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CHRONIC ALCOHOL INTOXICATION ON PREGNANT MICE

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Abstract

The article discusses the inhumanity of alcohol and other experiments on pregnant mice in biological education. Use of "indicator" animals with known microbiological status. Animals are placed in the same environment as the population being tested and periodically sacrificed and examined. Naked (athymic) mice are excellent indicators because they are immunodeficient and especially susceptible to pathogens. But these mice are not suitable for detecting changes in serological titer, which may indicate the presence of viruses, since there is no antigenic response in nude mice. To determine the serological titer, it is necessary to use animals with the appropriate immune status.

Keywords: *pregnant mice, experience, humanism, blood test, alcoholism, ethyl alcohol*

Introduction. The World Health Organization has identified six criteria for diagnosing alcohol dependence. The main and first criterion is a person's inability to control alcohol intake. According to the second criterion, a person feels the urge to drink. This desire can manifest itself both openly and under the pretext of relieving tension and relaxation. As a result of this desire, a person forgets his family, laws and norms of social behavior. The third symptom is that the body easily "tolerates" alcohol. If a person drinks three glasses of vodka and brags that he is not drunk, it is a dangerous syndrome. The problem is that the body tries to process ethyl alcohol into the bloodstream to the best of its ability. But sooner or later the final stage is reached and the mechanism is broken. As a result, alcohol causes mental weakness. That is, the person can greet you and forget about it after a few seconds.

The fourth symptom is abstinence syndrome. This means that a person feels tired, depressed, and his hands swell the day after drinking. Such people look forward to the end of the working day to drink again, even if they do not drink early in the morning. However, those who feel unwell after drinking are also divided into two groups, and those who are poisoned by alcohol can not be considered alcoholics. They simply feel bad the next day because they have been poisoned and do not want to drink again to improve their condition. Alcoholics, on the other hand, feel the need to drink again. However, alcohol poisoning is also directly related to the culture of alcohol consumption. If a person drinks two bottles of vodka, he receives 400 milliliters of ethyl alcohol. This is a lethal dose for a person weighing 70 kilograms. The average person is resuscitated with this dose. This does not happen in alcoholics. Therefore, for drinkers, alcoholism and heroism are synonymous. The fifth symptom is various diseases. That is, a person's laboratory tests are negative or his family breaks up as a result of drinking. He can't stop drinking and can't stop drinking alcohol. The last criterion is that alcohol plays a key role in human life. In other words, according to this criterion, a person's life and personal life are built around alcohol. Other non-alcoholic interests take second place.

Alcohol is one of the drinks that contains ethyl alcohol, and when drunk, it gives a person temporary pleasure and intoxication, as well as a harmful effect on the body, which has become a habit in many people. Those who are unable to abstain from alcohol are called alcoholics if they consume alcohol to the extent that it impairs their physical and mental health, family, social, and work life. Alcoholism is a disease that occurs as a result of regular consumption of alcohol and is addictive. This disease negatively affects a person's reputation by causing physical and mental disorders. Alcohol is mainly toxic to brain cells. A drunk person celebrates for the first moments, enjoys himself and so on. but as the effects of alcohol increase, all of this can be replaced by irritability, obscenity, irritability, and rudeness. Alcoholism causes dystrophic changes in the vascular system, the development of hypertension, serous liver, impaired renal function, as well as profound mental and somatic disorders. The disease results in mental retardation, alcoholic epilepsy, and sometimes alcohol psychosis. The patient is frightened, sleep is disturbed, hallucinations are observed. Accidents often occur among alcoholics, their ability to work is weakened. Alcoholism has a negative effect on the female psyche. Alcohol consumption during pregnancy is especially unacceptable. Thus, the alcohol consumed in this case has a very negative impact not only on the mother's body, but also on the health of the unborn child. It is more common for women with alcoholism to give birth to children with physical or mental disabilities.

Unfortunately, both in education and in science, have to experiment on animals in order to treat alcoholism and measure the scale of harm in general. Acute alcohol toxicity should be studied in several animal species, and it is imperative to use the species in which the therapeutic effect of the pharmacological substance has been shown and in which long-term toxicity was studied. Usually 2-3 species of rodents and non-rodents (mice, rats.) are used. Groups of male and female experimental animals are formed separately. For small rodents, each group should contain at least 5-6 females and the same number of males.

An experiment carried out on several lines often shows different susceptibility of the lines. The assessment of nanosafety should be based on the most sensitive line, but in some cases it is necessary to find the gene for such susceptibility. This will help clarify mechanism of nanotoxicity and obtain data for innovative drugs in the future. Unfortunately, toxicologists have never attempted such a design. If mice are used instead of rats, then more radical changes will be needed. According to foreign data, it was mice (91.4%) that were the most commonly used species for gene modification, and only then were rats (3.6%), zebrafish (2.3%), and other species, including chickens, sheep and cows (1.3%). The most frequently used for gene modification of mouse lines C57BL/6 (48.1%), 129Sv (11.1%), Balb/c (4.3%), CD1 (2.5%) and FVB (0.3%). The advantage in using mice is the wide availability of different strains and an extensive database of mouse genetics, mouse/human gene matching, and the relative ease of mouse genetic manipulation. Genetic modifications may include the "insertion" of the necessary gene that gives a response to nanosubstances.

The similarity constants show how many times faster (or slower) intoxication can develop in an animal compared to humans due to a higher (or lower) intensity of biological processes and, according to our calculations, if a person is taken as a unit: for a mouse ~9.7, rats ~5.2, guinea pig, ~4.3, rabbit, ~2.5, dogs, ~1.7, sheep, ~1.4, pigs, ~0.83 and horses~0.75.

When switching to real time, this means that, for example, intoxication or an adverse drug reaction that develops in a rat in 3 months will manifest itself in a mouse after 1.5 months, in a rabbit - after 6 months, in a dog - after 1 month, in humans - 16 months, and in the horse only after 22 months of exposure to the substance. The existence of allometric dependencies of time for the development of the effects of intoxication is necessary take into account when assessing the adequacy of the duration of pharmacological and toxicological experiments when extrapolating data from animals to humans.

Genetic analysis has shown that the number of newly acquired genes per neuron in the human brain is greater than in the chimpanzee brain. In addition, the adult human brain contains significantly more copies of mobile genetic L1 elements than the liver and heart, which is due to the adaptation of the nervous system to the constantly changing environment and the individual's lifelong learning. In 2006, it was found that the human genome contains 212 copies of the MGC8902 gene, which is expressed only in brain neurons and encodes the DUF1220 protein with unknown functions. At the same time, in the genome only 37 copies of this gene were found in chimpanzees, and one copy each in mouse and rat genomes. Hence, it was suggested that the MGC8902 gene may be involved in evolutionary changes in the brain. It is also assumed that the formation of a more complex neural network and, accordingly, a more complex structure of the human brain is responsible for the so-called extended transcription of the human genome. About 20% of brain neurons normally regenerate, while at the same time, with age, up to 30 g of neurons are irretrievably lost every year.

It has been established that mice infected with toxoplasmosis “run badly” from cats and, most importantly, the parasite is transmitted to cats with great success. It is also believed that toxoplasmas "redistribute" and affect the psyche of the infected person. This is one of them examples of an amazing biological phenomenon when a parasite can be managed by a host.

In real time it has not been possible to create yet human hybrids and to obtain therapeutic antibodies are used only mouse hybrids. Imaging monoclonal antibodies represent their own powerful immunogens, which are formed in the body of patients with HAMA (from the English "human anti-mouse antibodies" -

antimyshynye antibodies of man). To reduce the immunogenicity of such antibodies are carried out with the help of different and sufficiently labor-intensive ways of their "embodiment", transferring mouse sites, determining complementarity (CDR, from English. "Complementarity determiniges" regions). Protein NR2B was found that the process of training and blood pressure are regulated by one and the same biochemical mechanism, in particular, with the participation of protein NR2B. This protein has a beneficial effect on the process of memory and training in mice. Transgenic mice with an additional copy of the NR2B protein gene instantly learned the details of the LEGO designer. This line of mice was called "Arc", in honor of the hero of the TV series "Arc Hauser - Doctor of Medicine." It is assumed that the transfer of the gene NR2B protein in human offspring will allow to create the future "wunderkinds to order". However, the addition of "smart protein" sharply increases the likelihood of stroke in the carrier of an additional copy of the gene.

In view of all this, scientists are studying the effects of alcoholism on pregnancy through various experiments. As mentioned earlier, mice, the gene closest to the human gene, are used for this purpose. Scientists keep pregnant mice in a cotton cell impregnated with ethyl alcohol and its derivatives. Some even drink ethyl alcohol to pregnant mice. Blood tests and other tests of these pregnant mice are then performed.

Let's clarify right away: the main component of any alcoholic beverage is ethyl alcohol (or ethanol). It is he who is responsible for all the changes that occur to our body after drinking alcohol. After swallowing, ethyl alcohol enters the stomach, where approximately 20% of its volume is absorbed into the blood. Most (80%) a little later enters the bloodstream already from the intestines. Once in the blood, ethanol begins to act on the body. The fact is that ethyl alcohol has a different effect on different types of nerve cells, upsetting the balance of the processes of excitation and inhibition.

All alcoholic products necessarily contain ethyl alcohol. For example, what is beer? 100 grams of beer is 6-12 grams of poison (ethyl alcohol), “dressed” in hops, rye, yeast and other ingredients.

What is wine? 100 g of wine is 20 g of poison (ethyl alcohol), “dressed” in grape, apple and other must (juices). Different varieties of grapes, apples - these are different varieties of wine, but the main component of them is poison - ethyl alcohol, one for all. 100 g of champagne is 17 g of poison, and the rest is various extracts.

What is vodka? 100 g of vodka is 40 g of poison (ethyl alcohol) "dressed" in 60 g of water and various extracts.

What is cognac? 100 g of cognac is 40 g of poison, "dressed" in color, which is drawn from an oak tree and 60 g of water and various extracts.

What is moonshine? 100 g of moonshine is from 20 to 70 g of poison, "dressed" in water and fusel oils.

Once in the body of a mouse, ethyl alcohol is absorbed through the walls of the stomach and intestines, quickly reaches the liver and appears in the blood. The state of intoxication depends on the concentration of alcohol in the blood. The content of alcohol in the blood up to 0.5 g / l usually does not cause immediately noticeable changes. At an alcohol concentration of 0.5-1 g / l, there is no noticeable intoxication observed, but the nerve centers cease to function normally. This is a very dangerous condition, especially for car drivers. As a result of numerous medical examinations, the probability of accidents in this case increases 14 times. With the accumulation of 2 g / l in the blood, the degree of intoxication increases: the gait becomes unsteady.

In the biochemistry of ethanol, an important role is played by the fact that it forms solutions in a wide range of proportions with both water and fats. It is a by-product of glucose metabolism; the blood of a healthy mouse can contain up to 0.01% of endogenous ethanol, which is a metabolic product. When ingested, ethanol has a narcotic and toxic effect, depending on the dose, concentration, route of entry into the body and duration of exposure, its effect varies. Any dose of alcohol harms the body, there is no safe dose. Under the narcotic effect, its ability to cause coma, stupor, insensitivity to pain, depression of the central nervous system, alcoholic arousal, addiction, as well as its anesthetic effect is indicated. Under the influence of ethanol, endorphins are released in the nucleus accumbens (Nucleus accumbens). In certain doses to body weight and concentrations leads to acute poisoning and death (lethal single dose - 4-12 grams of ethanol per kilogram of body weight).

The main metabolite of ethanol, acetaldehyde, is toxic, mutagenic, and possibly carcinogenic. There is evidence for the carcinogenicity of acetaldehyde in animal experiments; in addition, acetaldehyde damages DNA.

Long-term use of ethanol can cause diseases such as cirrhosis of the liver, gastritis, necrotizing pancreatitis, gastric ulcer, breast cancer, stomach cancer and cancer of the esophagus (that is, it is a carcinogen), hemolytic anemia, arterial hypertension, stroke, cause sudden death of people suffering from ischemic heart disease; can cause serious metabolic disorders. Alcohol may increase the risk of having a child with congenital anomalies of the nervous system and cause growth retardation. The use of ethanol can cause oxidative damage to brain neurons, as well as their death due to damage to the blood-brain barrier. Alcohol abuse in mice can lead to clinical depression and alcoholism. The intake of alcoholic beverages while taking medication is highly undesirable, since alcohol perverts the effect of drugs and, as a result, becomes dangerous for the life of the mouse.

The negative effect of alcoholic beverages on the results of pharmacotherapy is diverse and depends on various factors: the individual characteristics of the patient, his sensitivity, the severity of the disease, but in all cases, in patients taking drugs and consuming alcohol, the effectiveness of pharmacotherapy is weakened, and sometimes even reduced to nothing. Ethanol can be synthesized in small amounts in the lumen of the gastrointestinal tract as a result of the fermentation of carbohydrate foods by microorganisms (conditional endogenous alcohol).

The existence of biochemical reactions with the synthesis of ethanol in the tissues of the mouse body (true endogenous alcohol) is considered possible, but has not been proven to date. The amount of endogenous alcohol rarely exceeds 0.18 ppm, which is on the border of sensitivity of the most modern devices. An ordinary breathalyzer cannot determine such quantities.

Ethanol can also be harmful to health when inhaled vapors at sufficiently high concentrations. Mutagens can be various factors that cause changes in the structure of genes, the structure and number of chromosomes. By origin, mutagens are classified into endogenous, formed during the life of the organism and exogenous - all other factors, including environmental conditions.

Chemical mutagens are the most common in the group. These include the following groups of compounds:

-some alkaloids: colchicine - one of the most common mutagens in breeding, vincamine, podophyllotoxin;

-oxidizing and reducing agents (nitrates, nitrous acid and its salts - nitrites, reactive oxygen species);

-alkylating agents (eg, iodoacetamide, epoxybenzanthracene);

nitro derivatives of urea: nitrosomethylurea, nitrosoethylurea, nitrosodimethylurea - often used in agriculture;

-ethyleneimine, ethyl methanesulfonate, dimethyl sulfate, 1,4-bisdiazoacetylbutane (known as DAB);

-some pesticides (pesticides of the aldrin group, hexachloran);

-some food additives (for example, aromatic hydrocarbons (benzene, etc.), cyclamates);

-oil refining products;

-organic solvents;

-drugs (eg, cytostatics, mercury preparations, immunosuppressants).

A number of viruses can also be conditionally classified as chemical mutagens (the mutagenic factor of viruses is their nucleic acids - DNA or RNA).

The mechanism of action is based on the formation of so-called DNA adducts with nucleic bases. The more such DNA adducts are formed in a molecule, the more the native structure of DNA changes, which leads to the impossibility of the correct course of protein biosynthesis processes (transcription and replication) and thereby generates the expression of mutant proteins. Almost all chemical mutagens are sources of malignant tumors (they are carcinogenic), but not all carcinogens exhibit mutagenic properties.

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Let us consider the mechanism of action of one of the mutagens, benzene epoxide.

By itself, benzene does not have mutagenic activity; is a promutagen. However, as a result of biological oxidation and biotransformation in the cells of the liver, kidneys, and especially in the myeloid tissue of the red bone marrow, it acquires mutagenic properties. Once in the hepatocyte, benzene is immediately hydroxylated by the microsomal oxidation system catalyzed by a group of enzymes of the cytochrome P450 family to epoxide. Benzene epoxide is extremely reactive due to the formation of a strained cycle between the oxygen atom and the benzene molecule. It is able to very quickly alkylate nucleic acid molecules, in particular DNA. The mechanism for the formation of a DNA adduct with benzene epoxide is the reaction of nucleophilic substitution of SN2: an electrophile - in this case, it is an epoxide (due to ring breaking, it becomes electron-deficient), - which interacts with nucleophilic centers - NH2 groups (which are electron-rich) of nitrogenous bases, - forming covalent bonds with them (often very strong). This alkylation property is especially manifested in guanine, since its molecule contains the most nucleophilic centers, with the formation, for example, of N7-phenylguanine. The resulting DNA adduct can lead to a change in the DNA structure, thereby disrupting the proper course of transcription and replication processes, which is the source of genetic mutations. The accumulation of epoxide in liver cells leads to irreversible consequences: an increase in DNA alkylation, and at the same time an increase in the expression of mutant proteins that are products of a genetic mutation; inhibition of apoptosis; transformation and even cell death. In addition to pronounced pronounced genotoxicity and mutagenicity, it also has strong carcinogenic activity, especially this effect is manifested in the cells of myeloid tissue (the cells of this tissue are very sensitive to this kind of xenobiotic effects).

Congenital malformations, primarily spina bifida, increased in oral doses of 150-250 mg / kg / day (approximately 1-2 times the recommended maximum human dose based on body surface comparison) in offspring of pregnant rats given ethyl alcohol during organogenesis. In the fetuses of pregnant mice treated at a dose of 50-200 mg / kg, the cleft palate was increased depending on the dose (approximately 0.2 to 0.8 times the maximum recommended human dose based on a comparison of body surface area). Incomplete osteogenesis and embryotoxicity have also been reported in pregnant rabbits at doses up to 200 mg / kg of ethyl alcohol per day (approximately 3 times the recommended daily human dose based on body surface area comparison). Although there is no adequate and well-controlled study in pregnant women, rifampin has been reported to cross the placental barrier and appear in cord blood.

