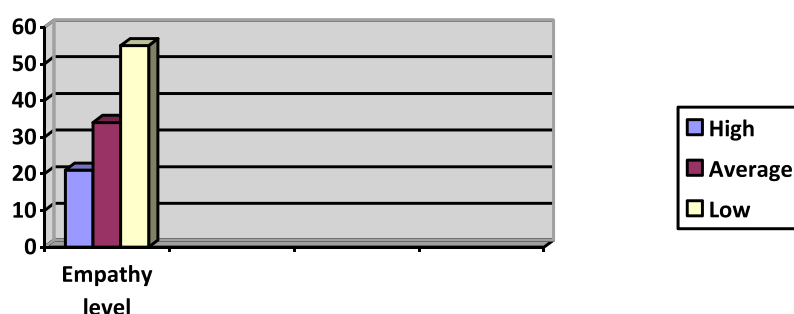Fig. 1. Multicultural personality levels

Fig. 2. Empathy levels

So, based on these characteristics, we diagnosed the formation of communicative tolerance. The analysis of the data we received allowed us to conclude that the vast majority of students are not able to hide or smooth out unpleasant feelings that arise when communicating with non-communicative partners, are not ready to accept and understand the personality of the companion, most respondents are not able to forgive mistakes, awkwardness, unintentionally caused troubles .

Diagnostics of data shows low indicators. For the formation of a multicultural personality with a high level of communicative competencies development, cognitive, motivational-affective and behavioral components, it is necessary to create appropriate pedagogical conditions, which can be:

1) the proper selection of topics and structuring the content of educational material in a foreign language based on a sociocultural approach and the principle of professional orientation;

2) the use of interactive forms and methods in the process of teaching a foreign language (discussions, role-playing games, dramatization, presentations, Internet communication, design technologies);

3) humanization of the interaction of subjects of the educational process: the interaction of the teacher and students on a dialogical basis, in the framework of cooperation and co-creation.

Thus, multicultural education is most successfully implemented as part of the university approach with the restructuring of not only the curriculum, but also organizational and institutional policies.

Unfortunately, most educational institutions are not ready for multicultural education within their walls. Multicultural education requires employees who are not only diverse in terms of age (the older wise generation and the young energetic generation of the teaching staff), academic degrees (from masters to doctors of sciences), but also culturally competent. Educators need to know, respond, and embrace a variety of beliefs, attitudes, and experiences. They should also be prepared to solve disputes. These issues include, but are not limited to, such as racism, sexism, religious intolerance, classicism, ageism, etc., that is, everything that may interest the young generation, cause their questions, disputes or interest.

For the successful solution of many problems and the formation of a multicultural personality, it is necessary to approach the pedagogical process in a diverse and creative way, covering such aspects as:

– Integration of a diverse list of literature, which demonstrates universal human experience in different cultures, the world's classic treasury of achievements;

– Encouragement of student participation in community life and social activity of an individual;

– Going beyond the scope of the textbook and sometimes the training material, supplementing the curriculum with current events and news outside the textbook, so you can draw parallels between the distant past experience and the world today.

– Creation of multicultural projects that require students to choose a background outside their own knowledge and skills, developing new abilities;

– Offer your university to undergo vocational training in the field of multicultural education in the classroom, or dual education that is very relevant in our time, involving students in the field of future activities.

We continue to work on the research and development of pedagogical conditions for the formation of a multicultural personality of language specialties students at universities.

References

1. Humboldt V. On the study of languages, or a plan for a systematic encyclopedia of all languages // Humboldt V. Language and philosophy of culture. – M., 1985.

2. Potebnya A.A. Thought and language. Kiev, 1993.

3. Snitko E.S., Maimakova A. The concept of the native language and its interpretation in modern linguistics.

4. Bystrova A.N. World of Culture (Fundamentals of Cultural Studies). Tutorial. 2nd edition, revised and supplemented. Moscow: Publishing House of Fedor Konyukhov; Novosibirsk: LLC "Publishing House UKEA", 2002.

5. Philosophical Dictionary / Ed. I.T. Frolova. – 4th ed. M.: Politizdat, 1981. – 445 p.

6. Ivanova L.V., Agranat Yu.V., Ivanova L.V. Pedagogical conditions for forming a policultural personality of students in the context of teaching a foreign language at a university // Fundamental Research. – 2013. – No. 1-1. – P. 82-84.

7. Pedagogical Encyclopedic Dictionary / Ch. ed. B.M. Bim-Bad. M., 2002. P. 130.

MANAGEMENT OF SOCIAL PROBLEMS OF EXPANSION OF MODERN DIGITAL REALITY IN SOCIO-TECHNICAL LANDSCAPES

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Evolution of human groups in certain territories and in various time leads to emergence and life in the habitat socio-technical landscapes, the using various practicians and digital technologies. In process of industrialization transition from an intensification of innovations of digital technologies to their expansion is observed. There are problems of formation of various scenarios of social management of new situations in socio-technical landscapes on the basis of various criteria – for example, values of risks. In work briefly are considered: classification of socio-technical landscapes, questions of formation of necessary components for calculation of numerical values of risk, the equation of dynamics of risk, the characteristic of modern digital expansion, questions of digital transformation is given, the generalized scheme of use of expert system for damping of consequences of digital expansion within the Industry 4.0 is provided. In the conclusion the conclusion about need of an intensification of scientific and practical researches in the field of development of a philosophical mathematical apparatus of assessment of numerical values of risks for use of the systems of support, those at design, of the correcting decisions realizing various scenarios of management is drawn. Work is performed with assistance of Grant by RSF No. 19-18-00504.

