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Chemical sciences

ANTIMONOAMINE OXIDASE ACTIVITY OF TRI- AND TETRACYCLIC CONDENSED PYRIMIDINES AND RELATED COMPOUNDS OF LINEAR STRUCTURE

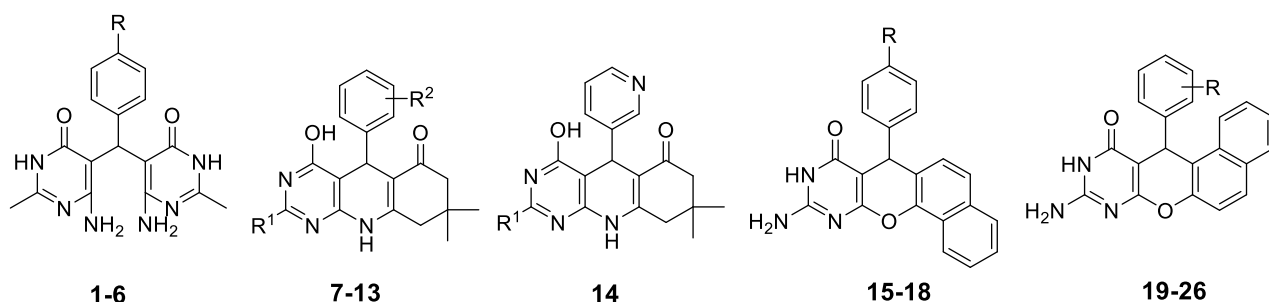
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Background. One of the consequences of the globalization process, which began in recent decades, is an increase in stress-related effects on humans, which leads to a sharp increase in the incidence of various diseases, including, among others, neurodegenerative diseases, mental disorders and various forms of depression. There is a modern wide arsenal of drugs with various pharmacological effects for the treatment of depression, among which monoamine oxidase inhibitors (MAOIs) are some of the most effective. However, it is known that MAO inhibitor drugs are often not effective enough, have significant side effects and cause drug resistance. Monoamine oxidase is a flavoprotein associated with the inner mitochondrial membrane that carries out the oxidative deamination of amines, polyamines and amino acid derivatives. Monoamine oxidase exists in two forms: MAO-A and MAO-B, which, despite significant identity in the primary amino acid sequence, exhibit slightly different substrate specificity. Thus, MAO-A is responsible for the metabolism of serotonin (5-hydroxytryptamine), norepinephrine, dopamine, while MAO-B shows specificity for dopamine, benzylamine, phenethylamine and, weaker, for serotonin. It is interesting to note that MAO-B catabolizes of the analgesic 1-methyl-4-phenyl-4-propionoxypiperidine (MPPP, Ro 2-0718) via the pyridine intermediate 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) to the final quaternary salt neurotoxin MPP⁺ (1-methyl-4-phenylpyridinium), which causes symptoms of Parkinson's disease. It is known that low levels of neurotransmitters in the plasma and tissues of the body are one of the etiological causes of depressive conditions, and therefore MAO inhibitors, causing an increase in the concentration of neurotransmitters, contribute to the correction of mental disorders. In addition, the enzymes polyamine oxidase (PAOs), L-Amino acid oxidases (LAOs), and Lysine-specific demethylase 1 (LSD1) are also similar in biochemical function and structure to monoamine oxidases A and B. Polyamine oxidases regulate the metabolism of the biogenic amines spermine and spermidine, which play a decisive role in cell growth and differentiation. Lysine-specific demethylase 1 (LSD1) plays an important role in the epigenetic regulation of gene function. Dysfunction of these enzymes plays a significant role in the processes of carcinogenesis. In connection with the above, the search for new drugs, inhibitors of monoamine oxidases and related enzymes is of significant interest in medicinal chemistry [1,2].

Purpose of the study. Previously, we described the syntheses of substituted pyrimidines and fused pyrimidines and studied their antimonoamine oxidase activity [3], and also patented a pyrido[1,2-a]pyrimidine derivative with high antimonoamine oxidase activity [4]. Since it is known that antimonoamine oxidase activity is characteristic of tri- and tetracyclic antidepressants, this report describes the study of the antimonoamine oxidase activity of tri- and tetracyclic fused pyrimidines and their acyclic intermediates. Synthesized fused pyrimidines were obtained by one-pot three-component cyclization of substituted pyrimidines, aromatic aldehydes and 5,5-dimethylcyclohexane-1,3-dione or 2-naphthol according to the described method [5,6]. In all series of fused pyrimidines, the aromatic ring contains substituents with electron-donating (ED) and electron-withdrawing (EW) groups, which makes it possible to evaluate the influence of electron effects and the size of substituent groups on antimonoamine oxidase activity.

Condensed pyrimidines of the following types have been studied: 5,5-((aryl)methylene)-bis(6-amino-2-methylpyrimidin-4(3H)-ones **1-6**, 2-(amino, methyl, methylio)-5-aryl-8,8-dimethyl-5,8,9,10-tetrahydropyrimido[4,5-b]quinoline-4,6-(3H,7H)-diones **7-13**, 2-(amino)-8,8-dimethyl-5-(pyridine-3-yl)-5,8,9,10-tetrahydropyrimido[4,5-b]quinoline-4,6-(3H,7H)-dione **14**, 10-amino-7-aryl-7,9-dihydro-8H-benzo[7,8]chromeno[2,3-d]pyrimidin-8-ones **15-18** and 9-amino-12-aryl-10,12-dihydro-11H-benzo[5,6]chromeno[2,3-d]pyrimidin-11-ones **19-26**.



1-6: R = NO₂ (**1**), MeO (**2**), Cl (**3**), Br (**4**), F (**5**), OCH₂Ph (**6**).

7-13: R¹, R² = NH₂, OH (**7**), Me, 2-OH-3-MeO (**8**), NH₂, NO₂ (**9**), SMe, Cl (**10**), NH₂, 2,3-MeO (**11**), NH₂, NO₂ (**12**), NH₂, OCH₂Ph (**13**).

15-18: Cl (**15**), NO₂ (**16**), F (**17**), Br (**18**).

19-26: OCH₂Ph (**19**), Cl (**20**), 2,3-MeO (**21**), MeO (**22**), Br (**23**), Ph (**24**), 2-OH-MeO (**25**), F (**26**).

The source of monoamine oxidase (MAO) was a 50% bovine brain homogenate, which was obtained by homogenizing the brain in a glass homogenizer with an equal (by weight) volume of a 2.5% Arcopal solution. In the resulting 50% homogenate, MAO activity was determined. The experimental samples contained 0.2 ml of homogenate, 0.18 ml of a solution of the test compound and 0.18 ml of a substrate solution. The sample volume was adjusted to 1.8 ml with 0.1 M K-Na-phosphate buffer to pH 7.4. Serotonin (5-HT) creatinine sulfate monohydrate was used as a substrate, which was added to the samples after a 30-minute preincubation of the enzyme with the test substance at room temperature. The serotonin content in the sample is 10 µmol/sample. Oxygen saturation was carried out for 5 minutes at 37 °C and then the samples were incubated for 45 minutes at 37 °C in an oxygen atmosphere. The reaction was stopped by adding 0.2 ml of 50% trichloroacetic acid. The protein was precipitated by centrifugation at 3000 rpm. In the protein-free supernatant liquid, the ammonia content was determined by isometric distillation for 24 hours, followed by nesslerization and photometry using a PEK-56-2 photometer-nephelometer. MAO activity is expressed as a percentage of control drug **Indopane**. Each compound was tested in 3-4 experiments (average data of 4 experiments), which are given in table.

Table.

Effect of the studied compounds at a dose $1 \cdot 10^{-6}$ of µmol/ml on deamination serotonin (5-HT) by brain monoamine oxidase (MAO) in vitro ($p < 0.05$).

Compound	Inhibition, %	Compound	Inhibition, %	Compound	Inhibition, %
1	48±3.2	10	24 (n/calc)	19	50±2.6
2	70±4.2	11	42±2.8	20	52±2.4
3	61±4.4	12	52±2.4	21	90±6.4
4	68±4.8	13	37±2.2	22	40±2.8
5	80±5.6	14	72±4.8	23	52±2.8
6	56±3.2	15	62±3.8	24	24 (n/calc.)
7	48±3.0	16	52±2.8	25	40±2.6
8	56±3.4	17	19 (n/calc)	26	65±4.0
9	48±3.2	18	33±2.2	Indopane	86±6.0

It was found that most of the compounds studied showed some level of antimonamine oxidase activity. Acyclic derivatives **1-6**, which are heterocyclic analogues of triarylmethane, exhibit moderate antimonamine oxidase properties, most pronounced in the 4-fluorophenyl derivative **5**. Annulation of the pyridopyrimidine ring with cyclohexanone to form tricyclic fused pyrimidines **7-14** is accompanied by a slight decrease in antimonamine oxidase activity, which little depends on substituents on the pyrimidine and phenyl rings. In the series of tetracyclic fused pyrimidines, 9-amino-12-(2,3-dimethoxyphenyl)-10,12-dihydro-11H-benzo[5,6]chromeno[2,3-d]pyrimidin-11-one **21** showed a pronounced antimonamine oxidase activity, inhibiting enzyme activity by 90%. The control drug indopan exhibits 86% activity in this test.