Oral administration of ethyl alcohol to both rats and rabbits during pregnancy has been reported to have embryocidal effects, although reproductive studies in mammalian species (mice, rats, and rabbits) have not revealed congenital anomalies associated with ethyl alcohol.

Strain mice are more sensitive than, and the degree of testicular weight loss is stronger than in hybrid animals. An analysis of these indicators revealed that on days 30 and 45 after administration of ethyl alcohol, the weight of the testicles was slightly higher in the variants with the introduction of NNP. In both periods of the analysis, the frequency of was lower in the case of the introduction of the drug. When summing up the results of the analysis on days 30 and 45 after administration of ethyl alcohol.

Table 7 presents the results of the analysis of embryonic mortality in the offspring of males who received a total dose of 3 Gy, fractionated by 0.6 Gy for 5 days, which were administered after ethyl alcohol with a minimum dose of RNP 4 mg/kg for 10 days. Within 4-6 weeks after the administration of ethyl alcohol, the fertility of males in the control decreased significantly up to complete sterility. Analysis of the results as early as the 3rd week of mating revealed a positive effect of RNP on the mortality rate of embryos before the implantation period. Summing up the results of the study of the genetic action of RNP, it should be noted that in all the experiments carried out, there was a tendency towards a therapeutic effect of RNP. A statistically significant decrease in the degree of alcohol damage in terms of the percentage of effective crossings was found with the introduction of NNP (10 mg/kg) five times, after the administration of ethyl alcohol at a dose of 3 Gy of gray hybrids CBAxC57BX F1. In addition, a decrease in the frequency of AGS was found in BALB mice in a similar variant of the experiment. Three similar experiments were carried out (3 Gy + 10 mg/kg RNP × 5) on mice of three different genotypes (gray hybrids, white hybrids and BALB strain mice). The therapeutic effect was most pronounced in BALB mice. A positive effect in hybrid mice was found only in experiments on old animals. This suggests that the beneficial effect of NNP is associated with the stimulation of the cellular repair system, which may be weakened in linear and old mice. In general, the beneficial effect is most pronounced at a relatively high dose of alcohol.

The mouse genome contains the same number of genes as the human genome, with 99% of these genes appearing to be identical and 96% in the same order. This means that disease genes identified in mice can be transferred to the human gene map. You can conduct experimental crosses between mice with different traits, and then very quickly begin to study the resulting offspring.

In view of all this, at least we should pay attention to their living conditions and good nutrition. We must follow safety rules in accordance with the norms.

The territory on which the building of biomedical research is located must be fenced and protected from

external access. The order of entry into the territory is strictly defined. carry out weaning of young animals from the uterus at the end of the suckling period (mice, rats - 28-31 days; hamsters - 21-29 days; guinea pigs - 27-29 days; miniature pigs - 45 days) and form groups of according to sex.

In the laboratory building, rats and mice are kept in cages in direct contact with the bedding. As bedding, it is recommended to use sawdust, shavings or small chips (length 5–20 mm, thickness 1–2 mm) from environmentally friendly hardwood. It is not allowed to use bedding made of chemically treated wood, as well as softwood. The bedding is autoclaved on trays at 118°C for 30 minutes. Bedding paper is stored and cut in a special auxiliary room. The required amount of bedding enters the housing in cut form in closed plastic bags. The closed bags are stored in the feed and litter storage room. Sanitization of the room is carried out in accordance with the "Plan of sanitary measures in the storage room for food and bedding". The control of the presence of parasites in the litter is carried out by a specialized state enterprise of the system of the sanitary and epidemiological service under a contract for disinfection work.

Methods: experimental, empirical, theoretical, comparative.

Result. In the end, not to mention that all the research proved that the mouse genome contains the same number of genes as the human genome, with 99% of these genes appearing to be identical and 96% in the same order. This means that disease genes identified in mice can be transferred to the human gene map. You can conduct experimental crosses between mice with different traits, and then very quickly begin to study the resulting offspring. It is possible to obtain mutant mice with certain gene defects, the phenotype of which can then be studied. In view of all this, at least we should pay attention to their living conditions and good nutrition. We must follow safety rules in accordance with the norms.

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CHEMICAL SCIENCES

PHASE EQUILIBRIUM IN THE $SmSb_3Se_6$ - $SmBi_3Se_6$ SYSTEM

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ФАЗОВЫЕ РАВНОВЕСИЯ В СИСТЕМЕ $SmSb_3Se_6$-$SmBi_3Se_6$

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Abstract

State diagrams of the $SmSb_3Se_6$-$SmBi_3Se_6$ system were studied by the methods of physical and chemical analysis. It is established that the systems are quasi-binary sections of the quasi-ternary system. Sm_2Se_3-Sb_2Se_3-Bi_2Se_3. In the system, a ternary compound of the composition $SmSb_{1,5}Bi_{1,5}$-$Se_6$is formed, which melts congruently, crystallizes in the rhombic syngony of the Sb_2Se_3 type, belongs to the type Pbnm- D^{16}_{2n}.. Parameters of the elementary cell a=11.65, b=11.81, c=4.018. The region of the solid solution near the initial components with a stretch of up to 2 mol % at 3000C was detected.

Аннотация

Методами физико-химического анализа исследованы диаграммы состояния системы $SmSb_3Se_6$-$SmBi_3Se_6$. Установлено, что системы являются квазибинарными сечениями квазитройной системы. Sm_2Se_3-Sb_2Se_3-Bi_2Se_3. В системе образуется тройное соединение состава $SmSb_{1,5}Bi_{1,5}$-Se_6, которое плавится конгруэнтно, кристаллизуется в ромбической сингонии типа Sb_2Se_3, относится к пр.гр Pbnm-D^{16}_{2n}. Параметры элементарной ячейки a=11,65 , b=11,81, c=4,018. Обнаружено область твердого раствора вблизи исходных компонентов протяженностью до 2 мол % при 300^0C.

Keywords: *system, synthesis, temperature, alloy, solid solution*
Ключевые слова: *система, синтез, температура, сплав, твердый раствор*

Введение

Современный научно-технический прогресс, включая освоение космического пространства, неразрывно связан с развитием полупроводниковой техники [1-4]. Бурное развитие последней явилось основным стимулом поиска сложных полупроводниковых материалов. Однако, растущая потребность полупроводниковой техники в материалах пока полностью не удовлетворяется в связи с отсутствием материалов, обладающих разным сочетанием оптических, магнитных и электрофизических свойств. Эти требования к материалам перед химиками-технологами открывают простор новых задач, синтез новых веществ с заданными свойствами.

Изучение химического взаимодействия в квазитройной системе Sm_2Se_3-Sb_2Se_3-Bi_2Se_3 представляет интерес в связи с применением редкоземельных элементов при коммутации термоэлементов на основе $B^{v}_2X^{vi}_3$ [1-4].

Соединение Sm_2Se_3 образуются с открытым максимумом, относится к кубической сингонии. Исходные соединения в квазитройной системе

Sm_2Se_3-Sb_2Se_3-Bi_2Se_3 хорошо изучены и подробно описаны в литературе. [5,6]

Существование соединений $SmSb_3Se_6$ и $SmBi_2Se_6$ установлено ранее. [7,8] При изучении систем Sm_2Se_3-Sb_2Se_3 и Sm_2Se_3-Bi_2Se_3 они плавятся конгруэнтно соответственно при 895К и 1000К.

Современный научно-технический прогресс, включая освоение космического пространства, неразрывно связан с развитием полупроводниковой техники [1-4]. Бурное развитие последней явилось основным стимулом поиска сложных полупроводниковых материалов. Однако, растущая потребность полупроводниковой техники в материалах пока полностью не удовлетворяется в связи с отсутствием материалов, обладающих разным сочетанием оптических, магнитных и электрофизических свойств.

Методика эксперимента

Исходными материалами для синтеза сплавов служили Sm металлический СММ-0, Sb(Bi) марки "В-4" Se марки "ОСИ-16-50"

Сплавы исходных соединений получали непосредственным сплавлением компонентов в вакуумированных кварцевых ампулах при 900-1100К (в зависимости от состава) с последующим медленным охлаждением в выключенной печи.

Для получения равновесного состояния сплавы подвергали гомогенизирующему отжигу в вакуумированных кварцевых ампулах при 900-1100К (в зависимости от состава) с последующим медленным охлаждением в выключенной печи.

Для получения равновесного состояния сплавы подвергали гомогенизирующему отжигу в вакуумированных кварцевых ампулах при 800К в течение 500ч. После термообработки сплавы соединений $SmB^v_3Se_6$ (B^v-Sb_iBi) системы S_3-S_6. Синтез сплавы системы подготовили вышеуказанными методами.

Исследования приводили комплексными методами физико-химического анализа по методике. [8].

Кривые нагревания и охлаждения сплавов до 1300К записывали на ПТР-73 (с использованием Pt-Pt/Re термопар), а выше 1300К на установке ВДТА-$8m_2$ в инертной атмосфере с использованием W-W/Re-термопар. Кроме эффектов сплавы состава 1:1.

Все полученные эффекты на термограмме (табл. 1) Эндотермические, обратимые. Микроструктурный анализ выполняли на отшлифованных и полированных поверхностях сплавов с помощью микроскопа МИМ—7. Травителем служили разбавленные растворы $KCl+HNO_3$ взятые в соотношении (1:1), время травления 20-25 с.

Микротвердость сплавов измеряли на приборе ПМТ-3 при нагрузке 0,2-0,3 Н. Результаты измерений приведены в таблице РФА проводили на дифрактометре ДРОН-2 в CuK^-_α излучении. Плотность сплавов определяли пикнометрическими методами при 300К (наполнитель толуол)

Результаты и обсуждения

Исследование микроструктуры показало, что сплавы, содержащие 0-2, 50 и 98-100 мол. % - $SmBi_3Se_6$ однофазные, а остальные – двухфазные (рис.1)

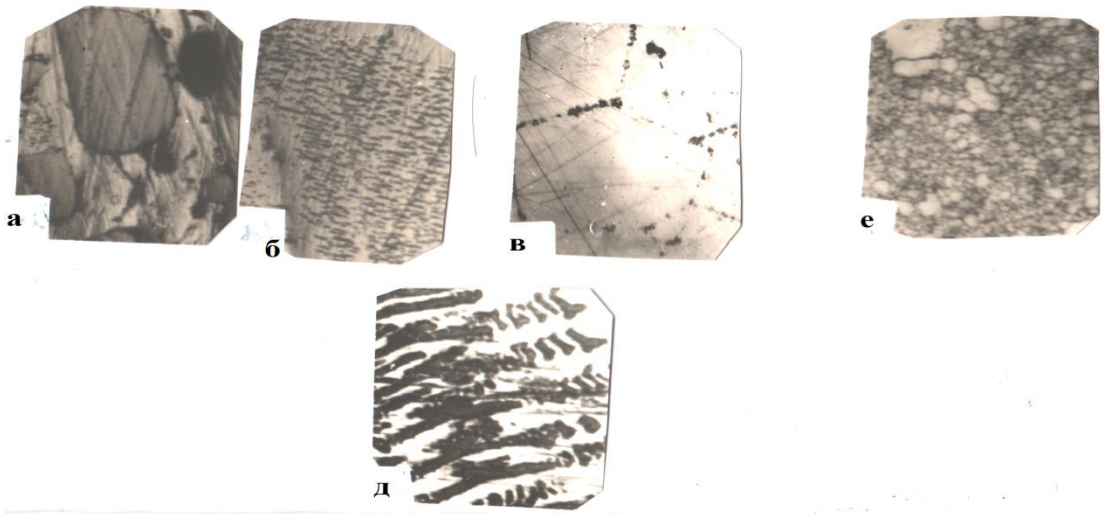

Рис.1 Микроструктурный анализ системы SmSb3Se6 - SmBi3Se6
а) 20мол% $SmSb_3Se_6$,б, 30мол%, с, 50мол%, е) 75мол%,д, 80мол% $SmBi_3Se_6$

При изучении микротвердости сплавов получены следующие значения 2250,24604, 3250 МПа соответствующие α-твердым растворам на основе S_3 и S_6 и новым фазам $SmSb_{1,5}Bi_{1,5}Se_6(S_i)$ (табл.1)

Табл.1

Результаты определения ДТА, плотности и микротвердость сплавов системы $SmSb_3Se_6$-$SmBi_3Se_6$.

Состав, мол%		Термические эффекты, К	Микротвердость, МПа			Плотность г/см^3
S_3	S_6		S_3	S_1	S_6	
100	0	895	2250	-	-	4,75
92	8	870,890	2260	-	-	4,77
95	5	850,885	2260	-	-	4,78
90	10	850,870	2255	-	-	4,80
80	20	850,880	Не изменяется	-	-	4,85
70	30	850	эвтектика			4,90
60	40	850,950	-	-	-	4,95
50	50	1100	-	3250	-	5,03
40	60	950,1050	-	Не изм.	-	4,99
30	70	950,1000	-	-	-	4,98
20	80	950,980	-	-	Не изм.	4,90
10	90	950,1000	-	-	2460	4,86
5	95	950,1050	-	-	2160	4,85
0	100	1000	-	-	2450	4,78

РФА сплавов системы подтверждают результаты ДТА, МСА и измерения микротвердости. Сравнение полученных дифрактограмм исходных компонентов и промежуточных сплавов показано, что сплавы, содержащие 50 мол. % $SmBi_3Se_6$ по положениям интенсивности дифракционных линий, отличаются от исходных компонентов.

На основе данных ДТА, ВДТА, МСА, РФА и измерениями микротвердости сплавов построена диаграмма состояния системы $SmSb_3Se_6$-$SmBi_3Se_6$. (рис.2)

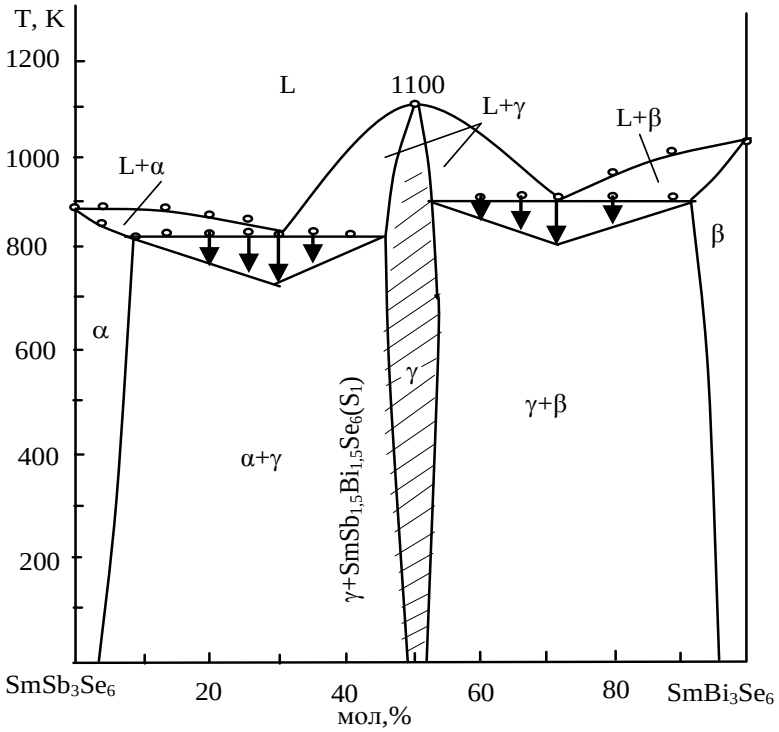

Рис.2 Диаграмма состояния системы $SmSb_3Se_6$-$SmBi_3Se_6$

Как видно из рисунка, что система является квазибинарной. В системе образуется одно соединение состава $SmSb_{1,5}Bi_{1,5}Se_6$, которое плавится с открытым максимумом при 1100К.

Соединение $SmSb_{1,5}Bi_{1,5}Se_6$ образуют эвтектики с α-твердым раствором на основе $SmSb_3Se_6$ и β-твердым раствором на основе $SmBi_3Se_6$ (координаты эвтектики отвечают 30 мол% $SmBi_3Se_6$ и 850К; 75 мол% $SmBi_3Se_6$ и 950К)

По методам МСА установлено, что на основе $SmSb_{1,5}Bi_{1,5}Se_6$ образуются области растворимости ~ 1,5 мол % (рис.2)

Расшифрование рентгенограммы порошка соединения вычислены периоды элементарной ячейки, исходя из соотношения между $1/d^2$ и параметрами ячейки обратной решетки по методу ИТО [9].

Установлено, что соединение $SmSb_{1,5}Bi_{1,5}Se_6$ обладает структурой Sb_2Se_3 с пространственной

группой Pbnm-D2n, параметры элементарной ячейки: a=11,65 b=11,81 c=4,01 Å

Выводы

1. Методами физико-химического анализа построена и исследована диаграмма состояния системы $SmSb_3Se_6$-$SmBi_3Se_6$.