In process of development of society in a certain territory in various relations of production and historical conditions synergetic processes are resulted by certain structures – the sotsio-technical landscapes (STL) [1–3]. As they can be classified as live and open systems, we will apply the principle of a steady disbalance of Bauer to them.

Research of questions of evolution, modeling and forecasting of STL much attention as, in our opinion, the functional condition of various STL in many respects causes stable development of society with optimization of relative entropy at the level of golden ratio is paid now.

If to consider chronology of development of STL within the theory of economical and political formations of society, then it is offered to allocate its following types:

1. Socio – closed;
2. Territorially caused;
3. Socio – open;
4. Territorially independent;
5. Synergetic;
6. Bifurcation.

At the most initial stage of development of society there was a requirement for the formalized description of the relation of various structures for it for the purpose of optimization of development to enter concepts: "number", "account", "calculation". Thus, there are first digital technologies. Development first of all of technical protection against unpredictability of the habitat, led, the final result, to modern expansion of computer, computing, information and analytical outlook and Miro of management in development domination as Mankind in general, and separate societies, including,

socio-technical landscapes. Thus, technologies of the Industry 4.0 appear so far.

In development of the digital Mankind technologies there passed the set of evolutionary, revolutionary and regression stages (for example – loss of technologies of development of the Moon, loss of manufacturing techniques of the computer almost for 70 years, loss of the Sumer account, etc.).

Development of new methods and means of digital technologies, to be exact their application, causes changes of the main characteristics of human life: health, mortality and birth rate, congenital malformations (as the first reaction of society to possible mutational processes), education (scientific and spiritual knowledge of the World), racial and civilization connections and wars, fight for existence against and the Nature (the Darwin principle), a coexistence phenomenon for joint survival ("anti-Darwin" the principle).

Life cycle of new digital technologies, certainly, in concrete STL causes emergence of certain processes π_i. Then the description of risk R emergence and development π_i in time and space can be presented in the form a set:

$$R(\pi_i, \text{tex}_j, L\pi_I(\tau), Ob_i, Sob_i), \qquad (1)$$

where π_i – process; tex_j – j set of technologies; $L\pi_j(\tau)$ – function of life cycle of process, Ob_i – objective changes, Sob_i – subjective perception, $R \in [-1,1]$.

Assessment of risk is carried out by subexpert system or a consultation.

As, generally, the risk changes in time, the hypothesis is made: the intensification of innovative processes of digital technologies

influences the speed of risk of emergence of processes or the phenomena in STL, expansion – influences acceleration, an ekstensifikation – damping.

(It is possible for this reason now "ocean" of digital expansion "spreads on many rivers and floodplains" public the practician and institutes – the Mankind protects stressful influence of fast dynamics of risks.)

Then, in the first approach the specified process is modelled by the equation:

$$R_t'' + (c - b) \cdot R_t' + (c - a) \cdot R_t = Sl, \qquad (2)$$

where a – expansion coefficient; b – intensity coefficient; c – extensiveness coefficient; Sl – the constant defining jet features of STL.

At a certain stage of development of humanity (not STL), when overcoming a certain threshold of population density, not personal amplifier of universal intelligence, for example, on the basis of computer technologies (first of all, local and global networks) or development of monotheist religions is created.

Thus, synergetic processes led to development of information society which semantic description included a lot of the new various concepts characterizing modern expansion of digital external control and transformation of STL (including, destructive):

– intensifications in time of internal information and power metabolism of STL expressed first of all digitalizations of an internal, autonomous control system;

– reorganization of the relations between elements of structure of STL;

– deformations of internal cyclic processes of STL defining its development according to Bauer's principle.

If to consider transformation of STL in philosophical and methodological aspect, then the theory of complexity can be the most relevant approach. From a position of the theory of complexity of STL is multielement system. Initially elements are understood as "a black box" of difficult system in which the rules regulating their individual behavior are known. Rules which elements follow can be simple concerning a complex and to be determined, probabilistic or stochastic. It is obvious that elements are independent, purposeful or have any value at external influence by other elements. Moreover some elements have intelligence, mental qualities, have conditioned and unconditioned jet reflexes.

Let's notice that if to present to STL in various models to describe in the form of the count, then the complexity in this case is quantitatively estimated according to the theory of the count (for example, [4]). And, depending on type of the chosen model there are different types of difficulties identified by the modelled values.

Nevertheless, long local actions have the global consequences influencing in a complex system in general. Such global consequences, by definition, are impossible at the level of an element within an emerdzhentizm: they cannot arise from local rules (qualities) which define behavior of elements. It is more clear within the following observations. As target agents are mutually independent, they can be in a condition of the conflict: action which, directly will lead to the purpose A hinders achievement of the goal In, and, therefore, causes the active resistance of agents of Century. Local actions can extend the influence step by step to more removed agents, thus, extending on all system of social management formed by elements and their relationship. The same actions will have in general various effects in any parts of system at different times.

Thus, social management is difficult, open system with four possible positive scenarios of events:

1) digital expansion happens without external participation of the subject (in ideal conditions), and under the influence of an external or internal factor (element), is regulated by means of external or internal factors (elements);

2) digital expansion happens without external participation of the subject (in ideal conditions), and under the influence of an external or internal factor (element), is regulated by the subject;

3) digital expansion happens under external participation of the subject, but is regulated internal by factors (elements) of system;

4) digital expansion happens under external participation of the subject and is regulated by it.