As expected, the 3D model of compound **21** clearly shows that, due to steric hindrance, the phenyl group is moved out of the plane of the tetracyclic framework and is at almost a right angle to it (fig.)

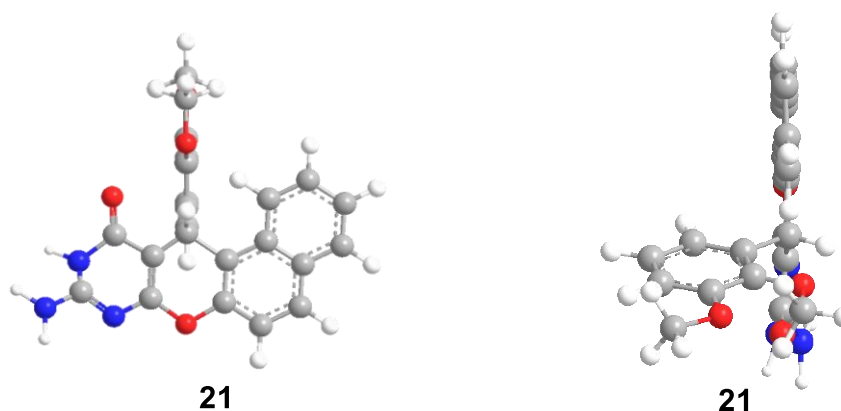


Figure. 3D Model of tetracycline 21.

Conclusions. The antimonoamine oxidase activity of previously synthesized tri- and tetracyclic fused pyrimidines and related compounds was studied. It was found that a derivative of the heterocyclic system benzo[5,6]chromeno[2,3-d]pyrimidin with two electron-donating 2,3-dimethoxy groups in the benzene ring exhibits high anti-MAO activity, inhibiting the enzyme by 90%. The remaining compounds in this series showed less activity. The results obtained create the prerequisites for further research in this direction.

References

1. Gaweska H., Fitzpatrick P. F. *BioMol Concepts*, **2011**, v. 2, p. 365. doi 10.1515/BMC.2011.030
2. Aljanabi R., Alsous L., Sabbah D.A., Gul H.I., Gul M., Bardaweel S.K. *Molecules* **2021**, v. 26, p. 6019. doi:org/10.3390/molecules26196019
3. Harutyunyan A. A., Sukasyan R.S., Grygoryan A.S. *Biolog. J. Armenia*, 2016, v. 68(1), p. 60.
4. Paronikyan R., Harutyunyan A., Grigoryan A., Nazaryan I., Hakobyan H., Gasparyan H. *Derivatives of [1,2-a]pyrimidine with psychotropic activity*. RA Patent 3379A, 2020.
5. Harutyunyan A.A., Israelyan S.G., Panosyan G.A., Akopyan M.R., Hovsepyan T.R. *Russ. J. Org. Chem.*, 2019, v. 55(12), p. 1896. doi:org/10.1134/S1070428019120145
6. Harutyunyan A.A., Israelyan S.G., Panosyan G.A., Hovsepyan T.R. *Russ. J. Org. Chem.* 2020, v. 56(7), p.1211. doi:org/10.1134/S1070428020070143

RESEARCH ON THE PRODUCTION OF SILICATE BRICK BASED ON ASH RESIDUES FORMED DURING THERMAL PROCESSING OF FIREWOOD

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Introduction.

As it is known, the ash waste generated during the use of thermal processing of wood and other plant raw materials as energy fuel has traditionally been used as an effective mineral fertilizer due to the main macro- and microelements necessary for the full growth and development of plants. During the burning of firewood in boiler houses, ash waste is usually formed in the form of three types of fractions (fly ash from cyclones, fly ash from filters and bottom ash) that differ in terms of volume, chemical composition and properties. The composition and physical properties of ash fractions (particle size, density, etc.) depend on many factors, including the physical and chemical properties of the fuel used, operating parameters of combustion systems, flue gas cleaning technologies, etc. it depends. The analysis of studies on the use of ash waste as a mineral fertilizer shows that ash waste contains ecologically active compounds of heavy metals (cadmium, lead, zinc, copper, etc.), the concentration of which increases with the transition from bottom ash to ash [1].

Main part

Their composition - in accordance with the requirements of the established standards, does not allow their use for agricultural purposes and determines its use in other areas of industry. Therefore, the search for effective technological and environmental aspects of such ash waste recycling is an urgent task. In this regard, construction composites obtained from accessible and inexpensive wood waste are of great interest [2]. Silicate bricks are used in almost the same areas as other small-sized wall materials. Silicate brick is made by using a moistened mixture of siliceous materials and other lime-containing components with the application of pigments, light fillers, and then hardening in an autoclave under hydrothermal conditions. The process can be schematical described as follows:

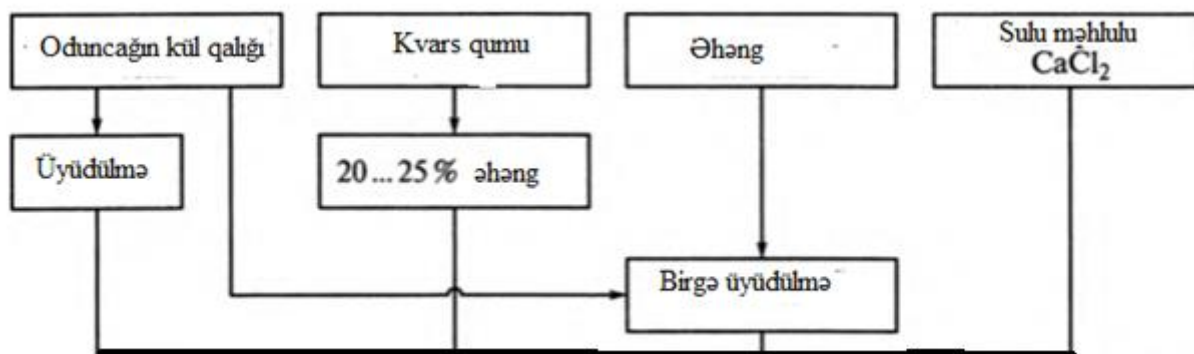


Figure 1. Schematic representation of silicate brick production.

Silicate bricks can have strength from grades M100 to M300, frost resistance from grades F25 to F100, water absorption of at least 6%, average density of 900-2200 kg/m³. With the increase in the rate of housing construction in our country, the issue of the production of efficient building materials, including silicate materials, is becoming more and more important. In this regard, the production of silicate bricks with an average density of less than 1000 kg/m³ in building materials is an urgent issue. It was determined that when wood ash is used as a component of the raw material mixture for the production of silicate bricks, a significant reduction in energy costs is achieved while maintaining the operational characteristics of the products. Addition of up to 45% ash to the composition of the silicate mixture during the co-grinding of the raw material mixture, including lime, sand and wood ash, not only improves the composition of the silicate mixture and the moldability of the raw brick, but also participates in the formation of calcium hydrosilicates. The strength

of the brick is ensured not by the total physical adhesion of new binding compounds, but by the chemical interaction of lime and quartz sand with the formation of calcium hydrosilicates according to the reaction:



The production of silicate bricks differs from the production of ceramic bricks according to the following technical and economic indicators:

- relative simplicity of the production process;
- high level mechanization and automation of production;
- less energy consumption;

- compared to ceramics, the duration of the technological process for the production of bricks is reduced by 5-10 times;

- The price of silicate brick is 2 times lower than that of ceramic brick. Silicate brick production consists of the following technological stages:

- 1) preparation of raw materials;
- 2) purchase of silica-lime binder (SLB);
- 3) preparation of silicate mixture and quenching of lime in it;
- 4) molding of raw brick;
- 5) brick processing in an autoclave;
- 6) packaging and storage of finished products.

The preparation of silicate mixture includes mixing of SLB and other raw materials, moistening the mixture to the required moisture level and extinguishing the lime in the mixture, etc. includes. The initial mixing of the mixture is carried out in low-speed or high-speed double shaft mixers with cyclic or continuous operation. Mixers are equipped with pipes or special devices to provide the water and sharp saturated steam necessary to achieve optimal humidity and improve the quality of the silicate mixture. After the raw materials are mixed, the silicate mixture from the mixers is fed to the slaking apparatus for slaking lime.

Results

The processing in the autoclave can be divided into three cycles.