2. Установлено, что системы являются квазибинарными сечениями квазитройной системы. Sm_2Se_3-Sb_2Se_3-Bi_2Se_3. В системе образуется тройное соединение состава $SmSb_{1,5}Bi_{1,5}Se_6$, которое плавится конгруэнтно

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EARTH SCIENCES

PHYSICAL, AGROCHEMICAL PROPERTIES OF SOILS OF THE TERRITORY OF THE FORMER RADAR STATION "DARYAL-U" (BALKHASH-9), USED FOR STORAGE OF PCB-CONTAINING EQUIPMENT AND WASTE

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ФИЗИЧЕСКИЕ, АГРОХИМИЧЕСКИЕ СВОЙСТВА ПОЧВ ТЕРРИТОРИИ БЫВШЕГО РЛС «ДАРЬЯЛ-У» (БАЛХАШ-9), ИСПОЛЬЗОВАВШЕГОСЯ ДЛЯ ХРАНЕНИЯ ПХД-СОДЕРЖАЩЕГО ОБОРУДОВАНИЯ И ОТХОДОВ

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Abstract

The article provides data on the physical and agrochemical properties of soils of the territory of the former radar station "Daryal-U" (Balkhash-9), used for the storage of PCB-containing equipment and waste. These soils are low humus. According to the accepted gradations, all soils are low in nitrogen and phosphorus, high in potassium. According to laboratory studies on the territory of the soil of varying degrees of salinity. The type of salinity according to the anionic composition is chloride-sulfate, according to the composition of sodium-calcium and sodium cations. The soils of the territory are saline, gray-brown saline and saline.

Аннотация

В статье приводится результаты физических и агрохимических свойств почв территории бывшего РЛС «Дарьял-У» (Балхаш-9), использовавшегося для хранения ПХД-содержащего оборудования и отходов. Данные почвы относятся к низко гумусным. По принятым градациям все почвы низко обеспечены азотом и фосфором, высоко обеспечены калием. По данным лабораторных исследований на территории почвы разной степени засолены. Тип засоления по анионному составу хлоридно-сульфатное, по составу катионов натриево-кальциевый и натриевый. Почвы территории солонцы, серо-бурые солонцеватые и солончаковатые.

Keywords**:** *physical, chemical properties, humus, nitrogen, phosphorus, potassium, salinity, salt salts.*

Ключевые слова*: физические, химические свойства, гумус, азот, фосфор, калий, засоление, солонцы*

Описываемый коренной берег представляет собой склон плато Северного Прибалхашья. Поверхность плато - плоская или слабоволнистая, слегка покатая к югу равнина шириной от 5 до 15 км. Ее южный (обращенный к озеру) край расчленен эрозией до мелкосопочника с чертами кырового рельефа, врезанного от поверхности 400 м н.у.м. С севера плато ограничено линией мелкосопочников (за пределами данной точки). Вода в этой части озера солоноватая, почвы побережья засолены, озерная терраса представляет собой обширный пухлый солончак. Поверхность плато в основном глинистая, в присклоновой полосе на ней более или менее развит щебнистый панцирь. Озерные террасы заняты галофитными сочносолянковыми пустынями, местами с значительным участием нескольких видов парнолистника, по саям - с кустами тамарикса. Непосредственно вдоль берега развиты более или менее обширные (местами редуцированные до узкой полосы) заросли тростника. С береговыми валами связаны характерные группировки с доминированием видов эфедры, итсигек, полыни.

Климат. Климат в районе озера континентальный. Средняя температура составляет около 24°C с максимумом 30° C (86° F) в июле, а средняя температура составляет -14°C в январе. Среднее количество осадков составляет 131 мм в год. Относительная влажность составляет около 60 %. Ветер, сухой климат и высокие летние температуры приводят к высоким испарением, норма - 950 мм в холодные и до 1200 мм в засушливые годы. Ветер имеет среднюю скорость 4,5–4,8 м/с и дует преимущественно на юг в западной части и на юго-запад в восточной части. Ветер вызывает волны высотой до 2–3,5 м. и устойчивые течения по часовой стрелке в западной части.

В году 110-130 солнечных дней со средним сияние 15,9М Дж/м2 в день. Температура воды на поверхности озера колеблется от 0°C в декабре до 28°C в июле. Среднегодовая температура составляет 10°C в западной и 9°C в восточной части озера. Озеро замерзает каждый год с ноября по начало апреля, а в восточной части таяние задерживается примерно на 10-15 дней.

*Почвенный покров***.** Для Прибалхашского района характерна экосистема пустынь [1]. Зональный тип почв – серо-бурые пустынные промерзающие. Они отличаются малогумусностью, высокой карбонатностью, более повышенным, чем в бурых почвах, содержанием солонцеватых родов почв и их комплексов. Имеют распространение мало развитые и неполноразвитые щебнистые почвы. Огромные площади (до 30% занимают песчаные массивы)

*Растительность***.** В экосистемах пустынь господствуют многолетнесолянковые сообщества (62%) [2]. Доминируют многолетние солянка – биюргун или ежовник солончаковатый (*Anabasis salsa*), черный боялыч (*Salsola arbuscula*), тасбиюргун (*Nanophytonerinaceum*), солянка восточная (*Salsola orientalis G.Gmel*), а из полыней - полынь белоземельная (*Artemisiaterra-alba*) и туранская (*Artemisia turanica*). На песках широко распространены саксаулы белый (*Haloxylon persicum*) и черный (*Haloxylon aphyllum*) и характерные псаммофильные кустарники и полукустарники (виды джузгунов (*Calligonum*), эфедры (*Ephedra*), песчаной акации (*Ammodendron*)).

Основные задачи работ: полевое обследование земельного участка, подлежащего рекультивации (уточнение расположения объекта, фактических границ нарушенных земель, установление возможного перспективного использования рекультивируемого участка; установление наличия плодородного и потенциально-плодородного слоев почв для рекультивации нарушенных земель; предварительное определение качества плодородного и потенциально-плодородного слоев почв в отвалах, их минералогический и механический состав, наличие токсичных солей в породах и необходимость химической мелиорации, уточнение условий увлажнения и естественного зарастания.

Объектом исследования является почвенный покров территории бывшего РЛС «Дарьял-У» (Балхаш-9), использовавшегося для хранения ПХД-содержащего оборудования и отходов.

Методы исследования: полевые - экспедиционные, лабораторно-аналитические

Результаты и их обсуждение. Рекогносцировочный обход объекта исследования позволил разметить ключевые точки закладки почвенных разрезов, которые были заложены на ненарушенных землях объекта исследования (рисунок 1).

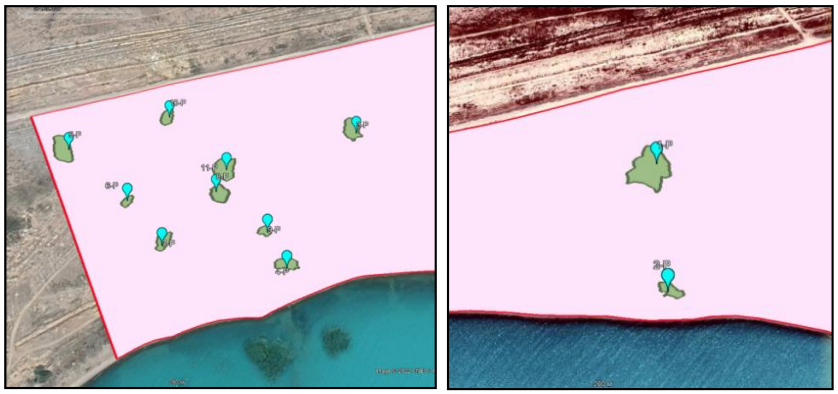

Рисунок 1 - Карта-схема точек закладки почвенных разрезов на ненарушенных землях

Физические свойства почв исследуемого объекта. Гранулометрическим составом почвы называют относительное (в процентах) содержание в ней твердых частичек различного размера. Эти частички являются отдельными зернами минералов, обломками горных пород, продуктами взаимодействия органических и минеральных веществ - их называют механическими элементами. Гранулометрический состав почв – относительное содержание в почве и породе механических элементов (фракций). Гранулометрический состав почв и пород оказывает большое влияние на почвообразование и плодородие почв. Гранулометрическим составом почвы определяются ее физические и водно-физические свойства (пористость, влагоемкость, водопроницаемость, водоподъемная способность, структурность и др.), а также воздушный и тепловые режимы. Гранулометрический состав, выраженный в содержаниях фракций гранулометрических элементов - важнейшая физическая характеристика почвы, одна из характеристик ее дисперсности. Он определяет все основные почвенные процессы, является одним из фундаментов почвенного плодородия, так как в зависимости от гранулометрии почв формируются те или иные сельскохозяйственные мероприятия. Знание гранулометрического состава почв также дает представление о генезисе, эволюции и использовании почв. Данные свидетельствует о том, что именно мельчайшие глинистые частицы составляют наиболее ценную часть почвы, в которой сосредоточены запасы многих необходимых для растений питательных зольных элементов. Таким образом, гранулометрический состав характеризует, в некоторой степени, физические свойства и химический состав почвы и материнской породы.

Данные показывают, что в гранулометрическом составе главная роль принадлежит тонкопесчаной и крупнопылеватой фракциям. Характерны опесчаненность корки, наличие щебенки на поверхности и увеличение содержания илистой фракции. Это характерно для серо-бурых пустынных почв (таблица 1).

Таблица 1

Содержание гранулометрического состава почвы

Разрезы	Глубина, см.	А.С.Н % H2O	Содержание фракции в % на абсолютную сухую почву						
			Размеры фракции в мм						
			Песок		Пыль			Ил	3-х Фракции < 0,01
			1,0 - 0,25	0,25-0,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001	
Р-1	0-10	1,08	40,437	35,301	8,087	5,257	4,448	6,470	16,175
	10-20	1,04	29,830	37,025	9,297	4,446	6,467	12,935	23,848
	20-30	1,10	32,841	35,612	6,067	3,236	7,280	14,965	25,480
	30-40	1,34	34,523	23,718	14,190	5,271	7,703	14,596	27,569
Р-2	0-6	0,60	53,823	25,252	8,853	2,414	2,817	6,841	12,072
	6-20	1,74	34,867	17,097	12,212	6,513	11,398	17,912	35,823
Р-3	0-13	0,76	28,114	48,912	4,031	5,240	6,449	7,255	18,944
	13-27	0,80	45,927	29,073	3,629	2,419	9,677	9,274	21,371
	27-40	0,72	45,951	15,774	4,835	3,223	7,252	22,965	33,441
	40-60	0,66	68,552	18,965	2,013	1,611	0,805	8,053	10,469
Р-4	0-18	0,36	80,992	7,367	1,606	1,204	2,007	6,825	10,036
	18-28	0,44	77,642	7,895	5,625	0,804	0,804	7,232	8,839
	28-40	0,16	77,424	14,964	1,202	0,801	0,401	5,208	6,410
	40-56	0,34	77,724	11,439	1,204	2,007	0,803	6,823	9,633
	56-72	5,74	29,111	57,734	0,424	1,273	1,273	10,185	12,731
Р-5	0-12	2,12	39,661	26,829	8,991	2,861	3,269	18,390	24,520
	12-27	4,26	41,278	37,414	2,925	8,356	0,418	9,609	18,383
	27-42	5,34	42,193	34,566	12,254	0,423	0,423	10,142	10,987
	42-77	4,72	41,373	33,018	3,778	3,778	10,915	7,137	21,830

	77-89	4,40	41,255	24,435	8,787	3,766	12,134	9,623	25,523
Р-6	0-15	0,58	39,067	45,242	2,414	1,207	3,219	8,851	13,277
	15-29	1,42	35,829	37,391	1,623	1,623	6,492	17,042	25,157
	29-45	1,26	39,822	33,846	4,051	0,810	4,861	16,609	22,281
Р-7	0-10	0,54	45,848	41,283	4,022	0,402	3,217	5,228	8,848
	10-25	1,08	44,197	32,754	6,470	2,022	0,404	14,153	16,579
Р-8	0-14	0,42	36,272	40,028	7,632	7,632	2,410	6,025	16,067
	14-34	0,54	44,902	36,598	5,228	1,207	3,217	8,848	13,272
	34-48	0,86	65,685	19,387	2,824	1,614	2,824	7,666	12,104
	48-53	0,98	45,365	34,437	2,020	2,424	6,059	9,695	18,178
Р-9	0-18	0,32	62,620	25,341	3,210	2,006	1,204	5,618	8,828
	18-39	0,80	53,569	25,867	1,613	0,806	4,032	14,113	18,952
Р-10	0-6	0,80	45,605	33,831	10,887	2,823	0,806	6,048	9,677
	6-29	2,80	45,473	16,667	4,527	1,646	6,173	25,514	33,333
	29-51	1,10	44,813	17,978	14,560	9,707	2,022	10,920	22,649
	51-59	5,90	30,967	17,173	30,606	5,101	3,401	12,752	21,254
Р-11	0-10	0,50	41,146	40,362	5,628	2,412	1,608	8,844	12,864
	10-26	0,70	48,157	28,479	7,251	0,806	3,223	12,085	16,113
	26-42	0,58	43,693	38,202	6,437	1,207	1,609	8,851	11,668

Данные ситового анализа каменистых фракций по классификации Н.А. Качинского показали, что в почвах разреза 3 в процентном отношении к весу почвы (100%), каменисто песчаные фракции колеблются от 21,3% до 66%, а от 12,8% до 22,1% приходится на мелкоземистую фракцию. В почвах разреза 5 каменисто песчаные фракции колеблются от 42,7% до 58%, а от 8,14% до 15,4% приходится на мелкоземистую фракцию. (таблица 2-3).

Таблица 2

Классификация почв по степени каменистости (по Н.А. Качинскому, 1958 [3]

Частиц>3 мм,%	Степень каменистости	Тип каменистости
<0,5	Не каменистая	Устанавливается по характеру скелетной части
0,5-5,0	Слабокаменистая	Почвы могут быть валунные, галечниковые, щебенчатые
5,10	Среднекаменистая	
>10	Сильнокаменистая	

Таблица 3

Ситовой анализ каменистых фракций почв

Место отбора	Глубина, см	Сухая навеска, г	Содержание гранул в грамм на воздушно-сухую почву, размеры фракций в мм, %								
			Каменистая часть почвы				Песок крупный			Песок мелкий	Мелкозем
			>10	>7	>5	>3	>2	>1	>0,5	>0,25	<0,25
Р-1	0-10	200	21,2	5,9	6	11	11,6	22,6	6,85	5,2	9,65
	10-20		2,45	1,37	4,69	15,5	17,3	21,7	13,8	11,3	11,89
	20-30		4,6	4,42	5,2	17,8	25,9	24,8	5,6	4,6	7,08
	30-40		17,6	4,65	6,1	21,3	22	16,4	4,95	2,92	4,08
Р-2	0-6		27,9	7,6	8,1	13,8	6,1	9,8	17,6	1,3	7,8
	6-20		8,6	8,95	15,1	23,1	10,8	14,1	7,4	7,3	4,65
Р-3	0-13		33,7	2,16	1,67	4,7	7,7	17,5	18,6	1,49	12,4
	13-27		56,1	3,95	2,1	3,8	5,1	10,6	5,6	5,8	6,95
	27-40		31,9	5,6	4,1	3,7	6,2	15,1	11,3	14,2	7,9
	40-60		18,9	1,55	2,3	2,75	11,4	36,6	12	8,75	5,75
Р-4	0-18		28,6	9,15	4,7	5,65	5,15	17,6	11	11,6	6,55
	18-28		40,1	3,75	1,45	2,7	1,95	2,31	14,2	15,4	18,14
	28-40		31,3	2,45	3,4	2,7	2,32	13,4	14,4	15,4	14,63
	40-50		51,8	2,55	3	3,95	3,65	8,75	6,85	11,75	7,7
	50-72		41,95	4,25	5,8	8,7	8,1	17,5	4,75	4,35	4,6
Р-5	0-12		41,3	2,1	2,55	3,7	6,85	20,1	8,25	5,2	9,5
	12-27		51,1	2,2	2,1	2,6	3,7	6,85	20,1	8,25	3,1
	27-42		26,2	3,85	4,5	8,1	10,1	22,8	9,1	6,4	8,95

	42-77		29,9	4,45	6,1	8,9	9,9	23,5	7	4,75	5,5
	77-89		26,5	6,55	6,35	12,7	14,1	20	5,7	3,6	4,54
Р-6	0-15		8,7	9,55	5,75	11,1	12,6	23,5	9,45	10,9	8,45
	15-29		43,4	5,2	4,4	4,8	4	11,7	7,45	9,45	9,6
	29-45		52,3	2,4	3,85	4,25	3,8	10,1	6,45	7,55	9,3
Р-7	0-10		6,15	1,7	2,25	6	13,9	33,6	10,3	11,9	14,2
	10-25		14,8	3,95	4,1	9,3	11	23,5	8,9	11,7	12,75
Р-8	0-14		7,9	1,6	1	2,4	7,6	25,3	13,4	15,1	25,7
	14-34		29,2	3,3	4,2	4	5,2	14	8,8	13,3	18
	35-48		28,7	4,31	3,75	4,7	5,25	15,4	12,2	14,1	11,54
	48-53		19,9	8,25	4,55	6,65	5,35	15,3	9,25	11,8	18,95
Р-9	0-18		2,6	1,35	1,9	7,4	12,1	30,4	16,2	14,5	13,55
	18-39		17	5,45	5,7	6,6	7,1	22,6	11,4	12,4	11,75
Р-10	0-6		32,7	2,25	2,85	3,55	4,25	12,6	7,7	12,7	39,3
	6-29		30,6	4,1	6,7	9,1	10,2	20,8	7,3	5,1	6,1
	29-51		17,6	9,9	11,3	16,7	14,2	23	3,9	2,6	0,8
	51-59		8,95	9,85	11,3	16,7	11,2	18,8	6,9	5,5	10,8
Р-11	0-10		25,2	6,3	8	7,1	6,3	11	7,8	11	17,3
	10-26		38,5	6,2	5,8	6,2	4,2	8,6	7,9	11	11,6
	26-42		25,4	5,95	5,2	5,6	3,95	8,7	8,4	14,5	22,3

Агрохимические свойства почв исследуемого объекта. Растительный покров является одним из важнейших факторов, определяющих количество и состав поступающих в почву органических остатков, которые являются основным источником накопления углерода в почве. Надземные и корневые растительные остатки служат источником образования перегноя и их содержание в почве может служить одним из показателей ее потенциального плодородия [4]. Корневой массе принадлежит решающая роль в накоплении углерода в почве [5].