Digitalization represents the total trend of development of science and technologies which is appropriately influencing activity of the person and society today. The digitalizations of change happening in connection with distribution affect the sphere of social management.

Digital expansion causes a fierce debate among politicians, economists and leaders of branch about its influence on society. As digitalization "gets" into various structures of society (especially in the most elementary and the least protected – for example, family), the concern grows on the subject of how it influences such factors as: jobs, salary, inequality, health care, efficiency of use of resources and safety.

Digital expansion already created new roles – professions (search optimization managers and managers of social networks), new types of the organizations (providers of cloud computing and the agency of social networks) and even new sectors of economy (digital safety and science about data). Digitalization influence also served as the catalyst of growth of employment in wider economy. For example, in India, by estimates, three-four workplaces for each work in sectors of outsourcing of business processes and IT services are created.

Thus, external digital expansion is in fact the modulator of various processes in STL, acting, at the same time, as the synchronizer of various STL for the solution of criterion function of STL of higher hierarchical level. For example, the last solutions and actions of the Government of the Russian Federation for digitalization of economy, health care, telecommunications, administrative management through economic regional forums stimulate growth of digitalization on the following (first of all social and territorial) levels: technical and personnel equipment by the advanced computing and information and intellectual technologies of concrete public health and educational institutions, local authorities (administrative structures) and others social and institutes of technology and "the local level".

In fact, digital expansion plays the leading role in neuroprogramming of a certain society and the certain people entering it as elements of some structure. Changes both in the interpersonal relations, and in psychosomatic changes of certain people result. Perhaps in due time to monitor these changes with monitoring:

– physiological changes in an organism;

– mental changes of individuals (monitoring of levels of mental diseases in certain STL);

– psychological changes (monitoring by Lyusher's tests, an unknown animal, etc.);

– changes of the interpersonal relations.

Emergence of changes in various types of the relations as the phenomenon can be analysed by means of complexity theory of V.I. Arshinov [5] and multilevel representation of crisis of V.V. Zherikhin and A.S. Rautian [6]. The specified approaches and results of monitoring allow to allocate unstable, destructive and organizational stages of emergence of change and social management.

The unstable stage is characterized by hypersensibility to some change due to digital expansion. Drawing an analogy to the theory of complexity, we note that this phenomenon represents the characteristic of a complex-

ity theory – instability [7]. Destruction at this stage is poorly expressed and defines the initial stage of emergence of some change. The same is observed also at the beginning of a destructive stage. Irreversible destruction is shown at a destructive stage when digital expansion gains global character and passes through the level of stability of system if to speak language of the theory of complexity.

This stage represents digital transformation. At a destructive stage the new quality of system characterizing the happening changes and STL providing digital transformation arises. When registration of new quality comes to the end also the social management expressing the organization or self-organization of system begins to prevail over destruction, transformation of STL is characterized by a prompt set of poorly ordered changes. This stage is defined as "subsiding of changes" under the influence of social management.

Minimization of consequences of digital expansion of reality is characterized by an organizational stage. At this stage all processes in system stop, the new quality is fixed, and there are changes, both in the interpersonal relations, and in psychosomatic changes of certain people (system elements). In other words, the positive result of transformation of STL by results of which there is a formation of one of scenarios of problems of social management, expansion of digital reality connected with consequences then again there is an unstable stage is observed.

Thus, this process is multicyclic (ritmokaskadny) with emergence of new scenarios of problems of social management, the expansion of digital reality connected with consequences.

As STL interacts with the external environment, there are problems of forecasting of its development realized including, by means of the automated systems of support of decision-making (expert systems) allowing to carry out the following scenarios of a koevolyution of STL:

1) To limit / broaden the territory;

2) To limit / expand a required subject;

3) To limit / exclude/expand physical impact;

4) To limit / exclude / expand psychological influence;

5) To notify / not to notify / inform the institutes realizing expansion of digitalization about negative or positive changes (feedback).

Each of 5 scenarios of the offered scenarios is characterized by a concrete set of actions in certain regional conditions.
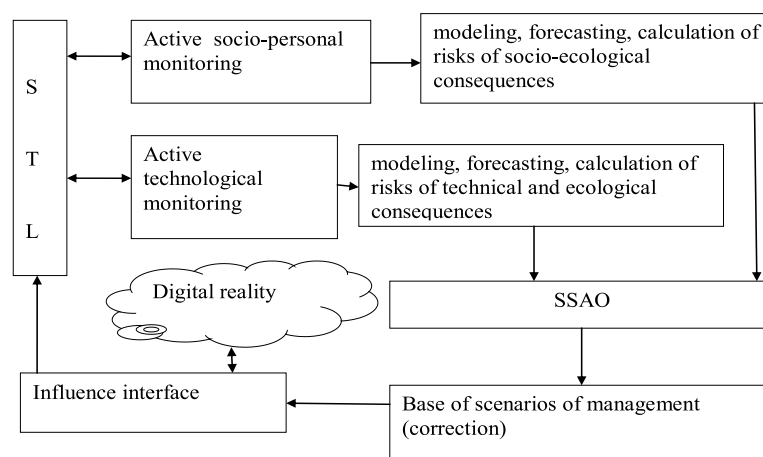
The generalized scheme "counteractions" of digital reality

As development of concrete scenarios demand the analysis of a large number of the current, retrospective and predictive information, there is a need of development of the corresponding expert system of support of adoption of the operating (correcting) decisions (SSAO) which prerequisites of design are presented, for example in [8]. The generalized basic scheme "counteractions" is shown to digital expansion on the basis of SSAO in the figure.