1). The first period lasts from the moment hot steam enters until the temperature of the raw materials is equalized, the pressure is kept at atmospheric level until it reaches $t=100^\circ\text{C}$. The moisture content of the raw material increases and the phase of evaporation of the raw material occurs. This period lasts from 0.5 to 0.75 hours. During this period, the dissolution of $\text{Ca}(\text{OH})_2$ and a small amount of SiO_2 begins, and the formation of high-base calcium hydrosilicates - Ca_2SiH_2 by their interaction - gives the brick high frost resistance.

2) Isothermal storage time at maximum temperature and pressure maintaining 100% humidity. During the first 1.5 hours, condensate continues to flow from the surface layers of the brick to the central part of the brick. The concentration of free dissolved lime decreases and more intensive dissolution of SiO_2 continues; as a result of the chemical reaction, low-base hydrosilicates are formed - CaSiH , which has high strength (up to 30 MPa), but low frost resistance (up to 10 cycles).

3) Cooling begins when the temperature and pressure decrease, as a result of which the brick cools down to 100°C . Due to the temperature difference between the brick (100°C) and the environment ($15 - 20^\circ\text{C}$), sudden evaporation of moisture from the brick (up to 10 - 12%) occurs. There are several ways to intensify autoclave processing.

1) Autoclaving at $t=203 - 205^\circ\text{C}$ is economically profitable.

2) Inclusion of more active siliceous components (tripol, fly ash, finely ground ceramic shards, ceramic gravel and gravel) in the silicate mixture.

3) Application of crystalline "fillers" (from 1 to 3%) - silicate production waste.

Keywords: silicate brick, firewood, processing, component, material.

Literature

1. Wildbacher N. Ash disposal of wood-burning boilers. Minsk, 2007. 28 p. 2. Borzunova A. G., Zinovyeva I. S. Complex processing of wood raw materials. Wood waste recycling // Advances in modern science. 2012. No. 4. p. 180-181.

EXPLORING THE EFFICACY OF OLEIC ACID-DERIVED IMIDAZOLINES AS CORROSION INHIBITORS IN VARIED ENVIRONMENTAL CONTEXTS

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In light of the contemporary environmental landscape, the imperative to devise robust corrosion-resistant formulations for the preservation of metal infrastructure has become increasingly salient on a global scale. Consequently, there exists a discernible inclination towards the deployment of composition-type reagents as corrosion inhibitors[1]. Chemical reagents serve as indispensable components within the realms of oil extraction and refining industries, instrumental in the mitigation of corrosion, prevention of salt precipitation, and function as bactericides to uphold equipment integrity. Henceforth, exhaustive scholarly inquiry has been diligently pursued in this realm within the Commonwealth of Independent States (CIS), with particular emphasis on Azerbaijan, culminating in the creation of corrosion inhibitors of notable industrial relevance[2-3].

The objective of the research presented herein was to synthesize imidazolines derived from oleic acid, diethylenetriamine, and hexamethylenediamine in various mole ratios conforming to established standards. Subsequently, a preservative solution was formulated by incorporating these imidazolines into T-30 oil at different concentrations, with the intention of application subsequent to an exhaustive analysis of their physical and chemical attributes.

Table 1.

	Constituent Profile	Concentration distribution in the solution, %	Corrosion resistance duration, in days		
			Q-4 hydrochamber	In seawater environment	0.001% sulfuric acid (H ₂ SO ₄) concentration in solution
Nº1	T-30 oil + Sample I	5	Continuation for 210 Days	157 days	151 days
Nº2	T-30 oil + Sample I	10	Continuation for 210 Days	Continuation for 168 Days	Continuation for 168 Days
Nº3	T-30 oil + Sample II	5	Continuation for 210 Days	137 days	135 days
Nº4	T-30 oil + Sample II	10	Continuation for 210 Days	145 days	141 days
Nº5	T-30 oil + Sample III	5	Continuation for 210 Days	Continuation for 210 Days	Continuation for 210 Days
Nº6	T-30 oil + Sample III	10	Continuation for 210 Days	Continuation for 210 Days	Continuation for 210 Days

Sample I: Imidazoline synthesized from Oleic Acid and Diethylenetriamine at a 2:1 molar ratio

Sample II: Imidazoline synthesized from Oleic Acid and Hexamethylenediamine at a 2:1 molar ratio

Sample III: Imidazoline synthesized from Oleic Acid and Hexamethylenediamine at a 1:1 molar ratio

As indicated by the data presented in Table 1, it is evident that the incorporation of inhibitors into the T-30 turbine oil yields a discernible enhancement in the corrosion protection efficacy for "steel-3" metal plates across various environmental conditions, encompassing assessment under a "Q-4" thermal hydrochamber, exposure to seawater, and immersion in a 0.001% H₂SO₄ environment.

References

1. Abbasov, V. M., Samadov, M. A., Sultanov, E. F., et al. Investigation of Alkyl Aromatic Sulfonic Acid Salts as Bactericidal Corrosion Inhibitors. *Petroleum Chemistry and Oil Refining Processes* 2007, 2 (29), 6-11.

2. N. A. Gafarov., A. A. Goncharov., V. M. Kushnarenko. *Corrosion and Protection of Equipment in Oil and Gas Fields Containing Hydrogen Sulfide*. Moscow: JSC and "Nedra" Publishing House. 1998, 439
3. N.A. Gafarov, V.M. Kushnarenko, D.E., *Corrosion inhibitors*. Moscow Chemistry, 2002, 2, 366.

Economic sciences

MODERN ASPECTS OF ASSESSING THE EXPORT POTENTIAL OF THE PETROCHEMICAL COMPLEX OF AZERBAIJAN UNDER NEW CONDITIONS

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СОВРЕМЕННЫЕ АСПЕКТЫ ОЦЕНКИ ЭКСПОРТНОГО ПОТЕНЦИАЛА НЕФТЕХИМИЧЕСКОГО КОМПЛЕКСА АЗЕРБАЙДЖАНА В НОВЫХ УСЛОВИЯХ

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Abstract

The article studies modern aspects of the assessment of the export potential of the petrochemical complex of Azerbaijan in modern times. For this purpose the export potential of petrochemical complex has been investigated and possibilities of expansion of export structure have been analysed. The importance of creation of competitive petrochemical enterprises along the additional production chain was substantiated. The export potential of large petrochemical enterprises put into operation in recent years was revealed and prospects for its increase were considered. The prospects of creating export-oriented petrochemical enterprises in the Sumgayit Chemical-Industrial Park were studied. The possibility of increasing the export potential of the petrochemical complex of Azerbaijan was assessed.

Аннотация

В статье изучены современные аспекты оценки экспортного потенциала нефтехимического комплекса Азербайджана в современное время. С этой целью был исследован экспортный потенциал нефтехимического комплекса и проанализированы возможности расширения структуры экспорта. Обоснована важность создания конкурентоспособных нефтехимических предприятий по дополнительной производственной цепочке. Раскрыт экспортный потенциал введенных в эксплуатацию в последние годы крупных нефтехимических предприятий и рассмотрены перспективы его увеличения. Исследованы перспективы создания в Сумгайтском химико-промышленном парке экспортноориентированных нефтехимических предприятий. Оценена возможность увеличения экспортного потенциала нефтехимического комплекса Азербайджана.

Keywords: Azerbaijan, petrochemical complex, export, export potential, export potential assessment, directions of export potential increase, prospects of export potential increase.

Ключевые слова: Азербайджан, нефтехимический комплекс, экспорт, экспортный потенциал, оценка экспортного потенциала, направления повышения экспортного потенциала, перспективы повышения экспортного потенциала.

В современное время экспортный потенциал играет большую роль в укреплении конкурентоспособности экономики страны, обеспечении макроэкономической и макростабильности [1; 2; 3]. Валютные средства, поступающие в страну за счет экспортной продукции, имеют стратегическое значение с точки зрения обеспечения финансовой стабильности. Поэтому, помимо экспорта нефтегазовой продукции, важными задачами, стоящими перед нашей страной в современных условиях, считаются формирование ненефтяного экспортного потенциала и увеличение объемов экспорта [4; 5; 6].