Органическое вещество почвы является важным показателем её плодородия. Оно состоит из ещё не успевших разложиться органических остатков и уже претерпевших изменения органических веществ, называемых гумусом.

Аналитические данные показывают, что содержание гумуса во всех разрезах по профилю почв колеблется от 0,1-1,2%. По существующим градациям содержания гумуса менее 2% относятся к очень низкогумусным (таблица 4,5).

Количество воздуха в почве и его состав зависят от ее воздухоемкости и воздухопроницаемости, а также от пористости и влажности, так как почвенный воздух занимает все поры, в которых нет воды. Важный компонент почвенного воздуха – углекислый газ, который обнаруживается в почве главным образом благодаря биологическим процессам. Аналитические исследоаания показали, что содержание CO_2 в почве колеблется от 0,16-6,43%. Высокое содержание его в почве (> 3 %) отрицательно действует на семена, угнетает развитие растений [6].

Азот - один из наиболее распространённых элементов в природе, тем не менее растениям часто не хватает азота, так как растения могут усваивать только определённые формы соединений азота (в основном аммонийную и нитратную формы) [4].

Аналитические данные показывают, что уровень содержание гидролизуемого азота от верхних к нижним горизонтам почв колеблется от 39,2 до 5,6 мг/кг, т.е. по принятым градациям в основном почвы по всем разрезам средне и низкообеспечены с уменьшением его содержания вниз по профилю. Высоким содержанием отличается почва разреза 2. Разрез - 2 заложен на террасе озеро Балхаш на высоте 336 м н.у.м. от Р-1 в восточном направлении, рядом заросли чингиля (*Halimodendron halodendron*). Чингиль серебристый – монотипный род растений семейства бобовые, листопадный солеустойчивый и засухоустойчивый колючий кустарник [7] (таблица 4,5). Бобовые растения фиксирует атмосферный азот.

Фосфор тоже жизненно необходим растениям и также входит в состав многих органических соединений. Кроме того, он участвует в энергетическом обмене клеток. Но подвижные формы фосфора во многих почвах находятся в дефиците [5]. Полученные данные показали, что уровень содержание подвижного фосфора по всему профилю в разрезах от верхнего горизонта к нижнему колеблется от низкого до очень низкого, т.е. от 35 до 3 мг/кг (таблица 4,5).

Таблица 5

Агрохимическая характеристика почв

№ раз-реза	Глу-бина, см.	Гу-мус, %	CO_2, %	Азот		Фосфор		Калий	
				Валовой, %	Подвиж-ный, мг/кг	Валовой, %	Подвиж-ный, мг/кг	Валовой, %	Подвиж-ный, мг/кг
Р - 1	0-10	0,9	1,76	0,07	22,4	0,152	35	2,375	370
	10-20	0,34	3,04	0,042	25,2	0,084	10	2,687	800
	20-30	0,24	4,67	0,028	19,6	0,084	8	2,625	1000
	30-40	0,31	3,2	0,028	14	0,08	4	2,625	1200
Р - 2	0-6	1,21	1,92	0,084	39,2	0,128	35	2,375	300
	6-20	0,55	6,43	0,056	33,6	0,12	18	2,625	800
Р - 3	0-13	0,72	1,25	0,056	19,6	0,128	35	2,375	240
	13-27	0,52	1,76	0,042	19,6	0,108	10	2,375	160
	27-40	0,21	0,83	0,042	16,8	0,08	8	2,625	120
	40-60	0,27	0,7	0,028	11,2	0,048	3	2,375	90
Р - 4	0-18	1,07	0,64	0,056	16,8	0,084	25	2,062	160
	18-28	0,34	0,74	0,028	8,4	0,08	8	2,375	100
	28-40	0,24	0,77	0,028	8,4	0,056	4	1,312	60
	40-56	0,1	0,67	0,014	5,6	0,056	3	2,062	60
	56-72	0,03	0,48	0,028	5,6	0,02	3	1	120
Р - 5	0-12	0,55	0,35	0,028	14	0,12	15	2,125	110
	12-27	0,52	0,26	0,028	11,2	0,12	8	1,687	50
	27-42	0,31	0,22	0,028	8,4	0,108	4	1,375	40
	42-77	0,14	0,16	0,014	5,6	0,108	3	1,687	50
	77-89	0,1	0,29	0,014	5,6	0,096	3	1,75	60
Р - 6	0-15	0,52	0,54	0,056	25,2	0,108	35	2,625	310
	15-29	0,55	0,64	0,056	14	0,048	4	2,125	120
	29-45	0,24	0,99	0,028	11,2	0,048	3	2,625	80
Р - 7	0-10	0,83	0,51	0,042	25,2	0,108	25	2,687	300
	10-25	0,41	0,58	0,042	8,4	0,084	12	2,25	130
Р - 8	0-14	0,31	0,58	0,028	14	0,084	28	2,687	300
	14-34	0,52	0,64	0,028	8,4	0,084	10	2,437	160
	34-48	0,38	0,96	0,042	14	0,064	8	2,625	90
	48-53	0,27	0,96	0,028	5,6	0,056	8	2,625	90
Р - 9	0-18	0,1	0,42	0,028	11,2	0,084	20	2,125	180
	18-39	0,24	0,58	0,028	8,4	0,084	8	2,625	170
Р - 10	0-6	0,79	0,48	0,042	25,2	0,08	23	2	350
	6-29	0,41	0,96	0,056	11,2	0,048	8	2,062	80
	29-51	0,41	0,58	0,028	5,6	0,04	4	1,75	80
	51-59	0,27	0,26	0,028	5,6	0,024	3	1,375	60
Р - 11	0-10	0,55	0,7	0,042	14	0,084	28	2,187	190
	10-26	0,41	1,15	0,042	5,6	0,08	10	2,375	100

Калий является важнейшим элементом питания растений, он входит в состав цитоплазмы клетки, в значительной степени определяет её свойства и поэтому влияет практически на все процессы в клетке [5]. Растениям доступны только подвижные формы калия, поэтому именно их мы и определяем. Результаты аналитических исследований показали, что уровень содержания подвижного калия (во всех разрезах) в верхних горизонтах очень высокий с уменьшением к нижнему горизонту почв, т.е уровень его содержания колеблется соответственно от 1200 до 40 мг/кг (таблица 4,5).

Таблица 5

Оценка потенциального плодородия почв по содержанию гумуса и доступных для растений фосфора, калия и азота

Уровень содержания	Подвижный фосфор P_2O_5, млн$^{-1}$*	Обменный калий K_2O, млн$^{-1}$*	Нитратный азот N - NO_3, млн$^{-1}$**	Аммонийный азот N-NH_3^+, N-NH_4, млн$^{-1}$**	Содержание гумуса (С орг*1,724), % от массы почвы***
Очень высокий	Более 250	Более 250	-	-	Более 10
Высокий	250–150	250–170	Более 20	Более 40	6–10
Повышенный	150–100	170–120	-	-	-
Средний	100–50	120–80	15–20	20–40	4–6
Низкий	50–25	80–40	10–15	10–20	2–4
Очень низкий	Менее 25	Менее 7	Менее 10	Менее 10	Менее 2

* - по Г. В. Мотузовой и О.С. Безугловой, 2007 (по методу Кирсанова); [8]

- по Г. П. Гамзикову, 1981; [9] * - по Л. А. Гришиной и Д. С. Орлову, 1978.[10].

Почвы объекта исследования по шкале относятся к слабокислым, слабощелочным и щелочным, pH – составляет 7,1-8,46.

Почвенный поглотительный комплекс (ППК) всегда насыщен катионами, но их состав и количество в разных почвах неодинаковы. Важнейшей характеристикой ППК и почвы в целом является емкость катионного обмена (емкость поглощения) (ЕКО).

Полученные данные показывают, что содержание Са колеблется от 1,5-27,2 мг-экв, т.е. 5,6-74,3 %. Магний всегда сопровождает Ca^{2+}. Типичное соотношение Ca:Mg = 5:1. В таких количествах действие Mg^{2+} аналогично действию Ca^{2+}. Содержание магния колеблется 1 -12,4 мг-экв, т.е. от 9,7-31,1% (таблица 6).

Таблица 6

Содержание поглощенных оснований, мг/экв

№ разреза	Глубина, см	Поглощенные основания в мг/экв на 100гр.почвы				
		Натрий	Калий	Кальций	Магний	Сумма
Р -1	0-10	0,16	0,38	4,46	2,97	7,97
	10-20	0,06	0,91	2,97	4,95	8,89
	20-30	0,19	1,66	2,48	3,96	8,29
	30-40	0,57	1,95	2,48	4,46	9,46
Р - 2	0-6	0,04	0,28	3,96	3,96	8,24
	6-20	0,42	0,97	7,92	0,99	10,30
Р - 3	0-13	0,16	0,20	4,46	1,98	6,80
	13-27	0,14	0,15	5,94	1,98	8,21
	27-40	0,06	0,15	3,47	1,98	5,66
	40-60	0,17	0,15	2,97	4,95	8,24
Р - 4	0-18	0,04	0,07	2,48	2,97	5,56
	18-28	0,21	0,15	1,98	1,98	4,32
	28-40	0,14	0,15	1,49	1,98	3,76
	40-56	0,14	0,15	2,97	2,97	6,23
	56-72	0,22	0,09	24,75	9,9	34,96
Р - 5	0-12	0,44	0,15	12,87	1,98	15,44
	12-27	0,22	0,15	22,28	7,92	30,57
	27-42	0,28	0,15	24,75	9,9	35,08
	42-77	0,35	0,15	27,23	8,91	36,64
	77-89	11,74	0,15	26,24	9,9	48,03
Р - 6	0-15	0,23	0,46	5,45	3,47	9,61
	15-29	0,30	0,18	7,92	2,97	11,57
	29-45	0,57	0,18	8,42	4,46	13,63
Р - 7	0-10	0,23	0,42	4,46	3,96	9,07
	10-25	0,27	0,18	7,92	2,97	11,34
Р - 8	0-14	0,23	0,37	5,45	2,97	9,02
	14-34	0,15	0,18	3,96	3,96	8,25
	34-48	0,12	0,17	3,96	3,96	8,21
	48-53	0,17	0,18	4,95	4,95	10,25
Р - 9	0-18	0,21	0,14	5,45	1,49	7,29
	18-39	1,37	0,03	4,95	3,96	10,31
Р - 10	0-6	0,08	0,2	6,93	2,97	10,18

	6-29	0,9	0,18	10,89	2,97	14,94
	29-51	17,89	0,18	22,28	9,9	50,25
	51-59	2,48	0,18	24,75	12,38	39,79
Р - 11	0-10	0,12	0,14	4,95	2,97	8,18
	10-26	0,25	0,18	6,93	3,47	10,83
	26-42	0,49	0,18	6,44	4,46	11,57

Образование засоленных почв в аридных областях зависит от многих факторов и причин таких как: геологическая структура и состав пород (засоленная материнская порода), топография местности и отрицательные формы рельефа, глубина залегания и засоленность (минерализация) грунтовых вод, расстояние от моря (эоловый перенос солей от моря к суше), гидрологический режим, осадки, вода с высокой минерализацией при ирригации, состав растительности (галофиты), способ использования территории для хозяйственных целей (неэффективная ирригация), ветровой режим территории (эоловый перенос).

Исследованию засоленных почв почвоведы уделяют большое внимание, так как они широко распространены, а решение любых вопросов их генезиса и мелиорации основывается на сведениях о засолении. К засоленным относятся почвы, содержащие легкорастворимые соли, в количествах, отрицательно влияющих на развитие растений – негалофитов. К этой категории относят почвы, содержащие хотя бы в одном горизонте почвенного профиля легкорастворимые соли в количествах, превышающих порог токсичности – минимальное допустимое количество солей, которое не вызывает угнетение растений. Все легкорастворимые соли считают токсичными для растений. Они увеличивают осмотическое давление почвенной влаги, снижая ее доступность для растений, отрицательно воздействуют на свойства почв и, кроме того, могут оказывать специфическое токсическое действие на растения, нарушая нормальное соотношение элементов минерального питания или увеличивая щелочность раствора. Засоление почв оценивают и диагностируют, анализируя почвенные растворы, фильтраты из насыщенных водой почвенных паст и водные вытяжки. Анализ почвенных растворов и фильтратов из насыщенных водой почвенных паст позволяет получить представление о концентрации солей в жидких фазах реальных почв. Метод водной вытяжки позволяет оценить общее содержание легкорастворимых солей в почвах. При оценке засоления, как правило, определяют анионы (CO_3^{2-}; HCO_3^-; Cl^-; SO_4^{2-}) и катионы (Ca^{2+}; Mg^{2+}; Na^+; K^+) легкорастворимых солей. К оценке засоления почв используют два подхода. Степень засоления почв оценивают либо по общему содержанию легкорастворимых солей в почве, либо по концентрации солей в почвенных растворах или фильтратах из насыщенных водой почвенных паст. Уровни этих показателей используют в качестве диагностических. Так, к засоленным относят почвы, у которых концентрация легкорастворимых солей в почвенных растворах превышает 5-7 г/л или почв, содержащих 0,05- 0,15 % легкорастворимых солей в зависимости от их состава. Водная вытяжка дает представление о содержании в почве водорастворимых органических и минеральных веществ, состоящих преимущественно из простых солей. Соли, растворимые в воде могут быть вредны. По степени вредности их располагают в следующем порядке: Na_2CO_3> $NaHCO_3$>NaCl> $CaCl_2$> Na_2SO_4> $MgCl_2$> $MgSO_4$.[11].

Почвы исследуемого объекта относятся к солонцам и серо-бурым солонцеватым почвам ($СнСБ^{сн}$) по карте Казахского научно-исследовательского института почвоведения и агрохимии имени У.У. Успанова. Аналитические данные показывают, что с глубиной содержание водорастворимых солей увеличивается. Почвы объекта относятся к средне и сильно засоленным почвам, хотя на карте не обозначено засоление серо-бурых почв. Возможно, в связи с аридизацией климата, по сравнению с ранними исследованиями ученых Прибалхашья изменились климатические условия в сторону иссушения. Иссушение привело к засолению почв, т.е. легко растворимые соли грунтовых вод в процессе испарения поднялись на поверхность почвы (присутствие белых пятен). По данным лабораторных исследований на территории почвы разной степени засолены. К засоленным почвам относятся почвы разрезов 2, 4 (нижний горизонт), 5, 10 и 11 (таблица 7). Тип засоления по анионному составу хлоридно-сульфатное, по составу катионов натриево-кальциевый и натриевый. Почвы территории солонцы, серо-бурые солонцеватые и солончаковатые.