For example, if STL is considered in city scale, then the described system of support of acceptance of the correcting influences can recommend certain scenarios in various directions of development of city structures and the welfare relations, modifications of geometrical forms of information and power communications depending on city "type": boundary, protecting, industrial, – agrarian, means concentrating, the funds distributing, operating kadrostroitelny, rational, "clever", "wise", social, "historical – the reserve", etc.

From the point of view of holding the correcting actions for optimum use of modern expansion, the system of support of decision-making can recommend to undertake in STL, for example, the following reforms: social, political, economic, modernization, etc.

And, for each STL element (striations, practicians, ontologies, subsystems) recommendations carry on the one hand concrete, with another – two-three alternative character for a possibility of the choice of the most optimal variant.

Thus, the problems of the analysis and management (adjustment) of situations and processes considered in work in STL resulting from "digital expansion" cause need of an intensification of scientific and practical researches as in the field of development of a philosophical mathematical apparatus of assessment of numerical values of risks of emergence and development of situations, and in the field of design of the corresponding systems of support of the correcting decisions. Eventually, it has to promote development of strategy of the Industry – 5.0 (refusal of society of consumers).

References

1. Budanov V.G. Metodologija sinergetiki v postneklassicheskoj nauke i v obrazovanii. M.: LENAND, 2017. 272 p.

2. Budanov V.G., Kamenskij E.G., Arshinov V.I., Aseeva I.A. Sociotehnicheskij landshaft v uslovijah cifrovizacii: k probleme koncepta i metodologii issledovanija. Izvestija Jugo-Zapadnogo gosudarstvennogo universiteta. Serija jekonomika, sociologija, pravo. 2019. T.9, № 3(32). – P. 213-225.

3. Artemenko M.V., Rodionova S.N. Sociotehnicheskie landshafty – predstavlenie i opisanie na regional'nom urovne // Social'no-jekonomicheskoe razvitie Rossii: problemy, tendencii, perspektivy, sbornik statej HVIII Mezhdunarodnoj nauchno-prakticheskoj konferencii. Kursk, 2019. P. 29–32.

4. Harari F. Teorija grafov. M.: Lenand, Editorial URSS 2015 304 p.

5. Arshinov V. I., Svirskij Ja. I. Slozhnostnyj mir i ego nabljudatel'. Chast' vtoraja // Filosofija nauki i tehniki. 2016. T. 21, № 1. P. 78–91.

6. Kotljakov V.M., Zherihin V.V., Rautian A.S. Anatomija krizisov. Gl. III: Krizisy v biologicheskoj jevoljucii. M.: Nauka, 1999. P. 29–51.

7. Arshinov V. I., Svirskij Ja. I. Slozhnostnyj mir i ego nabljudatel'. Chast' pervaja // Filosofija nauki i tehniki. 2015. T. 20, № 2. P. 70–84.

8. Artemenko M.V. Predposylki proektirovanija jekspertnyh sistem analiza i upravlenija sostojaniem i jevoljuciej sociotehnicheskih landshaftov v uslovijah cifrovoj real'nosti // Mediko-jekologicheskie informacionnye tehnologii – 2019: sbornik nauchnyh statej po materialam HHII Mezhdunarodnoj nauchno-tehnicheskoj konferencii; Jugo-Zap.gos.un-t.-Kursk, 2019. P. 114-119.

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VECTOR OPTIMIZATION OF A COMPLICATED INTELLECTUAL AND MECHANICAL SYSTEMS

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The design and optimization of a complicated systems are the most difficult problems. A complicated system consists of a number of subsystems and large set of a design variables or the calculation of one solution of such system can take very much of computer time. Different departments of the design office engaged in creating a intellectual system (machine) optimize their 'own' subsystems, while ignoring others. A system assembled from 'autonomously optimal' subsystems turns out to be far from perfect. A intellectual system (machine) is a single whole. When improving one of its subsystems, we can unwittingly worsen others. This implies that it is not always possible to solve optimization problems directly even for determination of the feasible solution set. The correct determination of the feasible solution set was a major challenge in engineering optimization problems. In order to construct the feasible solution set, a method called the Parameter Space Investigation (PSI) has been created and successfully integrated into various fields of industry, science, and technology. The methods of approximation of the feasible solution and Pareto optimal sets and the regularization of the Pareto optimal set are described in our paper. These methods are applied for solving the multicriteria optimization problems of a complicated systems.

Keywords: A Complicated System, Subsystem, The Feasible Solution Set, Pareto Optimal Set, Pseudo-Feasible Solution Set

Main Definitions

Let us consider a system whose operation is described by a system of equations or whose performance criteria may be directly calculated. We assume that the system depends on r design variables $\alpha_1,...,\alpha_r$ representing a point $\alpha = (\alpha_1,...,\alpha_r)$ of an r-dimensional space. In the general case, when designing a system, one has to take into account the design variable constraints, the functional constraints, and the criteria constraints [1]. These constraints defines D- the feasible solution set.

Definition 1. A point $\alpha^0 \in D$, is called the Pareto optimal point if there exists no point $\alpha \in D$ such that $\Phi_\nu(\alpha) \leq \Phi_\nu(\alpha^0)$ for all all $\nu = 1,...,k$, and $\Phi_{\nu_0}(\alpha) < \Phi_{\nu_0}(\alpha^0)$ for at least one of ν. A set $P \subset D$ is called the Pareto optimal set if it consists of Pareto optimal points.