Неслучайно в последние годы ведется целенаправленная работа в направлении укрепления экспортного потенциала нефтехимического комплекса, который является одной из отраслей ненефтяного сектора со значительным экспортным потенциалом нашей страны. Например, ввод в эксплуатацию в 2019 году важного экспортноориентированного предприятия - завода полиэтилена высокого давления оказал существенное влияние на рост ненефтяного экспорта нашей страны. Следует упомянуть завод полипропилена SOCAR Polymer, который имеет еще один высокий экспортный потенциал и считается первым крупным предприятием, созданным в нефтехимической отрасли нашей страны в рамках государственно-частного партнерства. 60% инвестиций, задействованных в создании предприятия, предоставил российский "Газпромбанк", остальные - "SOCAR", "Vitol", "Pasha Holding", "Gilan Holding" и "Azersun Holding". Общий инвестиционный потенциал этого стратегического экспортно-ориентированного нефтехимического предприятия составляет 816 млн. долл. США. находился на уровне доллара. Интересно, что за период работы этого завода ожидается получение дохода в размере 6,3 миллиарда долларов, из которых 30% будет приходиться на чистую прибыль компании. В то же время, в результате деятельности этого крупного экспортно-ориентированного завода, экспортные доходы ненефтяного сектора нашей страны значительно возрастут. Это может сыграть важную роль в создании новых источников финансовых ресурсов страны и формировании финансового источника [7; 8]. Для повышения экспортного потенциала и создания конкурентоспособных нефтехимических предприятий возможно эффективно использовать новые экономические механизмы, в том числе свободные экономические зоны, и важно их учитывать [9; 10; 11; 12; 13; 14; 15; 16].

Следует отметить, что большое значение в совершенствовании структуры экономики нашей страны имеет химический и нефтехимический комплекс, обладающий ненефтяным экспортным потенциалом. Известно, что история освоения этого района напрямую связана с развитием нефтяной промышленности. Так: «В 1960-е и 1970-е годы развивались нефтеперерабатывающие отрасли и создавались первые нефтехимические предприятия. Первый крупный нефтехимический завод в Закавказье был введен в эксплуатацию в 1952 году в Сумгайтском промышленном центре - заводе "Синтезкаучук". В последующие годы эта отрасль быстро развивалась [17, с. 12]. В частности, в Сумгайтском промышленном центре можно отметить экспортный потенциал объекта «ЭП-300», введенного в эксплуатацию в 1988 году, и объекта «Полимир 120», строительство которого было завершено в 1989 году. В результате эксплуатации этих мощностей появилась возможность эффективно перерабатывать побочные продукты и сырье переработки нефти и газа в нашей стране и производить экспортно-ориентированную продукцию [18, с. 196].

Совершенствование опыта, полученного в нашей стране, и определение более инновационных подходов являются важными условиями для использования возможностей диверсификации экономики и роста экспортного потенциала за счет переработки химической и нефтехимической промышленности. Важно системно изучать текущие экономические проблемы нефтехимического комплекса и более глубоко оценивать его экспортный потенциал [19]. При этом необходимо создать и развивать систему логистики в этой сфере в соответствии с мировым опытом, чтобы оценить экспортные возможности нефтехимических предприятий и реализовать бесперебойные поставки сырья и материалов, необходимых для увеличения объемов производства. экспорта. Организация многофункциональной логистической системы позволяет обеспечить более высокий уровень управления процессами формирования, движения, использования химического и нефтехимического сырья и эффективного вывода готовой продукции на мировые рынки. В связи с этим необходимо усилить снабжение сырьем важных объектов Сумгайтского завода «Этилен-Полиэтилен», который является основным крупным государственным нефтехимическим предприятием нашей страны. Так, в настоящее время основная технологическая установка этого завода «ЭП-300» работает не совсем на уровне проектной мощности, и важно усилить

сырьевое обеспечение этой установки. Мы считаем, что при этом следует ускорить процессы приобретения более современных перерабатывающих мощностей и внедрения технологий в нашу страну. Также необходимо расширить эффективные маркетинговые исследования для углубленного изучения экспортных возможностей предприятий данной сферы. Например, на Сумгайтском заводе «Этилен-полиэтилен» следует принять меры по увеличению производства этой продукции и освоению новых рынков, исходя из достаточной рентабельности экспортной цены важной экспортной продукции на мировых рынках. Устойчивое развитие предприятий нефтехимического комплекса и увеличение экспортного потенциала положительно влияют на социально-экономическое развитие нашей страны. В целом, помимо проведения масштабных работ по снижению зависимости экономики страны от нефти, наращивание возможностей нефтехимического комплекса, привлечение большего количества валютных ресурсов в страну также играет важную роль в решении социально-экономических проблем. В частности, нефтехимические предприятия выполняют ведущие функции в ускорении развития города Сумгайт, формировании его как современного города и превращении его в мощный промышленный центр [20].

Следует отметить, что непрерывное развитие нефтехимического комплекса и интенсивное ускорение этих процессов сформировались как одна из основных составляющих экономической политики нашего государства в этой сфере. Так, в «Стратегической дорожной карте развития нефтегазовой промышленности (включая химическую продукцию) Азербайджанской Республики», утвержденной Указом Президента страны от 6 декабря 2016 года, предусмотрено укрепление структуры экспортоориентированных предприятий. нефтехимической продукции и увеличение объемов экспорта поставлены стратегическими целями и в настоящее время идут процессы достижения этих целей.

В ближайшие годы должны быть расширены меры по более продуктивному использованию экспортных возможностей химической и нефтехимической продукции. Должен быть достигнут выпуск более конкурентоспособной и экспортоориентированной химической и нефтехимической продукции по дополнительной производственной цепочке, при этом приоритетом должно стать эффективное использование существующей сырьевой базы [21]. С другой стороны, следует уделить внимание увеличению производства экспортно-ориентированной продукции в нефтехимическом комплексе, обладающем сильным потенциалом, и использованию потенциала для ее экспорта на внешние рынки. Экспортный потенциал полиэтилена, изопропилового спирта, пропилена и другой продукции, производимой на нефтехимических предприятиях, остается высоким. Наряду с этим, в процессах организации новых химических предприятий в Сумгайтском химико-промышленном парке должны продуктивно использоваться возможности, созданные для повышения потенциала производства экспортоориентированной продукции.

Таким образом, создание этого парка позволило сформировать современную производственную и экспортную инфраструктуру, а также созданы достаточно привлекательные условия для внутренних и внешних инвестиций в парк. Современные аспекты развития нефтехимического комплекса страны и направления деятельности делают важным направление инвестиций в эту сферу. В частности, за счет совершенствования инновационно-ориентированного развития и структуры предприятий ненефтяной промышленности, расположенных в городе Сумгайт, может быть сформирован более благоприятный потенциал для увеличения экспортного потенциала.

Как мы уже упоминали ранее, экспортные возможности Сумгайтского химического индустриального парка увеличиваются, число резидентов этого парка составляет 37, а общий объем направляемых ими инвестиций составляет 4,4 миллиарда долларов. Высоко оцениваются возможности повышения экспортного потенциала за счет создания экспортоориентированных и конкурентоспособных предприятий в этом парке.

В ближайшее время мы станем свидетелями более интенсивного роста экспортного потенциала нефтехимического комплекса нашей страны. Кроме того, мы считаем, что меры по повышению экспортного потенциала нефтехимического комплекса сыграют важную роль в укреплении экономической безопасности страны, развитии предпринимательства и улучшении бизнес-среды, повышении инвестиционной привлекательности [22; 23; 24; 25; 26]. При этом мы считаем, что объективная оценка экспортного потенциала нефтехимического комплекса может создать дополнительные стимулы для ускорения инновационного развития и расширения применения цифровых технологий в нашей стране [27; 28]. Помимо всего этого, на

наш взгляд, среди приоритетов создания сети конкурентоспособных предприятий в процессах экономического развития на освобожденных территориях имеются возможности организации экспорта ряда нефтехимической продукции, в том числе изделий из пластмасс, на уровне малого и среднего предпринимательства региона, а также удовлетворения местного спроса [29; 30; 31; 32; 33].

Считаем важным учесть группу факторов и принять меры для эффективного использования экспортного потенциала нефтехимического комплекса, более объективно проанализировать и оценить экспортные возможности, увеличить долю этой отрасли в экспорте страны:

– необходимо дальнейшее углубление процессов расширения существующих в настоящее время мощностей химического и нефтехимического производства по дополнительной производственной цепочке и создания экспортно-ориентированных перерабатывающих территорий;

– процессы создания новых и высокотехнологичных нефтехимических перерабатывающих предприятий на базе нефтегазового сырья должны осуществляться интенсивнее;

- следует рассматривать создание крупных экспортноориентированных химических и нефтехимических предприятий и кластеров на базе современных технологий с учетом существующих сырьевых ресурсов в стране и регионе;

- следует принять меры по ускорению трансфера технологий и привлечению иностранных инвестиций для развития экспортноориентированных направлений химического и нефтехимического комплекса и т.д.