Таблица 7 - Содержание водорастворимых солей

№ раз-реза	Глубина, см.	Сумма солей, %	Водная вытяжка в %, мг.-экв на абсолютно-сухую почву																pH
			Щелочность				Cl', %	Cl', мг/экв	SO_4", %	SO_4", мг/экв	Ca^{++}, %	Ca^{++}, мг/экв	Mg^{++}, %	Mg^{++}, мг/экв	Na^{+}, %	Na^{+}, мг/экв	K^{+}, %	K^{+}, мг/экв	
			HCO_3, %	HCO_3, мг/экв	CO_3, %	CO_3, мг/экв													
Р-1	0-10	0,056	0,032	0,52	0	0	0,006	0,18	0,001	0,01	0,004	0,2	0,002	0,2	0,002	0,11	0,008	0,22	8,1
	10-20	0,069	0,041	0,68	0,005	0,16	0	0	0,008	0,16	0,002	0,1	0,004	0,29	0,004	0,18	0,011	0,27	8,36
	20-30	0,094	0,049	0,8	0,007	0,24	0	0	0,014	0,29	0,002	0,1	0,001	0,1	0,01	0,43	0,018	0,46	8,46
	30-40	0,516	0,032	0,52	0,005	0,16	0,089	2,51	0,215	4,49	0,006	0,29	0,006	0,49	0,137	5,94	0,031	0,8	8,16
Р-2	0-6	0,571	0,024	0,4	0	0	0,077	2,18	0,279	5,81	0,02	0,98	0,006	0,49	0,152	6,6	0,013	0,32	7,86
	6-20	0,531	0,024	0,4	0	0	0,099	2,8	0,227	4,72	0,022	1,08	0,006	0,49	0,137	5,94	0,016	0,42	7,79
Р-3	0-13	0,062	0,027	0,44	0,002	0,08	0,003	0,07	0,015	0,32	0,006	0,29	0,004	0,29	0,003	0,13	0,005	0,12	7,9
	13-27	0,07	0,027	0,44	0,002	0,08	0,001	0,04	0,024	0,51	0,008	0,39	0,005	0,39	0,003	0,14	0,002	0,06	7,99
	27-40	0,069	0,024	0,4	0	0	0,005	0,15	0,022	0,45	0,006	0,29	0,005	0,39	0,007	0,29	0,001	0,02	8,01
	40-60	0,176	0,017	0,28	0	0	0,026	0,73	0,08	1,67	0,025	1,27	0,006	0,49	0,02	0,87	0,002	0,04	7,74
Р-4	0-18	0,072	0,022	0,36	0	0	0,005	0,15	0,023	0,49	0,008	0,39	0,002	0,2	0,006	0,25	0,006	0,15	7,71
	18-28	0,051	0,022	0,36	0	0	0,001	0,04	0,014	0,28	0,004	0,2	0,002	0,2	0,005	0,23	0,002	0,06	7,76
	28-40	0,061	0,02	0,32	0	0	0,01	0,29	0,013	0,27	0,006	0,29	0,002	0,2	0,008	0,36	0,001	0,03	7,77
	40-56	0,152	0,017	0,28	0	0	0,059	1,67	0,024	0,5	0,01	0,49	0,005	0,39	0,036	1,55	0,001	0,02	7,79
	56-72	1,457	0,012	0,2	0	0	0,177	4,98	0,814	16,96	0,206	10,29	0,03	2,45	0,213	9,27	0,005	0,13	7,38
Р-5	0-12	0,116	0,02	0,32	0	0	0,019	0,55	0,041	0,85	0,006	0,29	0,002	0,2	0,028	1,21	0	0,01	7,66
	12-27	1,303	0,012	0,2	0	0	0,11	3,09	0,777	16,19	0,261	13,03	0,006	0,49	0,137	5,94	0,001	0,02	7,23
	27-42	1,329	0,005	0,08	0	0	0,174	4,91	0,725	15,1	0,221	11,07	0,005	0,39	0,198	8,6	0,001	0,02	7,04
	42-77	1,502	0,007	0,12	0	0	0,217	6,11	0,784	16,34	0,114	5,68	0,011	0,88	0,367	15,94	0,003	0,07	7,1
	77-89	1,385	0,005	0,08	0	0	0,188	5,31	0,731	15,24	0,055	2,74	0,007	0,59	0,397	17,27	0,001	0,02	7,14
Р-6	0-15	0,064	0,027	0,44	0	0	0,003	0,07	0,016	0,34	0,004	0,2	0,005	0,39	0,002	0,07	0,008	0,2	7,64
	15-29	0,059	0,029	0,48	0,002	0,08	0,003	0,07	0,011	0,23	0,002	0,1	0,002	0,2	0,011	0,47	0,001	0,02	7,84
	29-45	0,109	0,029	0,48	0,002	0,08	0	0	0,049	1,02	0,008	0,39	0,002	0,2	0,02	0,88	0,001	0,02	7,74
Р-7	0-10	0,056	0,027	0,44	0,002	0,08	0,001	0,04	0,012	0,24	0,004	0,2	0,004	0,29	0,001	0,03	0,008	0,2	7,62
	10-25	0,057	0,029	0,48	0,002	0,08	0,003	0,07	0,01	0,21	0,002	0,1	0,002	0,2	0,01	0,43	0,001	0,03	7,73
Р-8	0-14	0,045	0,029	0,48	0,005	0,16	0,001	0,04	0,001	0,02	0,004	0,2	0,001	0,1	0,001	0,05	0,007	0,18	7,59
	14-34	0,048	0,027	0,44	0,002	0,08	0,001	0,04	0,008	0,16	0,004	0,2	0,002	0,2	0,005	0,2	0,002	0,04	7,72
	34-48	0,057	0,032	0,52	0,002	0,08	0,003	0,07	0,007	0,14	0,002	0,1	0,001	0,1	0,012	0,5	0,001	0,03	7,76
	48-53	0,079	0,041	0,68	0,007	0,24	0	0	0,016	0,33	0,002	0,1	0,001	0,1	0,018	0,78	0,001	0,03	8,03
Р-9	0-18	0,066	0,024	0,4	0,002	0,08	0,001	0,04	0,023	0,47	0,006	0,29	0,005	0,39	0,002	0,09	0,005	0,13	7,52
	18-39	0,305	0,041	0,68	0,007	0,24	0,049	1,38	0,116	2,41	0,002	0,1	0,005	0,39	0,091	3,94	0,002	0,04	7,8
Р-10	0-6	0,112	0,044	0,72	0,005	0,16	0,013	0,36	0,021	0,44	0,002	0,1	0,004	0,29	0,022	0,97	0,006	0,15	7,72
	6-29	0,954	0,029	0,48	0,002	0,08	0,194	5,46	0,405	8,45	0,016	0,78	0,004	0,29	0,305	13,27	0,001	0,03	7,64
	29-51	1,656	0,022	0,36	0	0	0,458	12,91	0,604	12,58	0,104	5,19	0,008	0,69	0,459	19,94	0,001	0,03	7,51
	51-59	2,055	0,02	0,32	0	0	0,4	11,28	0,96	20	0,245	12,25	0,017	1,37	0,413	17,94	0,001	0,03	7,42
Р-11	0-10	1,466	0,029	0,48	0,002	0,08	0,005	0,15	0,96	20	0,006	0,29	0,004	0,29	0,459	19,94	0,004	0,1	7,8
	10-26	0,131	0,037	0,6	0,005	0,16	0,004	0,11	0,053	1,1	0,004	0,2	0,004	0,29	0,029	1,28	0,001	0,03	8,03

ЗАКЛЮЧЕНИЕ

Данные показали, что в гранулометрическом составе главная роль принадлежит тонкопесчаной и крупнопылеватой фракциям. Характерны опесчаненность корки, наличие щебенки на поверхности и увеличение содержания илистой фракции. Это характерно для серо-бурых пустынных почв.

Содержание гумуса во всех разрезах по профилю почв колеблется от 0,1-1,2%. По существующим градациям содержания гумуса менее 2% относятся к очень низкогумусным.

Уровень содержание гидролизуемого азота от верхних к нижним горизонтам почв колеблется от 39,2 до 5,6 мг/кг, т.е. по принятым градациям в основном почвы по всем разрезам средне и низкообеспечены с уменьшением его содержания вниз по профилю. Высоким содержанием отличается почва разреза 2. Разрез - 2 заложен на террасе озеро Балхаш на высоте 336 м н.у.м. от Р-1 в восточном направлении, рядом заросли чингиля (*Halimodendron halodendron*). Чингиль серебристый – монотипный род растений семейства бобовые, листопадный солеустойчивый и засухоустойчивый колючий кустарник. Бобовые растения фиксирует атмосферный азот.

Уровень содержание подвижного фосфора по всему профилю в разрезах от верхнего горизонта к нижнему колеблется от низкого до очень низкого.

Результаты аналитических исследований показали, что уровень содержания подвижного калия (во всех разрезах) в верхних горизонтах очень высокий с уменьшением к нижнему горизонту почв.

Содержание CO_2 в почве колеблется от 0,16-6,43%. Высокое содержание его в почве (> 3 %) отрицательно действует на семена, угнетает развитие растений

Почвы объекта исследования по шкале относятся к слабокислым, слабощелочным и щелочным.

Почвенный поглотительный комплекс (ППК) насыщен катионами.

Почвы исследуемого объекта относятся к солонцам и серо-бурым солонцеватым почвам (Сн СБ^{сн}) по карте Казахского научно-исследовательского института почвоведения и агрохимии имени У.У.Успанова. Аналитические данные показывают, что с глубиной содержание водорастворимых солей увеличивается. Почвы объекта относятся к средне и сильно засоленным. Возможно, в связи с аридизацией климата, по сравнению с ранними исследованиями ученых Прибалхашья изменились климатические условия в сторону иссушения. Иссушение привело к засолению почв, т.е. легкорастворимые соли грунтовых вод в процессе испарения поднялись на поверхность почвы (присутствие белых пятен). Тип засоления по анионному составу хлоридно-сульфатное, по составу катионов натриево-кальциевый и натриевый. Почвы территории солонцы, серо-бурые солонцеватые и солончаковатые.

Территория бывшего РЛС «Дарьял-У» (Балхаш-9) расположена по природно-климатическим условиям в пустынной части Прибалхашья и подвергнута тотальному нарушению, что требует обязательного проведения горнотехнического этапа рекультивации (уборка, планировка, срезка, засыпка и т.д.)

Почвенно-экологические исследования объекта показали, что в связи с изменением климатических условий в сторону иссушения и засоления проведение биологического этапа рекультивации не имеет основания на затратные финансовые и трудовые ресурсы биологического этапа рекультивации. При исследовании были выявлены разнообразные пустынно-степные растения, древесно-кустарниковые породы, адаптированные и произрастающие в естественных экстремально - пустынных условиях.

Из вышеизложенного следует, что территорию бывшего РЛС «Дарьял-У» (Балхаш-9) после проведения горнотехнического этапа рекультивации следует оставить под естественное зарастание, так как были выявлены достаточные растительные ресурсы окружающих ненарушенных ландшафтов, которые со временем будут естественным путем осваивать данную территорию.

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ECONOMIC SCIENCES

ISSUES OF IMPROVING TERRITORIAL INVESTMENT ACTIVITIES

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Abstract
This article discusses and draws conclusion based on the research of the Investment Program, investment projects and their sources of financing in modern conditions, the features of the formation of financing sources.

Keywords: *investments, regional investments, investment projects, gross domestic product, territorial distribution of investments, investor, investment activity, investment financing, investment share, investment activity, investment attractiveness.*

Introduction

The level of complexity of socio-economic problems in the country depends on the level of the regions development. In sustainably developed regions, revenues to the local budget will be well formed, and local governments will be able to fully fulfill their responsibilities. This is not subject to the central state budget. If the level of development of the regions is low, they, on the contrary, will become a burden for the central state budget. In this regard, the implementation of investment projects in the regions will largely depend on the investment potential of the regions.[1] The investment potential of regions is determined by their investment attractiveness. There will be a decent inflow in investments if the investment attractiveness of the region is high.

Methods and materials

The article examines the scientific works of economists from Uzbekistan and abroad on investment activities, the formation of state investment policy, the implementation of investment projects, and the analysis of sources of financial support for investment relations. The methods of comparative literature analysis, logical and structural analysis, grouping and comparative comparison, economic and statistical analysis, and hypothesis substantiation were used as the research methodology.

Results

Although the Law of the Republic of Uzbekistan "On Investments and Investment Activities"[2] provides for investment incentives and financing of investments through the issuance of investment loans, this provision is not reflected in the tax legislation. Therefore, the increase in investment using this financial resource is limited.

However, the effectiveness of this practice is known from foreign experience. The growth of investment resources will have a positive impact on the increase in the production capacity of the regions and will positively solve the problem of employment.

This issue is one of the most pressing issues of strategic importance for the Republic of Uzbekistan, especially in the context of a transition economy. Because the results of our research show that according to the data of 2020, in the territorial structure of investments, they are unevenly distributed between the regions of the Republic of Uzbekistan and the Republic of Karakalpakstan (Table 1)[3].

Table 1

Regional investment analysis for 2015-2020 years
(in percentages)

Regions	2015	2016	2017	2018	2019	2020	The average amount over the years 2015 - 2020	Changes over the years 2015-2020 (+) and (-)
The Republic of Uzbekistan	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**
The Republic of Karakalpakstan	4,7	5,2	10,7	9,4	5,2	3,0	6,4	-1,7
Andijan	4,1	3,5	3,1	4,2	3,6	3,4	3,7	-0,7
Bukhara	8,2	8,4	12,4	8,9	19,5	13,1	11,8	+4,9
Jizzakh	2,4	2,4	1,8	2,2	1,8	2,4	2,2	+0,0

[1] "Strategy of actions on five priority directions of development of the Republic of Uzbekistan in 2017-2021, Decree of the President of the Republic of Uzbekistan № PF-4947 dated February 7, 2017. T: Collection of legislation of the Republic of Uzbekistan", February 13, 2017.

[2] The Law of the Republic of Uzbekistan "On Investments and Investment Activities" was adopted on December 25, 2019. http://www.lex.uz (system of normative legal acts).

[3] Data of the State Statistics Committee of the Republic of Uzbekistan (www.stat.uz).

Regions	2015	2016	2017	2018	2019	2020	The average amount over the years 2015 - 2020	Changes over the years 2015-2020 (+) and (-)
Kashkadarya	14,4	18,7	15,1	19,2	17,5	10,4	15,9	-4,0
Navoiy	7,2	8,8	7,7	5,4	4,7	10,5	7,4	+3,3
Namangan	3,4	3,5	4,0	3,5	3,8	3,6	3,6	+0,2
Samarkand	6,4	5,8	5,4	4,6	4,4	5,7	5,4	-0,7
Surkhandarya	5,4	5,2	5,3	4,3	4,1	3,8	4,7	-1,6
Sirdarya	1,7	2,0	1,6	1,5	1,7	2,2	1,8	+0,5
Tashkent Region	2,6	8,4	8,8	8,8	10,0	9,4	8,0	+6,8
Fergana	5,1	4,4	4,7	5,7	5,3	6,1	5,2	+1,0
Khorezm	2,7	2,8	2,5	2,0	1,7	2,5	2,4	-0,2
Tashkent City	23,4	20,8	15,6	19,9	16,0	23,1	19,8	-0,3
Undistributed funds	8,3	0,1	1,3	0,4	0,7	0,8	1,9	-7,5

The analysis of the dynamics of investment changes in the regions of the country shows that the regions with the largest investments are Tashkent (19.8%), Kashkadarya region (15.9%) and Bukhara region (11.8%). Based on the analysis of the table data, the following conclusions can be drawn:

Firstly, in the territorial distribution of investments in the country, there was no significant change in the share of investments attracted in regions other than Tashkent. Only in the Tashkent region, for example, in 2020, we will see a sharp increase in the share of investments compared to 2015.

Secondly, the fact that in a given year, the share of regions in investments directed at the national level decreases and increases, mainly due to the placement of large investment objects in a particular region that are of strategic importance in the future.

Thirdly, the attraction of foreign investment largely depends on the geographical location of administrative territories, the level of development of communication facilities, economic and productive potential, and social aspects.

The next, the attitude to attracting foreign investment to a particular region or the assessment of the microenvironment in the regions within the country also has a certain impact.

Finally, the level of skills of local leaders in the field of market relations, the ability to direct domestic resources into the flow of investment, attract foreign investors based on the characteristics of production in the administrative region, search for potential entrepreneurs and encourage them to attract directly related foreign investment.

The legal and political aspects of the investment climate do not play an important role in such an assessment. Because such relations are considered and resolved in a certain order at the national level. As a result of the study, it was concluded that the share of investments in the total volume of all types of investments in the country is divided into the following 4 groups, and it is necessary to assess the level of their investment activity[4].

Group 1 - more than 15.0% (area with high investment activity);

Group 2 - in the range of 10.1-15.0 percent (region with good investment activity);

Group 3 - in the range of 5.1 - 10.0 percent (area of satisfactory investment activity);

Group 4 - up to 5.0% (area of unsatisfactory investment activity).

Table 2

The amount of investments in fixed assets per capita in the Republic of Uzbekistan in 2015-2020, million soums.

Regions	2015	2016	2017	2018	2019	2020
Fixed capital investments	**44810**	**51232**	**72155**	**124231**	**195927**	**202000**
Population	31	31.5	32.5	32.7	33.4	34.6
Per capita	1445	1626	2220	3800	5870	5838

[4] Tuxliev B.K. Issues of improving the system of investments and their financing: Monograph. "Innovative development publishing house", -T., 2021. p 141.

If we place the territories of our country in terms of the level of investment activity in the above-mentioned range of groups, we will witness the following situation. That is, in this regard, it is worth to say separately that the assessment of the activity of investments by regions, taking into account not only their share in the total attracted investments, but also the number of enterprises established and operating in a particular region with the participation of foreign investment, as well as the impact of foreign investment, in our opinion, In this regard, it is worthwhile, first of all, to analyze the growth rate and dynamics of changes in foreign investments and loans by Regions (Table 3).

Analyzing the dynamics of changes in investments and loans in the regions of our country, we can include Tashkent (30.6% of the total volume of investments in 2015-2020), Bukhara region (21.3%) and Kashkadarya region (17.8%) among the regions that have mastered the most investments.

Hence, the evidence suggests that there is a proportional relationship between the share of regions in the total attracted investments and the number of enterprises operating with foreign investment. This level of dependence is influenced by factors related to the investment environment and attractiveness. Although the regulations on the regulation and promotion of investment activities in the country are the same for all regions, the investment attractiveness of the regions is different. Therefore, the factors that affect the attractiveness of investment, in our opinion, will be a subjective factor, that is, it depends on the managerial ability of the leaders of the region.