When solving the problem, one has to determine a design variable vector point $\alpha^0 \in P$, which is most preferable among the vectors belonging to set P.

The Pareto optimal set plays an important role in vector optimization problems because it can be analyzed more easily than the feasible solution set and because the optimal vector always belongs to the Pareto optimal set, irrespective of the system of preferences used by the expert for comparing vectors belonging to the feasible solution set. Thus, when solving a multicriteria optimization problem, one always has to find the set of Pareto optimal solutions.

The Feasible and Pareto Optimal Sets Approximation

The algorithm discussed in [1] allows simple and efficient identification and selection of feasible points from the design variable space. However, the following question arises: How can one use the algorithm to construct a feasible solution set D with a given accuracy? The latter is constructed by singling out a subset of D that approaches any value of each criterion in region $\Phi(D)$ with a predetermined accuracy.

Approximation of Feasible Solution Set

Let ε_ν be an admissible (in the expert's opinion) error in criterion Φ_ν. By ε we denote the error set $\{\varepsilon_\nu\}$, $\nu = 1,...,k$. We will say that region $\Phi(D)$ is approximated by a finite set $\Phi(D_\varepsilon)$ with an accuracy up to the set ε, if for any vector $\alpha \in D$, there can be found a vector $\beta \in D_\varepsilon$ such that

$$\left|\Phi_\nu(\alpha) - \Phi_\nu(\beta)\right| \leq \varepsilon_\nu, \nu = 1,...,k.$$

We assume that the functions we will be operating with are continuous and satisfy the Lipschitz condition (L) formulated as follows: For all vectors α and β belonging to the domain of definition of the criterion Φ_ν, there exists a number L_ν such that

$$\left|\Phi_\nu(\alpha) - \Phi_\nu(\beta)\right| \leq L_\nu \max_j \left|\alpha_j - \beta_j\right|.$$

In other words, there exists L'_ν such that

$$\left|\Phi_\nu(\alpha) - \Phi_\nu(\beta)\right| \leq L'_\nu \sum_{j=1}^r \left|\alpha_j - \beta_j\right|.$$

We will say that a function $\Phi_\nu(\alpha)$ satisfies the special Lipschitz condition (*SL*) if for all vectors α and β there exist numbers L_ν^j, $j = 1,...,r$ such that

$$|\Phi_\nu(\alpha) - \Phi_\nu(\beta)| \le \sum_{j=1}^{r} L_\nu^{\,j} |\alpha_j - \beta_j|,$$

where at least some of the $L_\nu^{\,j}$ are different.

Let the Lipschitz constants L_ν, be specified, and let N_1 be the subset of the points D that are either the Pareto optimal points or lie within the ε-neighborhood of a Pareto optimal point with respect to at least one criterion. In other words, $\Phi_\nu(\alpha^0) \le \Phi_\nu(\alpha) \le \Phi_\nu(\alpha^0) + \varepsilon_\nu$, where $\alpha^0 \in P$, and P is the Pareto optimal set. Also, let $N_2 = D \backslash N_1$ and $\bar{\varepsilon}_\nu > \varepsilon_\nu$, .

Definition 2. A feasible solution set $\Phi(D)$ is said to be normally approximated if any point of set N_1 is approximated to within an accuracy of ε, and any point of set N_2 to within an accuracy of $\bar{\varepsilon}$.

Theorem 1. Let the criteria are continuous and satisfies the Lipschitz condition or the special Lipschitz condition. There exists a normal approximation $\Phi(D_\varepsilon)$ of a feasible solution set $\Phi(D)$.

Approximation of Pareto Set

Since the Pareto optimal set is unstable, even slight errors in calculating criteria $\Phi_\nu(\alpha)$ may lead to a drastic change in the set. This implies that by approximating a feasible solution set with a given accuracy we cannot guarantee an appropriate approximation of the Pareto optimal set. Although the problem has been tackled since the 1950s, a complete solution acceptable for the majority of practical problems is still to be obtained. Nevertheless, promising methods have been proposed for some classes of functions.

Let P be the Pareto optimal set in the design variable space; $\Phi(P)$ be its image; and ε

be a set of admissible errors. It is desirable to construct a finite Pareto optimal set $\Phi(P_\varepsilon)$ approximating $\Phi(P)$ to within an accuracy of ε.

Let $\Phi(D_\varepsilon)$ be the ε-approximation of $\Phi(D)$, and P_ε be the Pareto optimal subset in D_ε. As has already been mentioned, the complexity of constructing a finite approximation of the Pareto optimal set results from the fact that, in general, in approximating the feasible solution set $\Phi(D)$ by a finite set $\Phi(D_\varepsilon)$ to within an accuracy of ε, one cannot achieve the approximation of $\Phi(P)$ with the same accuracy. Such problems are said to be ill-posed in the sense of Tikhonov [2]. Although this notion is routinely used in computational mathematics, let us recall it here.

Let P be a functional in the space X, $P:X \rightarrow Y$. We suppose that there exists $y^* = \inf P(x)$, and $V_\varepsilon(y^*)$ is the neighborhood of the desired solution y^*. Let us single out an element x^* (or a set of elements) in space X and its δ-neighborhood $V_\delta(x^*)$ and call x_δ^ε a solution to the problem of finding the extremum of P if the solution simultaneously satisfies the conditions $x_\delta^\varepsilon \in V_\delta(x^*)$ and $P(x_\delta^\varepsilon) \in V_\varepsilon(y^*)$. If at least one of the conditions is not satisfied for arbitrary values of ε and δ, then the problem is called ill-posed (in the sense of Tikhonov).