Список источников

1. Aliyev, Sh.T. Strategic role of Sumgayit in the development of petrochemical industry of Azerbaijan / The International Conference on Actual Problems of Chemical Engineering - APCE 2020. - Azerbaijan State of Oil and Industry University. 24-25 december 2020 - P.430-435.
2. Əliyev, Ş.T. Azərbaycanla neftkimya kompleksinin inkişafının müasir aspektləri və istiqamətləri// "Audit" Jurnalı, 2016, №3, S. 41-45.
3. Алиев, Ш.Т. Вопросы развития химической промышленности Азербайджанской Республики// Химическая промышленность России сегодня, г. Москва, 2010, № 8. – с. 5-9.
4. Алиев, Ш.Т., Гусейнов, Ш.Э. Важность развития промышленных секторов экономики Азербайджана / Тенденції сталого розвитку економіки країни: досягнення, проблеми та прогнози: збірник тез наукових учасників Міжнародної науково-практичної конференції для студентів, аспірантів та молодих учених (м. Київ). – К.: Аналітичний центр «Нова Економіка» 27-28 січня 2017 р. –с. 28-31.
5. Алиев, Ш.Т. Вопросы модернизации и кластеризации промышленных отраслей Азербайджана в современных условиях/ Материалы конференции «Макро и микроэкономика: теория и практика». Караганда, Казахстан/ 02.09.2009. – с. 141-143.
6. Алиев, Ш.Т. Важнейшие детерминанты устойчивого развития экономики Азербайджана. Книга. Баку, «Элм», 2010. - 196 с.
7. Алиев Ш.Т. Влияние финансового кризиса мира на экономические процессы Азербайджанской Республики//Журнал Финансы и кредит. № 8 (344). Москва, 2009. С. 78-82.
8. Əliyev Ş.T. Azərbaycanla maliyyə sabitliyinin təmin edilməsi problemləri və maliyyə-kredit sisteminin inkişafının müasir aspektləri. Audit,–2017, 3, s. 26-40.
9. Əliyev, Ş.T. Azad iqtisadi zonaların inkişafının aktual aspektləri. Monoqrafiya. Sumqayıt: SDU-nun redaksiya və nəşr işləri şöbəsi, – 2022, – 422 s.
10. Алиев Ш.Т. Проблемы организации и перспективы развития особых экономических зон. — Баку: Наука. – 2008. - 252 с.
11. Алиев, Ш.Т. Роль специальных экономических зон в развитии предпринимательства и инвестиционной активности// Российское предпринимательство.- Москва, 2012. № 7 (205), – с. 180-184.
12. Piana V., Aliyev, Sh.T. and etc. 2009 – Innovative Economic Policies for Climate Change Mitigation. Economics Web Institute, Rome.
13. Алиев Ш.Т. Моделирование инноватизации национальной экономики в современных условиях // Научное обозрение, 2014 , № 06, С. 342-346.

14. Алиев Ш.Т. Важность применения новых экономических инструментов в экономических процессах Азербайджана// Национальные интересы: приоритеты и безопасность. 2009, № 12. С. 80–90.
15. Алиев Ш.Т. Перспективы развития свободных экономических зон в странах СНГ в контексте опыта Турции / Шафа Алиев // Zəfə Aliyev. – Стамбул, 2009. – январь. – с. 1-6.
16. Алиев Ш.Т. Важность применения новых экономических инструментов в экономических процессах Азербайджана// Национальные интересы: приоритеты и безопасность. 2009, № 12. С. 80–90.
17. Əliyev Ş.T. Azərbaycanın kimya və neftkimya kompleksinin qiymətləndirilməsi və yenidənqurulması istiqamətləri. Bakı, "Elm və təhsil", 2012. – 156 s
18. Экономика Азербайджана ШТ Алиев Сумгаит–2018, –376 с.
19. Əliyev T.N., Babayev M.T. Sahənin aktual iqtisadi problemləri: neft emalı və neftkimya. Bakı, "Elm və təhsil", 2011, 346 s.
20. Şəfa Əliyev. Azərbaycanın sosial-iqtisadi inkişafında Sumqayıt şəhərinin strateji əhəmiyyəti. Monoqrafiya. Sumqayıt, "Azəri" nəşriyyatı, 2019, 368 s.
21. Əliyev Ş.T. Azərbaycanın xarici iqtisadi siyasəti. Sumqayıt Dövlət Universitetinin nəşriyyatı, 2015. -185 s.
22. Aliyev, S., Gulaliyev, M., Purhani, S., Mehdiyeva, G., & Mustafayev, E. (2024). Comparative Assessment of Energy Security Level: The Case of the South Caucasus Countries. *International Journal of Energy Economics and Policy*, 14(1), 651–662. <https://doi.org/10.32479/ijeep.14984> <https://econjournals.com/index.php/ijeep/article/view/14984/7718> <https://econjournals.com/index.php/ijeep/article/view/14984>.
23. Aliyev, Sh.T., Babayev F., Gafarli G., Galandarova U., Balajayeva T. Economic security of regions: A prerequisite for diversifying the Azerbaijan economy// *Journal of East European and Central Asian Research (JEECAR)*. 2023. September. Vol. 10 No. 5 (2023), p. 827-840.– <http://dx.doi.org/10.15549/jeecar.v10i5.1480>.
24. Aliyev, Sh.T. Problems Of Diversification Of Azerbaijani Economy In Modern Conditions / VIII International scientific and practical conference «Current problems of social and labor relations» (ISPC-CPSLR 2020), Makhachkala. 17-18 December 2020. – P.38-44.
25. Алиев, Ш.Т., Гусейнова, Н.Э., Яхьяева, А.Ю. Проблемы повышения инвестиционной привлекательности Карабахского региона Азербайджана и пути их решения/ II International Scientific and Practical Conference Current Issues And Prospects for the Development of Scientific Research held on in Orléans, France, May 7-8, 2021, p.13-19. - <https://ojs.ukrlogos.in.ua/index.php/interconf/issue/view/7-8.05.2021/534>. DOI: <https://doi.org/10.51582/interconf.7-8.05.2021.002>.
26. N Megits, ST Aliyev, S Pustovhar, T Bielialov, O Prokopenko. The «Five-Helix» Model as an effective way to develop business in Industry 4.0 of selected countries // *Journal of Eastern European and Central Asian Research (JEECAR)* 9 (2), p. 357-368.
27. Alguliyev, R.M., Aliyev A.G., Aliyev Sh.T., Shahverdiyeva R.O. Development of information support systems for management of innovative structures / *The 8th IEEE International Conference on Application of Information and Communication Technologies (AICT2014)*, Astana, 2014. – 378-382.
28. Mamedov Z.F. Aliyev Shefa. Digitalization of the economy: analysis of influence on the banking sphere in Azerbaijan in the context of world experience// 55th International Scientific Conference on Economic and Social Development, Baku, Azerbaijan.: 25 June 2020, Book of Proceedings Vol. 2/4. P 584-591.
29. Əliyev, Ş.T. Qarabağ və Şərqi Zəngəzur iqtisadi rayonlarının yaradılmasının strateji aspektləri. // *Geostrategiya jurnalı*, – 2021. № 04 (64), – s.67-72.
30. Алиев, Ш.Т., Аббасова, Ч.И., Гамидова, А.М. Оценка потенциала и пути развития Карабахского экономического района Азербайджана / VIII International Scientific and Practical Conference International forum: problems and scientific solutions held in Melbourne, Australia. Scientific collection «interconf», September 6-8, 2021, № 73, p. 7-15. <https://ojs.ukrlogos.in.ua/index.php/interconf/article/view/14257/13074>.
31. Алиев, Ш.Т. Стратегическая важность возрождения Шуша в интенсификации социально-экономического развития Карабахского экономического района/ Ш.Т. Алиев, Л.А. Меликова// Современные тенденции развития науки и мирового сообщества в эпоху

цифровизации: Сборник материалов VII Международной научно-практической конференции, Москва, 30 июня 2022. – с. 321-329.

32. Алиев, Ш.Т., Меликова, Л.А. Актуальные проблемы и объективные реалии мирового опыта в восстановлении освобожденных от оккупации территорий/ IX Международная Научно-Практическая Конференция «Развитие науки и практики в глобально меняющемся мире в условиях рисков». – Россия, г. Москва. 28 марта 2022 года- С.277-286.

33. Алиев, Ш.Т. Стратегическая важность возрождения Шуша в интенсификации социально-экономического развития Карабахского экономического района/ Ш.Т. Алиев, Л.А. Меликова// Современные тенденции развития науки и мирового сообщества в эпоху цифровизации: Сборник материалов VII Международной научно-практической конференции, Москва, 30 июня 2022. – с. 321-329.

INFLUENCE OF COMMERCIAL DECISIONS ON THE PROCESS OF ORGANIZING COMMERCIAL ACTIVITY IN MODERN CONDITIONS

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Abstract

In modern conditions of a market economy, enterprises need to constantly improve, not stand still, in order to stay in this endless flow of information and constantly changing trends. This is due to high competition in the market. The enterprise must be able to quickly adapt to changes in the external environment. To achieve this, all commercial activities of the company must be flexible and customer-oriented.