Table 3[5]

Dynamics of changes in foreign investments and credit resources by regions in 2015-2020, %

Regions	2015	2016	2017	2018	2019	2020	The average amount over the years 2015 - 2020
The Republic of Uzbekistan	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**
The Republic of Karakalpakstan	5,1	6,1	4,3	1,6	2,7	1,4	3,5
Andijan	3,7	2,5	1,5	3,4	0,3	1,7	2,2
Bukhara	4,1	3,8	30,7	11,7	46,9	30,8	21,3
Jizzakh	0,7	1,9	0,7	1,1	0,5	0,7	0,9
Kashkadarya	7,9	17,7	17,9	31,7	20,2	11,5	17,8
Navoiy	7,8	0,8	9,0	2,9	0,5	9,9	5,2
Namangan	1,9	1,7	1,0	2,6	0,5	0,8	1,4
Samarkand	5,2	4,0	2,0	2,2	1,3	0,9	2,6
Surkhandarya	1,6	1,7	2,4	5,0	1,5	1,4	2,3
Sirdarya	1,4	2,3	1,0	0,6	0,8	0,9	1,2
Tashkent Region	8,1	6,3	3,6	3,4	4,0	5,7	5,2
Fergana	2,4	3,1	2,5	4,9	3,3	3,5	3,3
Khorezm	1,4	4,6	1,7	0,8	0,3	0,9	1,6
Tashkent City	45,7	43,7	21,7	28,1	15,8	28,8	30,6
Undistributed funds	3,0	-	-	-	1,4	3,4	1,8

It is credible to argue that, in assessing the investment activity of the regions, it is expedient to assess not only their size, but also the amount of investment per capita, the level of employment, growth of export potential, the state of reinvestment. Because the amount of investment alone cannot fully represent the investment activity of the region.

Discussion

In the context of a pandemic, a sharp decline in production and consumption in large countries, disruption of global production chains and trade links, large-scale investment to revive the economy due to falling commodity prices in global financial markets lead to higher inflation and higher unemployment. This situation affects GDP, which can lead to a monthly decline in GDP of up to 2 percent.[6]

Indeed, the pandemic has had its consequences for the economy of Uzbekistan. Given the sharp decline in production and consumption in major economies, disruption of global production chains and trade relations, falling commodity prices in global financial markets, and deteriorating conditions, Uzbekistan's economy, which is part of the global economy, will be softened. . Anti-crisis Fund (10 trillion soums) was created to take effective preventive measures.[7]

Economic activity in developed countries is expected to decline by 7%, and in developing countries-by 3%. This year, production in the European region

[5] Data of the State Statistics Committee of the Republic of Uzbekistan (www.stat.uz).

[6] Chakraborty I., Maity P. COVID-19 outbreak: Migration, effects on society, global environment and prevention. International Journal Science of the Total Environment 728 (2020) 138882. www.elsevier.com/locate/scitotenv

[7] COVID-19 pandemic and the fight against the global economic crisis: Center for Development Strategy, www.strategy.uz

could fall by up to 10 percent, while countries such as the United States and Japan could lose up to 6.1 percent of their gross domestic product. The economy is expected to contract by an average of 4.7 percent in Eastern Europe and Central Asia and 6 percent in Russia.[8]

The United Nations Conference on Trade and Development (UNCTAD) predicts that the negative effects of the pandemic could lead to a 40 percent reduction in foreign direct investment worldwide by 2020-2021. This is the lowest figure in the last 20 years.[9]

Investment attractiveness depends on a system of criteria that attracts investors to direct their funds to this area. It can be observed in the economic literature that the groups of factors that affect the investment attractiveness of regions are different. For example, the factors influencing the investment activity of the regions were studied objectively and subjectively by V.M.Askinadzi and V.T.Maksimova[10], A.N.Asaula, N.I. Pasyad change rapidly and slowly, K.V. Baldin, on the other hand, has both positive and negative influences.

Porter rejects the conclusion that international trade and foreign investment have only a positive effect on the country's economy. He argues that international trade and foreign investment may have a negative impact on the economies of some countries, that is, they may hinder the growth of production efficiency.

Interpretation of results on investment activities of the regions in our country are regulated by the Law of the Republic of Uzbekistan "On Investments and Investment Activities". Local public authorities within their competence and in the field of state regulation of investments and investment activities:

- implementation of investment policy at the local level to stimulate the

expansion of investment in the relevant territory of the country, including attracting investment, further improving the investment climate in the region, supporting the development of enterprises in the region;

- study and identify promising projects that require investment, as well as

free state facilities and land plots, taking into account the needs and potential of the regions (resource, natural and climatic, labor, etc.);

- consideration of issues directly related to the activities of investors, as well

as, if necessary, proposals for the implementation of promising business initiatives and projects by attracting direct investment;

- identify factors that hinder the timely and effective implementation of

investment projects in the region, including investment projects with foreign investment, and take prompt measures to eliminate them;

- improving the efficiency of the use of investments in the region's economy

based on the analysis of the activities of enterprises with foreign investments, as well as the fulfillment of investment obligations by investors;

- development of proposals for the improvement and diversification of

investment cooperation with foreign banks, funds, agencies and companies in the region on a mutually beneficial basis;

- implement measures to attract foreign investment to create more favorable

conditions.

Conclusions and suggestions

As a result of the study, the following conclusions were made on the topic:

1. Socio-economic and natural factors affect the degree of investment in the regions and increase their efficiency. Particular importance is the identification of the most important factor groups that will contribute to the active attraction of foreign investment in the regions and increase their efficiency.

2. The assessment of the impact of foreign direct investment on the economy is not limited by macroeconomic indicators, but also values the impact of investment projects on the socio-economic development of regions, analyzes the activities of enterprises with foreign capital, develops, selects and implements investment projects, and should take into account the effectiveness of large-scale measures.

3. Calculations to identify the main factors that ensure the active attraction of foreign investment in the economy of Uzbekistan and increase the efficiency of their use show that the regions are expanding production infrastructure, developing transport and communications, improving the quality of education, and providing effective employment, bringing the quality of state institutions to a qualitatively new level, liberalizing foreign trade, curbing inflation and improving the tax system are the main factors that stimulate the attraction of foreign investment.

4. In order to actively attract foreign investment to our country and increase the efficiency of its use, it is important that each region uses its relative advantages, untapped potential, growth resources and potential. Because when placing production capacities, the relative advantages of the regions are taken into account, the availability of such factors as available resources, infrastructure, and labor, increase the efficiency of capital use and ultimately ensure the competitiveness of products.

5. Improving the quality of administrative processes, improving the regulatory framework and legislation, developing production infrastructure, including transport and communications, electricity, gas and water supply, labor force as a necessary condition for increasing the efficiency of foreign investment in the regions to increase the inflow of investment and organizing the rational use of labor resources.

[8] Eminov A. Pandemic and post-pandemic period: how is the investment policy in foreign countries? Employee of the Legal Policy Research Institute under the Ministry of Justice

[9] Nasirov E. I. The impact of the crisis caused by the coronavirus pandemic on the world economy. Electronic scientific journal "International Finance and Accounting". No. 3 June 2020. Page 7.

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10. Askinadzi V.M., Maksimova V.T. Investment business - 2012.

PHILOLOGICAL SCIENCES

THE POETIC WORLD OF BAUYRZHAN SHIRMEDENULY

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БАУЫРЖАН ШИРМЕДЕНҰЛЫНЫҢ АҚЫНДЫҚ ӘЛЕМІ

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Abstract
The works of the poet B. Shirmedenuly are distinguished by individual content, the strength of the artistic spirit. In his original works, the poet clearly shows a sense of Concern for the future of the nationthe future of the country, the future of generations, the qualities of patriotism, perseverance are clearly visible in the original works of the poet B.Shirmedenuly. Noble poems prevailing in the poetry of B.Shirmedenuly awakening the spirit of the nation, civic pathos glorifying freedom, courage and patriotism. The article discusses the work of poets, focuses on the purity of thought, the depth of emotions.

Аңдатпа
Ақын Б.Ширмеденұлы туындылары мазмұн даралығымен, көркемдік лебінің қуаттылығымен ерекшеленеді. Ақынның төл туындыларынан ұлт болашағына, ел ертеңіне, тірліктің сан алуан құбылыстарына, қоғам дертіне, ұрпақ келешегіне деген алаңдаушылық сезімі, ұлтжандылық, қайсарлық, табандылық қасиеттері анық байқалады. Б.Ширмеденұлы поэзиясында ұлт рухын оятатын асқақ жырлар, батырлықты дәріптейтін азаттықты, ерлікті, елдікті сипаттайтын азаматтық әуен басым. Мақалада ақын өлең-жырларының тақырып аясы, мазмұн ерекшеліктері, идеялық мақсаты айқындалады.

Keywords: *kazakh poetry, poetic skill, the mission of the poet, civil pathos, pictures of life*
Кілт сөздер: *қазақ поэзиясы, ақындық шеберлік, ақындық мұрат, азаматтық үн, өмір суреттері*

Қазақ әдебиеті тарихы өз бастауын XV-XVIII ғасырдағы жыраулар әдебиетінен бастау алып, XIX ғасырда Абай, Махамбет поэзияларымен жалғасын тапты. Қазақ поэзиясының ол кездегі басты тақырыптары халық мұңы, азаттық, оқу, білімге шақыру, туған жерін мадақтау болса, қазіргі тәуелсіздік жылдарындағы қазақ поэзиясы жаңа бағытта дамып келеді.

Тәуелсіздік кезеңіндегі ақындар қатарында өлкеміздің талантты, жас, ер жүрек ақындарының бірі – Бауыржан Ширмеденұлы. Бауыржан Ширмеденұлы 1992 жылы 30 шілдеде Сырым ауданы, Өлеңті ауылында дүниеге келген. Журналист, айтыскер ақын. Бауыржан 2016 жылы өткен «Мыңжылдықтар тоғысындағы Астана» атты көшпенділер өркениеті фестивалі аясындағы ақындар айтысының Бас жүлдегері. 2017 жылы Шымкентте өткен аймақтық айтыстың I орын иегері. 2018 жылы Атырау қаласында өткен Мұрат Мөңкеұлының 175 жылдығына арналған халықаралық ақындар айтысында арнайы жүлдеге ие болды. Халықаралық айтыс ақындары мен жыршы-термешілер Одағының мүшесі. Ақынның «Дәптер» атты алғашқы жыр жинағы 2018 жылы «Жазушы» баспасынан жарық көрді. Осы жылы Жайық айтысының 60 жылдығына орай мерекелік медальмен марапатталды.

Қазақ әдебиетіндегі жыраулар поэзиясын зерттеуші ғалым, Қазақстанның Халық жаушысы, классик Мұхтар Мағауин «Жан – Алланың аманаты, жазу – аруақтың аманаты. Алмаса – міндет артқаны, жазбасаң – қарызға батқаның» [1, 16 б.] деген сөзі Бауыржанның да өмірлік қағидасы іспеттес. Бауыржанда жазуды тоқтатқан емес.

Бауыржанның қысқа әрі нұсқа, тақырыптық тұрғыда жаңашыл, өр рухты жырлары бүгінгі жастарға тәрбиелік мәні зор. Жас ақынның «Қарындасқа» атты өлеңі қазақ қыздарына тәрбиелік бағытта жазылған туынды. Ақын қыздардың батысқа еліктеп, белін, санын, кеудесін ашып жүргеніне налиды. Алайда, бір байқағанымыз, ақын қыздарға шаштарында жауып, орамал тағып жүруге кеңес береді:

Қарындас, шашыңды да жасыр жауып,
Жасыр, саябырсиды сосын қауіп.
Ұятын, сыйын сақтап қалам десе,
Орамал сауғаласын басың барып [2].

Қазақ қыздары ешқашан да шаштарын жауып, орамал таққан емес. Бұл қазіргі таңдағы діни бағыттағы теріс пікір дер едік. Қазақ салт-дәстүрі, нанымы бойынша қыз баласы басына тақия киіп, қыздық дәуреннің белгісі ретінде әр түрлі моншақтармен безендіріп жүрген. Бұл жердегі ақынның қазақ қыздарына берген ескертпесі

орынсыз дер едік. Әрине, тақырыпқа барлау, идеяны беру басқа да, тақырыпты меңгеру бір басқа. Басты мәселе тәрбие құндылығына деген жаңаша көзқарас қалыптастыруында.

Жалпы, «Қарындасқа» өлеңі тәрбиелік мәні бар, қыз баласының бойындағы қасиеттерді насихаттау мақсатында жазылған.

Сонымен қатар, Бауыржан абстрактілі ұғымдар шебер, әдемі және әсерлі әрекетке енеді. Әсіресе дерексіз ұғымдарды бейнелеудегі ақынның әдістері оның өзіндік стилін анықтайды. «Қалаға хат» атты туындысында ақын «бақыт» ұғымын заттық, деректі кейіпте суреттейді:

Бақыт деген қалаға барған жоқ қой...

...Сен қалаға кеткенде, бақыт деген
Қасында қалған еді қарт анаңның!

Бақыт қалған ауылда, саман үйде,
Қалды ол сол әуелгі бала күйде.
Бақытыңды іздесең, ауылға кел,
Бақыт әлі ауылда бар, әрине! [3]

Ал, «Ала дорба» туындысында автор анасының ала дорбасы арқылы балалық шақтың тәтті сәттері мен бақытты күндерін есіне түсіреді. Ала дорбаны символдық белгі ретінде беріп, анасының отбасы үшін жасаған ерлігін айта келе, барлығын сол балалықтың бақытты сәттеріне телиді. Сонымен қоса, сол бір шақты сағыну, аңсауы байқалады.

Сөз қолданысында Бауыржан Ширмеденұлының сөз өзгертудегі шеберлігі ерекше. Ақын өлеңге халықтық тіркестерді еркін енгізе отырып, шынайы өмір бейнесін жеткізуде тартымды сөз табады. Ауыспалы ой, күрделі шендестіру, салыстыру, теңеулерді ақын өлеңдерінде ұтымды әрі еркін қолданады. Мәселен, «Өлеңті, арналады саған жырым!» атты туындысында автор Батыс Қазақстан өлкесі, Жымпиты ауданына қарасты Өлеңті жерінің табиғаты мен кең даласын Голивудтың, Париж, Ұлытаулармен салыстырады:

Өлеңті, сені ойлаймын үнемі мен,
Ауылсың тым ерекше түр өңімен.
Көшеңде алшаң басып келе жатам,
Жүргендей Голливудтың кілемімен.

Таңдапты Ұлытауды Асан қайғы,
Тау бірақ Өлеңтіден аса алмайды.
Даламның дархан төсін тау түгілі,
Бұлттың да көлеңкесі баса алмайды.

Өзенің толқынды еді керім асқақ,
Арнасы суалыпты кері бастап,
Көрдің бе, өзен екеш өзендер де,
Алысқа кете алмайды сені тастап.

Кешқұрым махаббаты мүлдем берік,
Қос ғашық көпіріңде тұр тербеліп.
Сезімнің бесігі сол көпір бар да,
Париждың құны бар ма бір теңгелік? [3]

Ақын өлеңдерінде қазақ өлеңінің дәстүрлі ерекшеліктері айқын көрінеді.

Шығармашыл адамының басты міндеті – қоғамдағы жаңашылдықты насихаттау, ізгілендіру. Жас ақын Бауыржанда қоғамдағы ахуалды жағдайды көтеріп, батыл, мысқылмен жазылған туындылары бар. Оған ақынның «Туған күнің құтты болсын, Нұр аға!» туындысын айта аламыз. Ақын Тұңғыш Президент Нұрсұлтан Әбішұлы Назарбаевтың туған күніне арнап шығарған туындысында халықтың ауыр дерт, бүкіл әлем зардап шеккен вирустың өршуінен орын алған жағдайларды көтереді.

Билік қалай ауырып жүр вируспен,
Маска киіп жүрген жоқ па бұрыннан? - деген жолдарда ақын мысқыл, сарказммен билік басындағы шенеуніктерді сынайды. Аурухана, емханалара орын жоқтығын айта келе, әр қазаққа қара жерден бір орын табылатынын тілге тиек етеді.

Нұр-Сұлтан жақ карантинмен араз, ә?
Мұндай күні шырқалатын ән – аза.
Елордада бүгін айқай туған күн,
Біздің жақта жаназа да жаназа! [4]

«Мұрат – жанумен белдесу, ұзынмен бойласу емес, өз жұртыңның қажетін өтеу, мүмкін болғанынша, ең соңғы сәтіңе дейін әуелгі құбыла бағдарыңнан тайқымау» [1, 13 б.] Бауыржанның да мақсат-мұраты халқына қызмет ету, халық мұңын, зарын жырлау.

2019 жылдың аяғы мен 2020 жылдың басында бүкіл дүниежүзін шарпыған ауыр дерт «коронавирустан» мыңдаған тағдыр үзілді. Бұл дерт ушығып тұрған уақытта көптеген ақын-жазушылар осы тақырыпта қалам ұштады. Бауыржанның да 2020 жылы «Доп» атты туындысы негізгі тақырыбы – осы дерт. Негізгі идеясы – адамдардың бір-бірін шынайы жақсы көруі, дүние, мүлік, атақ-даңқты емес, адамды сүю, шынайылық. «Доп» поэмасы вирустың негізі бастауы Ухань жеріндегі Тао және Чань есімді достардың науқастанып, Чаньды «Мен сені жақсы көремін» деген бір ауыз сөзімен аман алып қалған Тао тағдыры суреттеледі:

Мінбеден бір дәрігер көрінеді.
Жүзінен жап-жарық нұр төгіледі.
– Иә, иә, вирустың емін таптым!
О, әлем!
Жақсы көру – оның емі!

Сілтідей тынып қалды бүкіл ғалам...
Сатырлаған, дыбыс жоқ сықырлаған.
Тоқтады дүниенің дөңгелегі,
Тоқтады сағат тілі тықылдаған..