An analogous definition may be formulated for the case when P is an operator mapping space X into space Y. Let us set

$$X = \{\Phi(D_\varepsilon), \Phi(D)\}; Y = \{\Phi(P_\varepsilon), \Phi(P)\},$$

where $\varepsilon \rightarrow 0$, and let $P : X \rightarrow Y$ be an operator relating any element of X to its Pareto optimal subset. Then in accordance with what was said before, the problem of constructing sets $\Phi(D_\varepsilon)$ and $\Phi(P_\varepsilon)$ belonging simultaneously to the ε-neighborhoods of $\Phi(D)$ and $\Phi(P)$, respectively, is ill-posed. Of course, in spaces X and Y, the metric or topology, that corresponds to the system of preferences on $\Phi(D)$ must be specified [2]. Let us define the V_ε-neighborhood of a point $\Phi(\alpha^0) \in \Phi(\Pi)$ as

$$V_\varepsilon = \{\Phi(\alpha) \in \Phi(\Pi) : \left|\Phi_\nu(\alpha^0) - \Phi_\nu(\alpha)\right| \le \varepsilon_\nu, \nu = 1,...,k\}.$$

In Theorem 2, a Pareto optimal set $\Phi(P_\varepsilon)$ in which for any point $\Phi(\alpha^0) \in \Phi(P)$ and any of its ε-neighborhoods V_ε there may be found a point $\Phi(\beta) \in \Phi(P_\varepsilon)$ belonging to V_ε is constructed. Conversely, in the ε-neighborhood of any point $\Phi(\beta) \in \Phi(P_\varepsilon)$, there must exist a point $\Phi(\alpha^0) \in \Phi(P)$. The set $\Phi(P_\varepsilon)$ is called an approximation possessing property *M*. Let $\Phi(D_\varepsilon)$, an approximation of $\Phi(D)$, have been constructed.

Theorem 2. If the conditions of Theorem 1 are satisfied, then there exists an approximation $\Phi(P_\varepsilon)$ of Pareto set $\Phi(P)$ possessing the *M*-property.

The theorem will be proved by analyzing the neighborhoods of the so-called "suspicious" points from $\Phi(D_\varepsilon)$, that is, the points to whose neighborhoods the true Pareto optimal vectors may belong. If we find new Pareto optimal vectors in the neighborhoods

of the "suspicious" points then these vectors may be added to $\Phi(P_\varepsilon)$. Taken together with $\Phi(P_\varepsilon)$, they form the ε-approximation of a Pareto optimal set, [2].

In [2] it is shown that this approach solves the problem of the ill-posedness (in the sense of Tikhonov) of the Pareto optimal set approximation.

Decomposition and Aggregation of Complicated Systems

When designing complicated systems, one has to deal with complicated mathematical models. Very often these models have many hundreds of degrees of freedom, are described by high-order sets of equations, and, as has already been mentioned, the calculation of one solution can take an hour or more of computer time. This implies that it is not always possible to solve optimization problems directly (otherwise we would have no problem with large-scale systems). One remedy may be to split (decompose) a complicated system into subsystems that can be easily optimized, and then aggregate the partial optimization results to obtain nearly optimal solutions for the whole system. This will allow a designer to determine the requirements for the subsystems so as to make a machine optimal as a whole and, in this way, justify the proposals for designing different units of the machine.

Construction of Hierarchically Consistent Solutions

To solve this problem we can use an approach associated with considering the whole system as a hierarchical structure .The lower level of this structure comprises subsystems, whereas the higher level is the system as a whole. In many cases, the optimization can be done more simply at the lower level. Therefore, by using the results of the optimization at the lower level and thus reducing the number of competing solutions for the whole system, we can optimize the system in reasonable time. This approach was proposed comparatively recently, and only the first steps have been made in this direction. In particular, this is true for the methods proposed here. Nevertheless, the results obtained can be used to optimize many large-scale systems.

Since the proposed approach is based on the optimization of the whole system through the optimization of its subsystems, we briefly describe the relation between the criteria for the system and subsystems. There are three possibilities for this relation:

1. Some of the criteria of the subsystem can implicitly affect the performance criteria of the system as a whole, and very often, such subsystem criteria are absent from the list of performance criteria of the whole system.

2. Some of the system criteria cannot be calculated at the subsystem level.

3. There are criteria that may be calculated for both the whole system and its sub systems.

The three schemes have the following common features:

1. It is supposed that some of the mathematical models cannot be effectively optimized with respect to the whole criteria vector Φ, because it takes a great deal of computer time to formulate and solve problem of the feasible solutions set determination.. However, the calculation of the values of particular performance criteria Φ_v needs a reasonable amount of computation.

2. The system is "partitioned" into subsystems. The couplings connecting the subsystems will be called external. To separate out some of the subsystems as autonomous, it is necessary to analyze the interaction of this subsystem with all other subsystems, as well as the external disturbances applied to the subsystem by the environment.

3. There are one or several criteria $\Phi_v(\alpha^{(i)})$ of the ith subsystem that dominate the corresponding criteria of other subsystems. This means that decreasing (increasing) the values of the criterion $\Phi_v(\alpha^{(i)})$ by no less than a certain amount ε_α (for example, $\Phi_v(\beta^{(i)}) > \Phi_v(\alpha^{(i)}) + \varepsilon_\alpha$) entails decreasing (increasing) the value of the respective criterion $\Phi_v(\beta)$ for the whole system, compared with $\Phi_v(\alpha)$. Here, α and β are the design variable vectors of the system, and $\alpha^{(i)}$ and $\beta^{(i)}$ are the design variable vectors of the ith subsystem corresponding to the vectors α and β. This condition implies that the system contains one or several subsystems that determine the quality of the system with respect to the vth criterion.