Keywords: *modern conditions, commercial activity, company, process, industry.*

Introduction.

Commercial activity acts as a way to implement commercial relations between market entities, which become dominant in a market-oriented economy. These relations are designed to stimulate production, develop needs, and intensify commodity-money exchange. Therefore, commercial activity, being an objectively necessary category of a market economy, has priority importance and occupies a leading place.

The essence of commercial activity is an integrated approach to organizing a set of commercial processes and operations aimed at performing commercial functions in the implementation of commodity-money exchange at all its phases.

As noted above, commercial activities include processes and operations of an organizational, managerial, legal and economic nature. It does not cover technological operations performed along the entire path of movement of goods from production to the consumer, such as loading, unloading, packaging, packaging, storage, sorting, and preparing goods for sale. These operations reflect the technology of trading processes. Commercial activities and technology of trading processes are interrelated, but each of them has its own place and functions [1].

Main part

Without commercial activity there can be no technology, just as without technology there can be no commercial activity. These disciplines form the system of functioning of the trading industry. Commercial activity takes place not only in the trading industry, but also in manufacturing, in the service sector, in the market for intellectual property, technology, and securities. It is based on the organization and management of commercial processes.

The commercial process means the sequential execution of operations that provide organizational, economic, social, and legal aspects of commodity-money exchange.

The set of specific operations depends on what stage of the exchange the commercial process serves and according to what scheme the exchange is carried out. For example, in the presence of intermediaries, the path of movement of commodity-money exchange is as follows: manufacturer - one or more wholesale intermediaries - retail trade - the final consumer, and in their absence: manufacturer - final consumer without intermediaries. A commercial operation is an important component of commercial activity, which is a set of techniques and methods that ensure the functioning of different stages of commodity-money exchange.

All commercial operations can be divided into main and auxiliary. Some of them have specific features (for example, exchange, auction operations).

Thus, commercial activity consists of commercial processes and transactions that take place in the interaction of market entities with the aim of ensuring the effective exchange of goods and services.

In the process of commercial activity, both economic and social problems must be comprehensively solved. The goal that comes to the fore is to make a profit, which also serves as a means for solving other equally important problems, including social ones; and presupposes high economic training of a specialist in commercial work.

The main objectives of commercial activity are:

-formation of relations between entities operating in the market on a mutually beneficial basis;

- increasing the ratio of supply contracts, strengthening contractual discipline;
 - development of stable direct economic relations, increasing their efficiency;
 - protecting the interests of consumers, ensuring their priority;
 - introduction of progressive methods of wholesale and retail trade;
 - increasing the level of work on studying demand, economic justification of the need for goods;
 - improving the mechanism for managing commodity resources, supply and demand, creating a competitive assortment;
 - promotion of sales of goods, after-sales service, provision of additional services
- timely and adequate response to changes occurring in the market.

The choice of location for a retail trade enterprise is a strategically important decision that largely determines the success of its activities. Convenience of location is a significant factor in the attractiveness of a trading enterprise for consumers. Often, merchants have to invest large amounts of money in purchasing and equipping retail premises. Therefore, it is important to choose a location for your store that will provide an advantage over competitors and allow you to quickly achieve a return on investment [2].

When choosing a store location type, the following options may be considered.

1. The central business district is an area where many commercial enterprises are traditionally concentrated and the most important public transport routes intersect.
2. Personalized service over the counter is a traditional selling method. It assumes that the seller serves each buyer, helps him in choosing a purchase, advises on the use of the product, packs and releases the product.

When identifying purchasing intentions, the seller determines the attitude of buyers towards types, varieties, etc. The sale ends with settlements with buyers and the issuance of purchases to them. The advantages of this method are that it provides assistance from the seller in selecting the right product, and it is also possible to push the buyer to make a purchase. The disadvantages are that a lot of time is spent on consultation and dispensing of goods, which can cause queues and irritation of other buyers.

3. Sale of goods with open display and free access. This method of sale is characterized by the fact that the goods are openly displayed at the seller's point of sale (on counters, slides, hangers, etc.). The buyer has the opportunity to independently inspect and select the desired product.

The impact of advertising decisions on commercial activity can also be seen in figure 1.

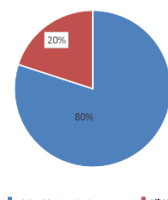


Figure 1. Directions for spending funds on advertising, in%

Results

Achieving a positive commercial result requires efforts to increase the advantages of a trading organization in any situation, even if it operates successfully in the market. Commercial work must be carried out actively, ensuring a systematic increase in the volume of sales of goods and services while ensuring the profitable operation of the trading organization. In modern conditions of market development, uncertainty in the external environment and ever-increasing competition, the role of commercial activities of enterprises, ensuring business profitability and further development, is significantly increasing. Currently, commercial activity is considered not only as a process of performing trade and organizational operations, but also as the most important area of functioning of a trading enterprise, which has a significant impact on the final results of the work.

References

1. Gunyakov Y.V. Commerceology: a premonition of change. Innovative business models of commercial activity / Gunyakov Yu.V., Gunyakov D.Yu.-Krasnoyarsk: SFU, 2015.-160p.
2. Dashkov L.P. Organization and management of commercial activities / Dashkov L.P., Pambukhchiyants O.V.-M.: Publishing and trading corporation "Dashko and K", 2018. -400 p.

CONNECTING THE INTERNATIONAL MONETARY SYSTEM TO GLOBAL ECONOMIC TRANSFORMATION CHALLENGES

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Abstract

The stability of the international monetary system is a complex issue that requires constant attention and monitoring. The analysis of the current system, its mechanisms, processes, and the challenges it faces, clearly indicates the need for potential changes in its operation. Among the challenges, four are particularly noteworthy, requiring continuous research to understand their impact on national financial systems. These challenges are the rapid growth of Fintech, the increasing role of emerging economies within the international monetary system, the digitization of currencies, and the transition towards a multipolar international monetary system.

Keywords: *IMS, Hegemon Currency, FINTECH, Digital Money, Emerging Markets.*

Introduction.

The world economy is in a state of profound transformation, driven by a multitude of factors that are increasing its complexity. These changes are reshaping the global economic landscape and the management of international monetary and financial affairs. In this dynamic environment, the future evolution of the IMS is crucial for the development policies of national financial systems. Our research aims to shed light on these developments and their implications, emphasizing the following key points:

The IMS proved ineffective in the face of the global financial crisis. For the most part, we highlight two important factors that determined the depth of the fall of the world economy in the last crisis: procyclicality and financial innovation. The procyclical nature of the development of the global economy was associated, on the one hand, with false incentives for the development of financial management and corporate governance of financial institutions and, on the other hand, with a fundamental underestimation of long-term risks. Financial innovation, another factor, played a significant role in the unfolding of the crisis. New financial instruments, technologies, and non-traditional financial institutions appeared, while the risk management, financial supervision, and regulatory systems remained unchanged. In the years since the subprime financial crisis, changes and transformations have taken place, which can generate vulnerabilities.

National Financial Systems Interconnection with International Monetary System.

The collective efforts to reform the IMS continued after the Kingston conference. As Edward Bernstein predicted, the IMF and IMS today are very different from what they were in 1976 [1]. The SDR is not at the system's center, and floating exchange rates are more comfortable for national financial systems. IMF members have tried to respond to financial crises, meet the needs of countries in transition, and increase attention to financial stability. However, the changes made were ad hoc responses to emerging needs, not comprehensive reforms of the IMS themselves. One of the collective efforts to try to reform the IMS was at the G-20 meeting in 2011. Before the Cannes summit of the G-20, Michel Camdessus, former managing director of the IMF, Alexandre Lamfalussy, former managing director of the BIS and President of the European Monetary Institute, and Tommaso Padoa-Schioppa, former Minister of Economy and Finance of Italy founded an international group to develop a new vision of the international monetary order. The resulting initiative, the Palais Royal, was comprehensive but largely ignored by policymakers [2]. More recently, a group of IMF experts developed studies that proposed new policies to the IMF, explored reform options or revised existing policies, and presented an overview of the challenges facing the IMS [3].

According to this study, IMS today is a significant force. Thus, IMS has evolved over the past four decades to become less prescriptive than its predecessors, which had more rigid rules. Indeed, many of the features of the current IMS—freedom in choosing the exchange rate regime (with a de facto central role for the US dollar in the IMS), significant openness to trade, and capital flows—have provided more flexibility in responding to shocks and crises. At the same time, this evolution coincided with the period of commercial and financial globalization, with the reduction of poverty and the large-scale increase of incomes and inequality. However, the crisis of 2007/09 revealed considerable weaknesses in the IMS,

which provided an impetus for reform. In particular, the IMS has not prevented tensions between domestic policymaking and global financial stability from forming.