«Құлақ салсын дүние, ғалам маған!
Құлақ салсын уақыт пен заман маған!
Күллі адамзат – қылмыскер!
Қылмысы сол –
жақсы көрмей кетіпті адамды адам! [5]

Ақын ойы адамдардың бір-бірін тірісінде қадірін білмей, құрметтемеуін алға тартады. Осы уақытқа дейін адамзат ойы заттық тұрғыда бағаланып келсе, бұл дерт адамдар арасындағы қарым-қатынастың, материалдық құндылықтың

емес, моральдық құндылықтың маңызды екенін көрсетті.

Бауыржан сол кездің ауыр шындығы, әлемде қанша ғалым мен ғылым бар болса да, дамуы артта қалғанын көрсетеді. «Доп» поэмасының алғы сөзінде ақын Светқали Нұржан ақынға мынандай баға береді: «Мен Бауыржан Ширмеденді ең әуелі айтыс ақыны ретінде таныдым. Басына тұмақ, үстіне ішік киіп еңгезердей болып сахнаға шыға келгенде ізінен Шалкиіздің шаңы ілесіп келе жатқандай шалықтап-ақ қаласың. Ал орынтаққа жайғаса салып, көнеліктермен кестелеп, дырау-сарынмен дестелеп жыр төккенде құлағыңа Доспамбеттің дабылы естілгендей аруақтанып сала бересің...» [5]. Қазақ әдебиетінің бастауы жыраулардың ұрпағы Бауыржан Ширмеден жырлары тақырыбы, идеясы жағынан оқырманға үлкен ой салатын, ұлт мұраты жолында қызмет етеді.

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POLITICAL SCIENCES

THEORETICAL BASIS FOR THE STUDY OF EUROPEAN INTEGRATION

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Abstract

The assessments of the survival and development of the European Union are deprived of a seriously reliable theoretical and methodological approach. The complex system approach, which treats the European Union as an open social system, facilitates the analysis of such a complex subject and allows the formulation of research questions on the causes and mechanisms for the emergence of European Union, its equilibrium and its interaction with the environment. The proposed integrated approach includes Open Systems Theory, Functional Systems Theory, Cybernetics and Synergy. The research questions formulated through this approach allow to analyse the behaviour of the EU independently of the political conjuncture.

Keywords: *European Union, integrated system approach, research questions*

JEL *B10*

Introduction

The European Union, of which Bulgaria is a member, has experienced several crises since 2008, which raise the question of its survival and further development. For Bulgaria, the results of membership in the Union are ambiguous, the question of its meaning is yet to be asked. An attempt should be made to understand in depth the logic of the EU's existence and development with a view "from the outside" and "from the inside", so as to be able to make sense of the possible scenarios for its development.Since 2010 there are numerous predictions of the break-up of the euro area, and, prospectively, of the entire Union. Such opinions are being circulated without clarity on the internal mechanisms that determine one process or another. Conspiracy theories and/or political bias contribute to the confusion. However, the lack of theoretical clarity about the nature of integration as a process, which has accompanied it from its inception, is a primary concern. 'Theories' such as 'federalism' or '(neo) functionalism' attributed to the origins of the integration community reflect rather wishful thinking and subservience to conjuncture - economic and political. At best, they represent a summary of a small body of experience, without offering a reliable method for credible predictions.

The difficulty stems from the lack of a reliable theoretical and methodological approach to such a large and complex object of study as the European Union. In the present work an attempt is made to apply the sufficiently popular systemic approach, which implies considering the European Union as an independent open system consisting of subsystems with a greater degree of autonomy, at the same time being a subsystem in the general system of international relations. European integration is seen as a process of forming an open system. Within the framework of the systemic approach or as its complement, the possibilities offered by related sciences - cybernetics, synergetics - are used.

The idea that each object of knowledge can be approached as a whole, composed of separate elements that together create a new quality other than the simple sum of their qualities - is one of the most fruitful methodological concepts. It finds application in all fields of science, technology and social life. Systems research arose in response to science's attempts to find a general theory with universal applicability to large, complexly-organized objects such as social entities. If attempts to find a universal theory are considered unsuccessful, the application of a complex systems approach to such a complex object as the EU allows the formulation of research questions whose answers do not depend on the political conjuncture.

1. Holistic approach

The systemic approach is an extension of a philosophical movement that has its origins in classical Greek philosophy, so-called "holism". In a broad sense, this branch of science is concerned with the problem of relating the part to the whole, the qualitative uniqueness and priority of the whole in relation to its parts. (Nikiforov, A., 2010) In a narrower sense, holism is understood as a "philosophy of wholeness" developed by the South African philosopher and politician Ian Smuts, who also introduced the term itself into use (Smuts, J., 1926), building on Aristotle's claim that "*the whole is greater than the sum of its parts*" ("Metaphysics").

The statement in question is the main ontological principle of holism. On this view, the whole world is a whole, and the distinct phenomena and objects within it have meaning only as part of a community. In gnoseology holism rests on the principle that knowledge of the whole must precede knowledge of its parts. (In this case, however, it is not certain that such an approach yields the best results. Without prior study of the constituent parts of the EU, it will be difficult to grasp the logic of integration: what goals each participant sets for itself through it, what price it is willing to pay for giving up sovereignty, how the goals and costs of integration change over time.)

From the holistic concept comes the systems theory with the key concept "system", as well as the often used concept "synergy" and the whole scientific field "synergetics", a derivative of the systems approach, with the leading idea of the emergence in the system of

a new quality, different from the sum of the qualities of the elements of the system.

2. Open systems theory

The term "system" appeared only in the 19th century, introduced into the natural sciences by Sadi Carnot, the creator of thermodynamics. The concept was applied to mechanical devices (steam engines), but quickly gained universal application, including in the social sciences. It became a generalization of the holistic approach. In 1850 Rudolf Clausius completed this process by adding "the medium" as a key element in the notion of the system. (Clausius' other contribution, directly related to today's attempts to apply the systems approach, is the introduction of the concept of "entropy". Clausius used it to denote the irreversible dissipation of energy and the increase of disorder in thermodynamic systems, a principle also applicable to social systems.) In the second half of the 19th c. Karl Marx, e.g., already freely used the term "system" in his study of the economized model of society. (Kuzmin, V.P., 1983) Sociology since its inception has also used "systems language".

In the 20th century there were attempts to place the concept of "system" at the basis of a general approach explaining the functioning of all observable objects. The first version of General Systems Theory to be generally recognized and accepted by researchers was that of L. von Bertalanffy, proposed in the 1930s, developing the concept of holism. Its basic idea in recognized the isomorphism of the laws governing systems - physical, biological and social. Interest in the theory remains high in the field of management, including in the study of integration problems. This theory is a logico-mathematical field of research, the task of which is the formulation and derivation of general principles applicable to "systems" in general. Bertalanffy's approach examines objects at three levels - elements, system, and metasystem, i.e., each system consists of elements, which are themselves systems, while being part of a higher order system. (By this logic, the lower limit must be set by the indivisible elementary particles, and the upper limit by the Universe in its totality.) The primary in the system is the whole, composed of elements "*in definite relations with each other and with the environment.*" (Bertalanffy L., 1968) Bertalanffy developed his theory through observation of living organisms, which he defined as "open" to the "external environment" systems: their life processes presuppose the presence of an exchange of matter and energy (information) with the environment, the exchange being governed by system characteristics. In this way, organisms acquire additional energy (and building material), which makes it possible to overcome entropy, and also ensures the resilience of the system in relation to the environment. Open systems adapt to changes in the environment and continue to function in mobile equilibrium, striving for a state independent of time and initial conditions, but only of system parameters. In dynamic equilibrium, the system structure (the elements, the relationships between them and the laws governing their interaction) remains constant, and equilibrium is constantly disturbed and restored by the exchange of matter and/or energy. Entropy is contained by the control of this exchange. In this logic, "closed" systems can be seen as an external case in which exchange is zero. They reach static equilibrium through a limiting degree of isolation from the environment.

A viable system is one that can neutralize the unwanted inflow of information, and in the boundary (purely abstract) model of a closed system, there is simply no such inflow. "*Central to dynamic (systems) theory is the concept of stability, i.e. the response of the system to deformation*".(Bertalanffy L., 1968) Stability, i.e., the ability of a system to maintain equilibrium by neutralizing adverse external influences, is a feature, typical for all systems.

An important research question arises in this case. With minimal exchange of matter/energy (information), control is easier. Do open systems then tend towards boundary compaction and (self-)closure? Does this logic apply to Ancient Egypt, to Rome and Medieval China in their "natural boundaries", to the USA in their isolationist period? Is the EU trying to specify its "natural" borders, e.g. in Turkey and Ukraine? Perhaps the answer lies in the dynamic of the environment. A fluid and unpredictable environment implies more of a 'closure', as the flow of matter/energy can be difficult to manage, e.g. the inflow of 'refugees'. The laws of thermodynamics are also valid here - increasing the volume reduces the relative surface area (the boundary), control over the exchange becomes easier, and the relative energy consumption decreases.

Bertalanffy tries to build a general theory applicable to all objects of study, with general laws allowing mathematical modelling. Critics have faulted him that his definition of a system as a complex of interacting elements excludes immaterial systems because of the requirement of "interaction". It limits the degree of generalization. Also, the initial conceptual and logical apparatus in L. von Bertalanffy's version is too general (Kolev, T., 1987) and key concepts are yet to be clarified: environment, interaction, etc. environment, interaction, etc.

In the case of the EU as a complex human community, the irrational quantities in human behaviour cannot be measured and put into equations. (Norbert Wiener, whom Bertalanffy himself considers a like-minded person, emphasises these limitations in attempting to apply mathematical methods to social systems.) The complexity of social systems requires a combination of qualitative and quantitative description and analysis that is in fact difficult to achieve. One of the leading systems theorists, Vadim Sadovsky, expresses the difficulties of constructing a general concept of system in a general applicable theory: "*... great doubts arise as to the possibility of constructing a single universal definition of the concept of 'system', and such that formalized sign systems, living organisms, and management systems, as well as various economic systems, science as a system, the diversity of biological systems at various levels, social systems etc.*" (Sadovskij, V., 1974)

In the case of the EU, unification can hardly be presented as a mathematical model, at least because of the obstacles in collecting reliable empirical data and

deriving the appropriate equations. Sadowski categorises the concepts that make it possible to study social systems by applying a systems approach:

- Group A, internal structure of the system: element, link, link channel, interaction, whole, subsystem, organization, structure, leading part of the system, decision-making subsystem, hierarchical structure, etc.

- Group B, system-specific properties: isolation, interaction, integration (process of creating an open social system), ..., (de)centralisation, ...,system state, system integrity, stability, perception retention and processing of information, feedback, equilibrium, rolling equilibrium, ..., (self-)management, ..., etc.

- Group B: environment, system state, behaviour, function and functioning, change, adaptation, homeostasis (equilibrium state), growth, development, equifinality, etc. (Kolev, T., 2009)

Sadowski arranges and conducts a close examination of multiple definitions of "system" into three groups:

- Group I: definitions treating "system" as a class of mathematical models;

- Group II: definitions constructed on the basis of the concepts of "element", "relation", "relationship", "whole" with a more pronounced methodological orientation;

- Group III: definitions that include the concepts of "input", "output", "information processing", "feedback", "control", etc., which represent more specialized notions of a system and cybernetic systems in particular.

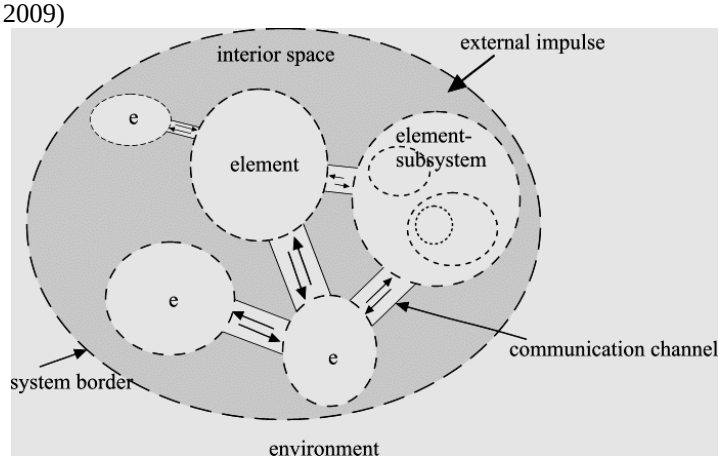

Fig. 1: Schematic representation of the system
Source: own development
(The link with Norbert Wiener's "Cybernetics" is clarified below.)

3. Functional Systems Theory

Pyotr Anokhin also developed his theory of functional systems in the 1930s as a development and continuation of Ivan Pavlov's research on higher nervous activity. Anokhin investigated the center-periphery relationship in the nervous system and his theory also aimed at universal application. The main question Anokhin poses is whether the interaction between elements, taken by itself, can create a system. After an analysis of the processes in the nervous system (the brain) the conclusion is that interaction is a necessary but insufficient condition for the formation of a system. (Kolev, T., 2009) For this purpose, factors are also needed which govern the interaction and unite the set of elements. One of the paradoxical conclusions is that the system-forming factor is precisely the end result of the system's construction. i.e., its preset desired end state. Integration (understood as the formation of a system) can be unlocked by setting some ultimate (mentally achievable) goal. The problem comes down to having a model to follow. The wish has been expressed by various political figures (including W. Churchill) to build (something like) "United States of Europe" following the obvious example of the USA. The Roman Empire, which is an essential part of (Western) European political mythology, is also cited as a relevant example.

According to Anokhin, the outcome of a system's activity is a system-forming factor isomorphic to different classes of systems, and the systems approach should seek to answer the following questions:

1. What outcome should be obtained?
2. When should the result be obtained?
3. By what mechanisms should the result be obtained?
4. How is the sufficiency of the result assessed?

"*We can call a system only such a complex of selectively involved components in which the interaction and interrelationship acquire the character of interaction of the components to produce a focused useful result.*"(Kolev, T., 2009) The outcome that results from the existence and functioning of a system can be its system-forming factor, given that every system is made up of elements that in turn can be viewed as systems, and the output system can be represented as an element within a higher-order system, a metasystem. In this sense, what results from the existence and functioning of the system within the metasystem can be seen as a necessity, necessitating the emergence of an object with certain properties. E.g. the sense organ in a living organism, being a system in itself, is built up to become part of the metasystem, acquiring the particular properties it requires.

For the first time Anokhin raises the question of the system-forming factor with a search for its "isomorphism" for different types of systems. According to his elaboration, the systems approach manifests itself in the search and formulation of the factor in question. For the purposes of the EU analysis, we seek the answer to the questions:

1. How and why does the EU emerge?
2. What does the desired end result look like that unleashes the development of the union - bringing its elements together, managing the interaction between them and turning them into a system?

Theorists of European integration work with the notion (albeit sometimes vaguely formulated) of a desired end-state, and also with the belief that in the course of integration the EU's subsystems will change, will acquire the functions required by the end-state, and new subsystems will emerge possessing these functions. These perceptions find expression in the Union's continuously complex governance scheme.

Anokhin's "Principle of the Functional System" views it as the unification of the individual mechanisms of the organism into an overall "integrative unit", by means of an adaptive behaviour to the pattern. Anokhin considers two types of functional systems:

- The first achieve equilibrium only at the expense of internal resources (of the organism), and do not seek such in the environment. These are self-sufficient and tend towards the closed systems considered by Bertalanffy - with minimal/zero interaction with the environment. In other words, the outward behavior of such systems boils down to "reaction ...to deformation" (see above) Perhaps such systems only reflect external influences? Is this logical construct confirmed by the behaviour of (self-)isolated communities - e.g. the USA and Albania in certain historical periods? The research question is: is it logical for the EU to strive for self-sufficiency (self-isolation)?

- The latter achieve equilibrium through flexible behaviour in interacting with the environment and optimising exchanges with it. Here again the question arises of the role of the external environment and its specific definition. The question is, does the EU manage its exchanges with the environment optimally?

4. Cybernetics

The theory of open systems with its refinements, as well as the theory of functional systems, have many points of contact with cybernetics, a science with roots in ancient Greece. Norbert Wiener studied the general regularities of control and information transfer processes in different systems - machines, living organisms or social entities. There is a view that systems theory is simply the mathematical equivalent of cybernetics. The main difference between the two theories lies in the emphasis they place: while Bertalanffy stresses the special importance of the exchange between system and environment, Wiener emphasizes the intra-system connections and views the functioning of the system simply as a response to external influences. The combination of the two approaches provides a good basis for the study of EU integration processes: on the one hand, it allows to examine internal development impulses, internal potential, including internal constraints, and on the other hand, external impulses (favourable or not) and external constraints. Ignoring internal or external factors increases the risk of incorrect conclusions and explanations about the causes of integration processes, and implies inaccurate predictions about their further course.

The main task facing management is the survival of the system. Cybernetics studies the stability of material systems, their remaining in equilibrium. The striving of cybernetic systems for equilibrium is their basic internal law - in biologically appropriate behavior in animals, in conscious and socially appropriate behavior in humans, or in the EIM program. Key to cybernetics is the notion of "feedback" introduced by Anokhin: along the "sensor-control centre-executive" chain. The processing and transmission of information, as well as the reaction in response to external influences, have a direct bearing on equilibrium management. After the 2008 economic crisis, the EU is seeking to regain its internal equilibrium point, so it is particularly important to examine the mechanisms that ensure the Union's equilibrium, as well as the impulses, both external and internal, that disturb it.