4. It is supposed that the subsystems can be optimized by using the PSI method.

5. Let t be the total time for calculating the values of $\Phi_v(\alpha^{(i)})$, $i = \overline{1, m}$ and T be the time for calculating the value of $\Phi_v(\alpha)$, where α is the system design variable vector corresponding to all $\alpha^{(i)}$. Then the inequality $t << T$ is assumed to hold.

The idea of optimizing the whole system consists in the following. First, when optimizing each (ith) subsystem, we obtain for this subsystem a pseudo-feasible solution set $\overline{D}^i$, which, as a rule, is somewhat larger than the true feasible solution set. After this, we compile the vectors for the whole system using the respective vectors from the sets $\overline{D}^i$. On the

domain thus obtained, we check whether the criteria and functional constraints of the system are satisfied and, as a result, obtain the feasible solution set D for the whole system. Finally, we search for the optimal solution over the set D.

The main point of this idea is item 3. Let us consider it in more detail. We will say that the pseudo-feasible solution set $\overline{D}^i$ for the ith subsystem is dominant if the condition $\alpha^{(i)} \notin \overline{D}^i$ entails $\alpha \notin D$.

Theorem 3. In the systems satisfying the aforementioned conditions, there exist subsystems and criteria $\Phi_v(\alpha^{(i)})$ such that the corresponding pseudo-feasible solution sets $\overline{D}^i$ are dominant.

This assertion makes it possible to discard the design-variable vectors α without calculation of the whole system, if the corresponding vector $\alpha^{(i)}$ violates the constraint $\Phi_v^{i\,**}$. In other words, optimizing the whole system is reduced, to a considerable extent, to the optimization of its subsystems. The schemes given next are based on this idea. These schemes are presented in order of increasing complication. We consider different relationships between the design variables of the system and its subsystems, discuss basic possibilities of simplifying the original model, the ways of determining external disturbances for subsystems, etc.

Let us consider the conditions under which schemes A, B, and C are utilized.

Scheme *A*

Let us have the mathematical models of subsystems that can be optimized (in a reasonable amount of time). We suppose that each component of the design variable vector, $\alpha = (\alpha_1, ..., \alpha_r)$, of the whole system is a component of at least one subsystem vector $\alpha^{(i)}$ and, on the other hand, that any component of the vector $\alpha^{(i)}$ is a component of the vector α. Therefore, for each of the subsystems, the vector $\alpha^{(i)}$ is uniquely determined by the vector α.

It should be noted that if it is possible to approximate the sets $\overline{D}^i$, the approximation of the feasible solution set for the whole system can be constructed.

However, this procedure is effective only when applied to comparatively simple mechanisms and machines or their units. In more complicated cases, the assumption concerning the relationship between the vectors of design variables α of the whole system and respective vectors $\alpha^{(i)}$ for subsystems are not valid, and we have to use Schemes B and C. Here, situations are possible where the design variable vector of the whole system contains components that are absent from the subsystem level. This can

take place, for example, if it is impossible to correctly take into account some external couplings when calculating the subsystem. Therefore, these couplings are usually ignored. Vice versa, among the subsystem design variables, there can be some that weakly (if at all) affect the performance criteria of the system to be optimized. As a rule, these design variables are not included in the list of design variables of the whole system.

Scheme *B*

Unlike Scheme A, we assume here that the original model is simplified so that it becomes amenable to optimization. Here, external couplings between subsystems are retained, and the simplification is due to either aggregation of solutions for subsystems (this has been mentioned already) or aggregation of internal design variables of the subsystems. Note that, if we succeed in constructing approximations of the sets $\overline{D}^i$, $i = \overline{1, m}$, we can guarantee that D is nonempty.

Scheme *C*

We suppose that the system contains a sufficient number of design variables that influence criteria of the subsystem in which they are included and do not affect criteria of other subsystems. By sufficiency we understand that each of the subsystems can be optimized, provided the previous condition is fulfilled. This condition is also necessary because if it turns out that criteria of some subsystem depend on all or almost all of the design variables of the whole system, it will be difficult to optimize this subsystem as the whole system. If this condition is satisfied, we can optimize subsystems in the following two ways.

1. Suppose we can optimize the simplified system for fixed values of the design variables that do not influence the ith subsystem $i = \overline{1, m}$. In other words, we can optimize the simplified system in a reasonable amount of time, having fixed the system design variables that do not influence criteria of the examined subsystem. External disturbances acting on the subsystem are determined as a result of computations related to the simplified model.

2. If the assumption of item 1 is not valid, the simplified model is not considered. In this case we construct simplified models for each of the subsystems. The simplification of the subsystem model is regarded as acceptable if at least one of the subsystem performance criteria can be calculated with sufficient accuracy and, in addition, the constraint related to this criterion permits us to exclude from consideration

a sufficiently large number of design variable vectors α. Having been considered separately, such models of subsystems are not of practical interest. However, provided we have a model of the whole system and the conditions defined above are satisfied, these models facilitate the optimization of the whole system. Note here that external disturbances acting on subsystems are determined not from the model of the whole system, as occurred previously, but from the subsystem models themselves.