Moreover, weaknesses in financial supervision have allowed vulnerabilities to accumulate. As a result, the IMF and other institutions and groups of countries (FSB, G20) responded by taking substantial steps to revise the supervisory and lending toolkits. However, as the eurozone crisis deepened in 2011, policymakers focused on more immediate political challenges. Currently, the research of economic systems brings us closer to a deeper understanding of the foundations of the functioning of the economy, where technical-scientific progress inevitably generates the emergence of new "high" technologies, informational sub-branches, and "new" qualitative financial markets.

Therefore, we have identified the most significant challenges IMS faces (Figure 1).

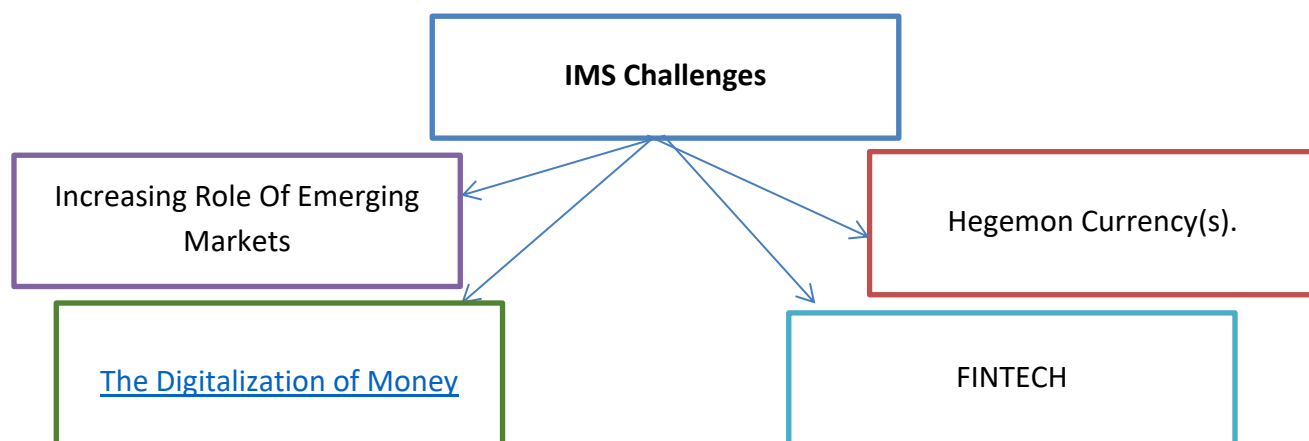


Figure 2. IMS Challenges

Several fundamental considerations are focused in the debate on the future shape of the SMFI:

1. The ability of the system to accommodate the growing economic power and active participation of the leading emerging economies, including a possible global role for their currencies
2. The system's adoption of the necessary institutional mechanisms to advance international co-operation while reducing the risks of protectionism, currency wars, and political conflict
3. Distributional equity in promoting the specific development needs and objectives of low-income developing countries

The significance of these elements has increased in recent years as the globalization of markets and industries has deepened the links between countries. However, the central issue in the SMFI debate is attributed to the hegemonic currency(s).

Currently, the dollar remains the dominant international currency. It maintains its position for several reasons. The US financial market is the most liquid in the world, and this status quo is self-reinforcing because the US financial system is so extensive that investors from all over the world concentrate their transactions in this market. All other aspirants to the role of the dominant international currency have many shortcomings [4]. The economies of the UK and Switzerland need to have the size and scope to provide markets with the scale required by the IMS. Japan's economy is periodically in crisis, and in the past, the Japanese government discouraged international use of the yen because that status discouraged export-oriented production by maintaining a "competitive" exchange rate. As for the EURO, according to Benjamin Cohen, it is a currency without a country - the product of an international agreement, not the expression of a single sovereign power. Its success, therefore, depends critically on the continued cooperation of EMU member states, which can hardly be guaranteed at all times. Decentralized decision-making among sovereign governments without coordination is potentially a recipe for disaster [5].

As it stands, the US dollar is the linchpin of the current international monetary system. It is the primary funding currency, with approximately half of all cross-border loans and international debt securities denominated in dollars. The majority of foreign exchange transactions, about 85%, are conducted in dollars. It also holds the lion's share of official foreign reserves, representing 56% [7]. Furthermore, almost half of international trade is invoiced in dollars, and approximately 58.77% of international payments are made in dollars [8].

The fact that global attraction to the yen, euro, and renminbi has not grown stronger is usually associated with one or a combination of these factors. For example, in the case of the euro, fragmented

domestic capital markets and the absence of a genuine European safe asset - one that provides stability in difficult economic times - would have prevented more comprehensive use of the euro [9].

However, the general consensus is that other currencies continue to face considerable obstacles to moving the US dollar into the IMS and that the system's shape can be expected to remain unchanged soon.

There is even an active debate in the literature about how long it takes for one major currency to replace another. The consensus is that the process takes years if not decades. [10]

In contrast, consumers have generally had much more limited exposure to and interest in the use of international currency, except in "dollarized" or "euroized" economies, where the US dollar or euro is, or was, the formal means or informal means of payment instead of the national currency [11].

Over time, due to the complex phenomena occurring in the IMS, the situation has changed significantly. Globalization, combined with the rapid evolution of online services, has fueled consumer demand for payment services that operate across borders and are much faster, cheaper, and easier to use. As a result, global tourism flows, for example, have doubled over the past 15 years. The number of internet users has doubled, as has the number of mobile phone users. Data transfer costs have dropped considerably, and access to more convenient services has expanded. Global remittances have increased by more than 50% in just ten years, while cross-border e-commerce activity has tripled [12]. As a result, the phenomenon of digitalization of currencies gained momentum.

Therefore, it is natural that new and emerging private payment methods mainly target consumers and employees, not merchants, who constitute a much larger category than potential users with associated network effects. This meant that existing digital initiatives were adopted much more quickly.

How we respond to the challenges of digitizing international currencies depends on the international monetary community. On the one hand, it can focus on efforts to ensure the prosperity of private payment systems in a space that respects common global policy priorities. Alternatively, mobilizations can be accelerated to overcome remaining weaknesses in global payment systems, where it is believed that only public money can provide a secure store of value, a credible unit of account, and a stable means of payment. There is a third option: doing both simultaneously and creating an environment where public and market-based payment systems effectively complement each other, jointly shaping the 21st-century payments universe [13].

To understand the drivers of international currency use in the digital age, we need to pinpoint the factors that determine international currency use. Given that consumers are at the heart of the competition for international digital currencies, the factors and their relative importance determining the extent and scope of global currency adoption could be permanently reconsidered following the change in their preferences [13].

Price stability remains a prerequisite for a currency's widespread use, whether digital or not. For this reason, many central banks worldwide have adopted price stability as their primary objective. This is why unstable crypto-assets such as bitcoin, whose price in fiat currencies is highly volatile, will never be able to serve as a reliable means of payment (Table 1). Finally, the currency with the lowest inflation rate would crowd out its competitors [13].

Table 1. Historical Annual Return, Bitcoin (in USD)

Year	Opening price	Closing price	Return (%)
2011	0.30	4.72	953.8%
2012	4.72	13.51	272.4 %
2013	13.51	758	4500 %
2014	737	322	-76.7 %
2015	322	429	69.3 %
2016	429	966	161.1 %
2017	966	13769	959.2 %
2018	13763	3830	-72.2 %
2019	3832	7208	89.5 %
2020	7208	28990	302.8 %
2021	28994	46306.45	39.8 %
2022	46311.75	16547.50	-65.1 %
2023	16547.91	42265.19	155.9 %

Source: [14].

In addition to stability, convenience is another important factor, especially for end consumers, which will play an increasing role in the digital age. This means that digitization can significantly change the way currencies compete with each other. It also follows that it will become much more difficult to predict the future contours of IMS [13].

A further challenge of IMS is the increasing role of emerging markets. Emerging and developing economies account for nearly 60% of global GDP and drive significant global poverty reduction. In the last three decades, China alone has lifted more than 600 million people out of poverty [15]. However, after years of success, emerging markets - as a group - are now facing a harsh new reality. Growth rates fell, capital flows reversed, and the medium-term outlook deteriorated sharply.

Moreover, based on current IMF forecasts, emerging and developing economies will converge to advanced economy income levels at less than two-thirds the pace that was forecast just a decade ago [16]. This is a problem not only for emerging markets but also for the developed world, which has come to rely on emerging markets as destinations for investment and customers for its products [15]. It also carries the risk of rising inequality, protectionism, and populism. According to Christine Lagarde, emerging and advanced economies must play their part to promote faster and more sustainable convergence. First, this requires boosting innovation - by removing barriers to competition, reducing red tape, improving labor mobility, and investing more in education and research. This would unleash entrepreneurial energy and help attract private investment in new, surprising, and valuable ideas [15]. Second - facilitating more significant technology exchanges between advanced economies and their emerging peers. This would require, for example, finding a balance between protecting intellectual property and disseminating technology.