Wiener gives the example of bees in a hive acting in concert, even though the nervous systems of individual bees are not directly connected to each other. "*The secret lies in the mutual communication between the members of the hive*"(Wiener, N., 1961), i.e. in the exchange of information between them. The fact that communication/information exchange is key to community building calls for an in-depth study of the specificities of this exchange within the EU. Again using the example of social insects, Wiener points out that the value of information coming from the stimulus depends not only on its nature, but also on the whole neural construction of the transmitter and receiver, i.e. the communication network.(Wiener, N., 1961) Communication requires both parties to be 'tuned to the same frequency'. The answer to the question of how the receiver understands the message depends on his senses, powers of interpretation, etc. Communication in social systems is in "symbolic language" (conditional information) and the question of the content of symbols and its uniform interpretation is raised. At the heart of the EU's 'symbolic language' are 'European values. Their content and interpretation should be studied among the different communities in the union, which may give them different meanings. The question could be asked how comprehensible the so-called 'Brussels language' is to citizens.

The distortion of information in its dissemination among a multitude can make coherent behaviour and community building impossible. In fact, the question of comparison between the individual organism and the community of organisms should not be posed in the above way - one of the principles is that the subsystem always has a higher degree of internal integrity/cohesion than the system, which in turn is more homogeneous than the metasystem. The proof is in each link of the "elementary particle - atom - molecule - cell - organism - community" chain. In the study of the EU, the extent to which the tendency to abolish the nation-state as a level of governance by devolving powers 'upwards'

(to supranational governing bodies) and 'downwards' (to districts and municipalities) is consistent with systemic logic is crucial.

Here the overlap between cybernetics and systems theory is complete and the concept of "system" is fully applicable to the study of management processes. In these, the basic outcome in the process of system formation is clearly observed. Governance is the transition of the governed system from one state to another by purposeful influence from the governing centre. (Incidentally, it can also be assumed that governance may have the purpose of keeping the governed system in the same state by purposeful influence. This goal is possible given that the system has reached an equilibrium state.) Optimal control implies the satisfaction of some criterion - for example, expenditure of time, labor, substance, or energy. When studying a complex dynamic system such as the EU, it is possible to select such quantifiable criteria - budget, turnover, unemployment, etc., which facilitates the research task.

One of Wiener's most important insights, is the assertion that *"...society extends only as far as the actual transmission of information extends.*"(Wiener, N., 1961) i.e., without distortion and loss of utility, without becoming "noise."

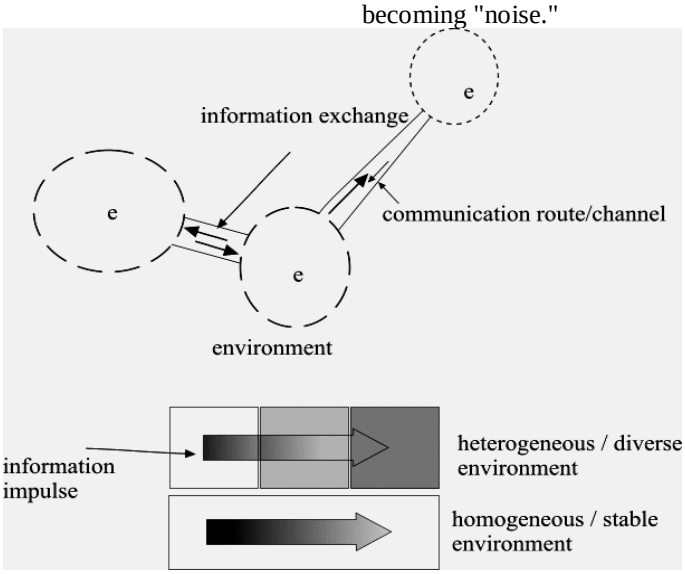

Fig. 2: Information losses when extending and narrowing communication paths
Source: own development

The question of the EU's natural borders is particularly acute in relation to the latest rounds of enlargement: how many and what other countries can be effectively governed from the centre? Is the Union still effectively governed in its present form? To what extent can the explanation for Britain's departure be sought in the inability of that country to be effectively governed by 'Brussels' as the 'quasi-imperial' centre of the union?

Here Wiener provides some methodology for determining the optimal size of a community by comparing the number of decisions coming into it from outside with the number of decisions made inside it. According to him, the measure of the effective size of a group is the size that it must possess to reach a certain degree of autonomy. (Wiener, N., 1961) Information has another feature: its value is determined not only by its quantity but also by the properties of the receiver, e.g., own information stock, ways of interaction with the environment, perceptibility, interests, etc. As Bushev emphasizes, value possesses this information "... *that serves to achieve a particular purpose*." (Bushev, M., 1992) If the information is irrelevant to the system's goals, it remains without consequence. Again, we return to the law that the system cannot be operated with external programs. Management information can be characterized as such a program; it is internal to the system and external to its elements.

The question comes down to measuring the number of decisions coming from outside. Is there, e.g. in foreign trade, a limit to self-sufficiency/independence and what determines it? (Before leaving the EU, Great Britain was the only country in the union whose share in its foreign trade was under 50%.) How to ascertain the number of decisions mentioned, especially if some of them (political) remain hidden to the researcher? In this case, as Wiener himself admits, mathematical methods are insufficient and one must also work through historical review and analogies:"...*whether our social science research be statistical or dynamic...it can only be accurate to a few decimal places and will ultimately never provide us with the kind of verifiable, meaningful information that would be comparable to what we have come to expect in the natural sciences.*" (Wiener, N.,1961)

As an example of a high degree of stability and equilibrium, Wiener cites the small rural community in which, over time, "*uniform levels of understanding and behavior, ...respectable norms*," and "*ubiquitous public opinion"* are established.(Wiener, N.,1961) The explanation obviously lies in the effective dissemination of information-formal ties are complemented by strong informal ties, each member of the small community knows everyone and communicates with them directly. Therefore, "*small, cohesive communities have a high degree of homeostasis...*"(Wiener, N., 1961) This explains why e.g. Switzerland is a country with a sustainable direct democracy. Relationships between community members are close and strong, information moves

quickly and without distortions along short communication paths. The small community avoids one of the main dangers to equilibrium, namely the information network (mass media) falling into the hands of "*a very limited number of rich people... interested in the power and money game... which... is one of the main anti-homeostatic factors in society.*"(Wiener, N., 1961) (These observations apply to democratic societies where mass media are also subject to the usual market principles. In outright dictatorships the mass media are in a different mode, but this is not, or rather should not be, the case in EU countries. The presence or absence of censorship in the EU should be considered separately.)

Related to this is another important manifestation of systems thinking in cybernetics - the set may have more or less information than its members. The former case is a fundamental characteristic of human community. Obviously, its formation goes with the accumulation of a common, superior stock of information - in other words, a whole quality greater than the sum of its parts is formed. The question arises as to whether the process is reversible; whether access to the common information may be hindered and/or constricted. When the rule that common information exceeds the information of individual groups or individuals is violated, the community breaks down to lower levels of organization. According to Wiener, *"...large communities subjected to (the above-described) disruptive influence have much less publicly available information than small communities..."*(Wiener, N., 1961) In his view, the state is "dumber" than most of its citizens, and it is not true that the larger organization is "smarter" than the individual. (The sanity of officials in Brussels has long been questioned over some controversial directives, and this is confirmation of the validity of those doubts.)

Again comes the question of how big an effectively managed and balanced European Union can/should be. The existence of cultural "ghettos" (i.e. communities excluded from the general exchange of information) is a sign of the disintegration of a community and this is the case with the EU. However, the question arises, how can the ratio between common and private information in the EU be measured? Is the level of citizens' awareness of the Lisbon Treaty a sufficient indicator?

The question of the effective amount of public information is directly linked to the economic basis of the EU and its ideological justification. As Wiener notes, even by the mid-20th century the basis of the market economy was not sustainable ('homeostatic'). "*In many countries, the view, recognized in the United States as official dogma, is widespread that free competition is itself a homeostatic process, i.e. that in a free market the selfishness of traders... will promote the common good... Unfortunately, the facts speak against this simple-minded theory.*" (Wiener, N., 1961)

Wiener likens the free market to the Monopoly game, subject to the general game theory developed by von Neumann and Morgenstern. Even under the assumption that each player follows a perfectly reasonable strategy based on the information available to him, the game is complex and unpredictable, and with multiple players the outcome is most often highly uncertain and unsustainable. *"Greed-driven coalitions" are temporary and typically "end in ... deceit, betrayal and fraud. This is an accurate picture of high business life and the closely related political, diplomatic and military life."* (Wiener, N., 1961) It is also one of the most accurate explanations for the constant drive to establish a monopoly in all areas - indeed an attempt to reduce unpredictability and instability. Even if an agreement is reached between the players, however, *"...the prize remains with the one who, choosing the opportune moment, breaks the agreement and betrays his partners."* (Wiener, N., 1961) Herein lies the explanation for the periodic economic crises under capitalism and essentially a critique of the market model - from a man who has never been accused of holding left-wing (in the classical sense) views.

However, these considerations call into question the very basis of the EU's existence - after 1986 this basis is the Union's Internal Market, built on the (neo-)liberal principles of free trade and free competition. In this case, it is necessary to measure how much of Community law relates to the Internal Market. The main issues discussed in the Union's official documents always, especially after the mid-1980s, concern economic growth, financial discipline, free trade, unemployment - all manifestations or consequences of the free market. The EU's equilibrium, according to the official formulations, depends on free competition, which is a higher principle. But free competition implies a permanent distortion of equilibrium. What are the EU's mechanisms for restoring it? Can the Union's common policies be seen as 'compensatory links'?

5. Synergetics

Synergetics is the study of the relationship between structural elements (subsystems) that are formed in open systems due to an intense exchange of matter and energy with the surrounding environment under non-equilibrium conditions. In 1977, the physicist Hermann Hacken used the term with the following contemporary definition of it: "*A discipline that studies the joint action of multiple subsystems, resulting at the macroscopic level in structure and corresponding functioning. In such systems, there is a concerted behavior of the subsystems, resulting in an increasing degree of orderliness, i.e., decreasing entropy.*" (Haken, H., 1982) (In other words, the development of an open system does not follow the second law of thermodynamics - it is viable as long as it manages to maintain entropy through exchange with the environment.)

In fact, synergetics is a further development of the systems approach into a dynamic model, applying key concepts from thermodynamics and cybernetics such as entropy, disequilibrium, information, and feedback. The discipline emphasizes self-organization, the mechanism of emergence of complex systems and of transition to new, more complex systems at a higher level. It is about so-called "evolving systems". Like systems theory and cybernetics, synergetics seeks a universal law that explains processes in both living and non-living nature, in this case self-organization. By self-organization, synergetics means the spontaneous transition

from less complex and more chaotic forms of organization to more complex and more ordered ones. The principle is that processes of increasing complexity and order have a single algorithm, regardless of the nature of the systems in which they take place. These processes depend on the exchange of matter and/or energy with the environment in a state of thermodynamic equilibrium. (Here the contribution of Ilya Prigozhin, who described the so-called "dissipative systems" and the way they dissipate and absorb the incoming energy from outside, is great.) Synergetics states that the evolution of non-equilibrium open systems towards increasing complexity and orderliness proceeds through two phases:

- smooth evolutionary development, until the point at which the external impact, or the accumulated internal potential (or both together) reach critical values and bring the system to an unsustainable critical state;

- an abrupt transition to a new steady state of greater complexity and order (structural change), with a qualitative change in the properties of the system, the so-called bifurcation. In bifurcation, random factors play a major role in the further development.

Applied to the EU, synergetics can answer the following questions: What triggers the self-organisation of the union - external and/or internal impulse? If it is an external impulse, does this impulse continue to operate, or has the EU become a self-contained system resistant to external influences after the initial impetus? Conversely, is the Union currently close to an unsustainable critical state, a bifurcation, and how to assess this?

The bifurcation unlocks a movement towards one of a number of possible, new steady states - so-called "attractor pools". Random factors determine exactly which qualitatively new steady state the system will move into. According to synergetics, development is in principle unpredictable - because of the role of chance, it is impossible to determine its direction unambiguously. On this line of reasoning, the future of the EU (if it is close to or already in bifurcation) should remain unclear. Obviously, using this approach alone there is no way to make a qualitative prediction about the future state of the Union. In this case, the method of historical analogies with unions that show similar systemic characteristics in similar conditions should be added. Again, it is important to take into account functional systems theory, according to which the final state is a system-forming factor. The pre-specified notion of federation is only one of many possible end states. The question is how to induce movement in the direction of the desired state if all random factors cannot be anticipated and controlled? If this is impossible in principle, then attempts at 'social engineering' (Johnson, P., 1993) are doomed and integration (if by this we mean the formation of a complex social system) cannot be a politically managed process by conscious means.

According to synergetics, randomness, irreversibility and unsustainability appear as the main source of development. In self-organization, the new order towards a more complex system emerges through the random deviations in the state and behavior of its elements. Such fluctuations in equilibrium systems are counteracted by negative feedback ('compensating linkages'), ensuring that the structure of the system is maintained in an equilibrium state. In complex open systems, the inflow of external energy reinforces the disequilibrium, the deviations increase and accumulate. At some point, the compensating linkages cannot maintain order and the system either degrades or a new, higher order emerges. Close to the equilibrium point and with a weak inflow of external energy, the compensatory bonds bring the system to full equilibrium. The capacity for change decreases.

Again, the question arises, is this the preferred state of a system, is this not the ultimate goal of development? Every system has its life cycle: growth - culmination (equilibrium) - decline. Obviously we can refer self-organization to the first phase in the life cycle. Hence one of the main questions: which life cycle is the EU in? How far from the equilibrium point is the EU? Is the quest for trade self-containment/self-sufficiency an expression of a quest for equilibrium?

In highly non-equilibrium states, systems become sensitive to external influences. In this case, self-organization is a process in which global external impulses stimulate the emergence of new structures within the system.

A key question is whether the integration process is primarily the result of an initial external impulse. In this case, such an impulse can be found, for example, in the US's targeted policy of supporting Europe's post-war reconstruction (the Marshall Plan) and the trade closure of Eastern Europe within the framework of the Commonwealth of Independent States.

In non-equilibrium conditions, the relative independence of the elements in the system gives way to cooperation: close to the equilibrium point, an element interacts only with its neighbours; far from the equilibrium point, its behaviour is that of a 'system' element, and coherence in the behaviour of the elements increases. It is common knowledge from empirical observations of human communities that external pressure coheres, becomes an integrating factor. (Toynbee, A., 1954) It may be that by virtue of this logic the EU is now looking for such an external 'integrating' factor. Importantly, in this case, there is a way to check to what extent EU elements behave as 'systemic', e.g. by checking the economic exchange between member states: to what extent, e.g., is the movement of economic factors mainly between neighbours?

Self-organization can only take place in sufficiently complex systems, with a critical mass of interacting elements bound by so-called necessary bonds (without which the elements are non-viable). Simpler systems are not capable of spontaneous adaptation to the environment, much less development. When they receive an excessive amount of energy from outside they lose their structure and irreversibly break down. The EU is a complex system, but how complex? How much external energy can it bear? On a practical level, the question remains, e.g. how much uncontrolled immigration can destroy the structure of the Union?

Self-organization occurs only if the positive feedbacks outweigh the negative ones. In dynamically stable, adaptive systems (in a state of homeostasis), incoming external signals have the effect of permanently

returning the system to the initial state through compensatory connections. In a self-organizing, evolving system, externally induced influences accumulate and amplify due to the overall positive reactivity of the system. This leads to the emergence of a new order and new structures, as in the formation of new social formations. The question to be followed here is to what extent is the EU the result of a phase transition and is it currently entering a new one?

Conclusion

The combination of the above theories and approaches can ultimately provide the necessary theoretical basis for the study of the European Union, allowing the formulation of three groups of research questions, including those with a practical focus. The answers to these questions can explain the nature of the union, illuminate the internal mechanisms of its functioning and allow a short-term forecast of its development:

1. Questions focusing on the causes and mechanisms of the emergence of European integration:

- How and why did the EU emerge? What does the desired end result look like that triggers the development of the union and turns it into a functional system?

- What triggers the self-organisation of the union - external and/or internal impulse? If it is an external impulse, does this impulse continue to operate, or has the EU, after the initial impetus, become a self-contained system resistant to external influences? (Is it possible that the desired end result is "external"?)

2. Questions focused on the internal state of the union:

- How can one measure the ratio between common and private information in the EU and hence the degree of integration?

- How close to the equilibrium point is the EU and how strong are its compensatory links?

- To what extent is the EU the result of a phase transition?

- Which life cycle is the EU in? Is it currently close to an unsustainable critical state, a bifurcation, and how to assess this? Is it currently entering a new phase transition?

- Is the drive towards trade self-containment/self-sufficiency an expression of a search for equilibrium?

3. Questions focusing on the EU's interaction with its environment:

- Do open systems lean towards (only) closing and sealing borders, as control is easier with minimal exchange of matter/energy (information)?

- If equilibrium systems only seek to reflect external influences, is it logical for the EU to strive for self-sufficiency (self-isolation) and is there a limit to self-sufficiency/independence?

- How optimally does the EU manage its exchanges with its environment?

- How complex a system is the EU? How much external energy, including uncontrolled immigration, can it bear?

- How big can/should an effectively managed and balanced EU be?

- Is the EU trying to clarify its "natural" borders - Turkey and Ukraine?

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