Therefore, let all subsystems be optimized, and for each of the subsystems, let the pseudo-feasible solution set $\bar{D}^i$, $i = \overline{1,m}$ have been obtained according to [1].We define the concatenation operation for the sets $\bar{D}^j$, $j = \overline{1,m}$ as follows. Denote by $\bar{D}_{1,2}$ the set consisting of vectors $\alpha = (\alpha^{(1)}, \alpha^{(2)})$, $\alpha^{(1)} \in \bar{D}^1, \alpha^{(2)} \in \bar{D}^2$, such that common (i.e., influencing both subsystems) design variables included in both $\alpha^{(1)}$ and $\alpha^{(2)}$ assume equal values. (If some design variables, such as those describing external couplings, have been omitted when calculating the subsystem, they are added to $\alpha^{(1)}$ and $\alpha^{(2)}$ when constructing vector α). We will denote the result of iterating this operation m times by $\bar{D}_{1,...,m} = \tilde{D}$ and call the set $\tilde{D}$ the superstructure over the sets $\bar{D}^1,...,\bar{D}^m$. This definition allows us to aggregate different subsystems into the whole system by concatenation of their design variable vectors. Let the sets $\bar{D}^j$ be defined for all $j = \overline{1,m}$. The set $\bar{D}$ consisting of the design variable vectors of the whole system α such that $\alpha^{(j)} \in \bar{D}^j$, $j = \overline{1,m}$ is called the pseudo-feasible solution set for this system. Now let us give the idea of the algorithm for constructing the feasible solution set D. Let us take two subsystems from those obtained after partitioning the system. Suppose there are n common design variables influencing the criteria of both subsystems. We denote these design variables by $\alpha_1^{(j)},...,\alpha_n^{(j)}$, $j = \overline{1,2}$. Let us take an arbitrary vector $\alpha^{(1)} \in \bar{D}^1$ and fix the values of the components $\alpha_1^{(1)},...,\alpha_n^{(1)}$ of this vector. We assume that when probing design variable spaces of the subsystems, we use the points of P_τ nets for each of the subsystems. Then, since the common design variables $\alpha_1^{(j)},...,\alpha_n^{(j)}$ are first in each of the subsystems, they will assume the same values at all points with identical numbers [1]. In $\bar{D}^2$, we find the vectors $\alpha^{(2)}$ whose first n components assume values equal (to the specified accuracy) to the values of the respective components of the vector $\alpha^{(1)}$. After this, we concatenate the vectors $\alpha^{(2)}$ with the vector $\alpha^{(1)}$. As a result, we obtain the vectors $\alpha = (\alpha^{(1)}, \alpha^{(2)}) \in \bar{D}_{1,2}$. If we find no vec-

tor $\alpha^{(2)} \in \bar{D}^2$ that can be concatenated with the vector $\alpha^{(1)}$ the vector $\alpha^{(1)}$ is no longer considered. After performing this operation with all vectors of $\bar{D}^1$, we obtain the superstructure $\bar{D}_{1,2}$. If there are m subsystems, the process of constructing the superstructure $\tilde{D}$ is similar. We have only to ensure that the concatenation condition is satisfied. After constructing $\tilde{D}$, we calculate the system only at the points of this set. Thus, the original model is calculated repeatedly. However, it is done only on the set $\tilde{\tilde{D}}$. If the number of elements in $\tilde{\tilde{D}}$ is not too large, optimization of the whole system in a reasonable amount of time becomes possible. After introducing constraints Φ_ν^{**}, we obtain the feasible solution set D. Note that here, as in Scheme B, it is possible that D can turn out to be empty. In this case one should repeat all the described operations until $D \neq \varnothing$. However, D cannot be empty if one succeeds in approximating the sets $\bar{D}^i, i = \overline{1,m}$. We denote these approximations by $\tilde{D}^i$.

Theorem 4. The set $\tilde{D}$, being a superstructure over the sets $\tilde{D}^i, i = \overline{1,m}$, approximates the pseudo-feasible solution set $\bar{D}$ of the whole system with a prescribed accuracy.

Corollary. The pseudo-feasible solution set $\bar{D}$ contains the approximation of the feasible solution set D for the whole system.

Note, that these methods were applied for design of a many-links manipulator and of a car for shock protection. For example, they may be applied to the systemtems described in [3-5].

Conclusion

1. Suggested by author methods of approximation of the feasible solution and Pareto optimal sets are applied to solving the multicriteria optimization problems of complicated systems.

2. The methods of construction of hierarchically consistent solutions are considered.

References

1. Sobol' I., Statnikov R. Selecting Optimal Parameters in Multicriteria Problems, 2nd edn., Drofa, Moscow, (2006)

2. Statnikov R., Matusov L. Multicriteria Analysis in Engineering, Kluwer Academic Publishers, Dordrecht/Boston/London (2002).

3. Wang L., Chen, Y.: Diversity Based on Entropy: A Novel Evaluation Criterion in Multi-objective Optimization Algorithm. I.J. Intelligent Systems and Applications, 10, P. 113-124 (2012).

4. Ning H., Zhanmin W. A Growing Evolutionary Algorithm and Its Application for Data Mining. I.J. Intelligent Systems and Applications, 4, P. 8-16. (2011).

5. Roy C., Rautaray S., Pandey M.:Big Data Optimization Techniques: A Survey. International Journal of Information Engineering and Electronic Business, Vol.4, No. 4, P. 41-48. (2018) DOI: 10.5815/ijieeb 2018.04.06.