Another critical area that could cause turbulence in IMS is the interaction between technology and financial services - FinTech. In the pre-COVID-19 period, there has been an increase in international interest in developing new payment and credit technologies, including digital payments, currencies, and online lending platforms, sometimes provided by non-bank providers. These initiatives promise to lower costs and improve access to finance for more underserved households and businesses. However, as with any financial innovation, these initiatives give rise to potential risks to financial stability, 242, as well as new opportunities. In addition to increased monitoring of these risks, rethinking and reforming the necessary regulatory structures, including the appropriate boundary between banking and non-banking activities when setting regulatory standards and providing access to central banks, may be necessary. The rapid development of monetary digitization and FinTech phenomena gives IMS even greater complexity.

Conclusion.

The world economy is going through a profound transformation caused by a series of factors that have direct implications for increasing the economy's complexity. As a result of these developments, the industrial landscape of the world economy and the management of international monetary and financial affairs are fundamentally changing. How the SMFI will evolve in the future is crucial for the development policies of national financial systems. In this context, we would like to mention the following:

1. Global economic and financial activity depends on the USD financing capacity. Wide international use of a dominant currency generates significant benefits for IMS, but also presents risks. The benefits come from network effects, which reduce capital transfer costs and risks around the financial system. The risks are generated by the exposure of many international investors and borrowers to the US dollar. Consequently, shocks to US monetary policy, US credit conditions, or general increases in global risk aversion are likely to be transmitted to domestic financial systems. These dynamics increase the imperatives of managing the risk of a reduction in cross-border flows by national financial systems.

2. The COVID-19 pandemic and its aftermath have produced vulnerabilities in the world economy. It highlighted the need for a better global financial safety net that protects emerging markets and developing economies. These countries face significant economic pressures even in regular times and have little room for maneuvering in the face of such devastating global shocks. Given the growing importance of emerging countries in the world economy, helping them to withstand such shocks should be in the interest of advanced economies.

3. How we respond to the challenges of digitizing international currencies depends on the international monetary community. On the one hand, it can focus on efforts to ensure the prosperity of private payment systems in a space that respects common global policy priorities. On the other hand, mobilizations can be accelerated to overcome remaining weaknesses in global payment systems, where it is believed that only public money can provide a secure store of value, a credible unit of account, and a stable means of payment. There is a third option: doing both simultaneously and creating an environment where

public and market-based payment systems effectively complement each other, jointly shaping the 21st-century payments universe.

4. FinTech presents unique opportunities for financial systems. The rapid changes in technology transforming the financial system will enable financial institutions to improve the execution of various core functions. However, some aspects of fintech represent significant new, unprecedented challenges. Adjusting the regulatory framework of financial systems to the challenges generated by FinTech is one of the main objectives of the new configuration of the financial architecture after COVID-19.

References

1. Bernstein, E. M. (1976). *The New International Monetary System*. In *Reflections on Jamaica*. In: *Princeton Essays in International Finance*, no. 115. New Jersey: Princeton University.
2. Boorman, J.T., Icard, A. (2011). *Reform of the International Monetary System: The Palais Royal Initiative*. New Delhi, India: SAGE Publications, 378 p.
3. IMF. (2016). *Strengthening the International Monetary System: A Stocktaking*. Washington: International Monetary Fund.
4. Eichengreen, B. (2010). *Exorbitant Privilege. The Rise and Fall of the Dollar and the Future of the International Monetary System*, Oxford: Oxford University Press, 224 pages
5. Cohen, B.J. *The Future of the Global Economy: The Euro Versus the Dollar*. London: Routledge, 2011. 208 p. ISBN 978-0415781497.
6. BIS. (2022). *The Triennial Central Bank Survey of foreign exchange and over-the-counter (OTC) derivatives markets*. Available Online: <https://data.bis.org/topics/DER/tables-and-dashboards>.
7. *Share of currencies held in global foreign exchange reserves from 1st quarter 1999 to 4th quarter 2023*. Available Online: <https://www.statista.com/statistics/233674/distribution-of-global-currency-reserves/>.
8. Statista. (2024). *Most used currency in the world for international payments in SWIFT*. Available Online: <https://www.statista.com/statistics/1189498/share-of-global-payments-by-currency/>.
9. Cœuré, B. (2019) *The euro's global role in a changing world: a monetary policy perspective* [online]. In: speech at the Council on Foreign Relations, New York City, 15 February 2019. Available Online: : <https://www.ecb.europa.eu/press/key/date/2019/html/ecb.sp190215~15c89d887b.en.html>
10. Chițu, L., Eichengreen, B., Mehl, A. (2014). *When did the dollar overtake sterling as the leading international currency? Evidence from the bond markets*. *Journal of Development Economics*, Vol. 111(C), pp. 225-245. ISSN
11. Calvo, G. (2002). *On dollarization*. *The Economics of Transition*, Vol. 10, No 2, pp. 393-403.
12. *Cross-border retail payments*. (2018). Committee on Payments and Market Infrastructures, February. Available Online: <https://www.bis.org/cpmi/publ/d173.pdf>.
13. Cœuré, B. (2019). *Digital challenges to the international monetary and financial system*. Toulouse School of Economics conference on "The Future of the International Monetary System." Available Online: <https://www.bis.org/review/r190918b.pdf>
14. Bitcoin. (2024). *Bitcoin (Cryptocurrency)*. Available Online: <https://www.upmyinterest.com/fund?tick=Bitcoin>
15. Lagarde, K. (2015). *The Role of Emerging Markets in a New Global Partnership for Growth* by IMF Managing Director Christine Lagarde. Available Online: <https://www.imf.org/en/News/Articles/2015/09/28/04/53/sp020416>
16. Lagarde, K. (2016). *A New Economic Multilateralism - CIRSD*. Available Online: <https://www.cirsd.org/sr-latn/horizons/horizons-spring-2016--issue-no-7/a-new-economic-multilateralism->

Geological and mineralogical sciences

OFFSHORE "DEVELOPMENT-IN-EXPLORATION" CONCEPT

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Abstract

The development of offshore oil and gas fields is currently one of the prospective, but economically high-cost trend of the oil and gas industry. The paper discusses the issue of upfront development at the stage of geological exploration ("Development-in-Exploration"), which makes it possible to improve the economic performance of offshore projects (primarily for small and medium-sized oil and gas discoveries).

Keywords: Hydrocarbons, offshore, field development, DHI, exploration, Gulf of Mexico, integrated model, development-in-exploration.

At present, compared to 1990 (Figure 1), there is a significant increase in oil production from offshore fields (an increase of more than 2 times from 12 to 28 million barrels per day), while in onshore fields the increase in daily production was 32% and only due to production from shale formations in the USA, Canada and Argentina [1]. Meanwhile, traditional HC formations have been under a steady decrease of daily oil production after the decade of 2000s. This problem is associated with an extended level of exploration of the world's onshore oil and gas basins and, accordingly, a decrease of the potential for the discovery of new large and medium-sized hydrocarbon fields in traditional reservoirs and the gradual exploitation of already discovered ones. Scientific and technological progress since the 80-90s of the 20th century has driven the development of the continental offshore (mainly the US shelf of the Gulf of Mexico and the shelf of the North Sea) in all regions of the world, reaching its apogee in 2005-2024. Offshore fields are characterized by increased technological complexity compared to onshore fields, as well as high CAPEX, which directly depend on the time of the project implementation from the beginning of exploration to the production of the "first oil".

To solve this problem, the authors consider the experience of discovering deposits in the offshore area of the Salino del Istmo basin (Gulf of Mexico, Mexico).

In contrast to the U.S. Gulf offshore, the studying area is the least explored area of the Mexican shelf. HC deposits were found mainly in the upper part of Tertiary sediments (Figure 2). The trapping mechanism is one of the main risk factors. The presence of HC deposits is confirmed by the evidence of DHI anomalies (attenuation of a negative seismic anomaly along a single hypsometric level), AVO analysis and seismic inversion, which makes it possible to select prospective structures only by the presence of DHI anomalies at the exploration stage. This fact is fully confirmed by the results of exploratory drilling within the basin – all 15 wells drilled within DHI targets confirmed the presence of HC deposits (the largest is Zama with geological reserves of about 400 Mtons, and all the rest - from 20 to 100 Mtons). It should be noted that targeted exploration for hydrocarbon deposits by the presence of DHI anomalies is widely used in various regions of the world for turbidite sediments, such as on the Norway and West Africa offshore [2]. Figure 3 shows an example of the identification of the DHI anomaly in the Turonian deposits at the Jubilee field (Ghana) and the UM4 formation at the Yoti prospect (Mexico). In general, HC deposits in the Salino-del-Istmo basin are confined to the raised wings of anticlinal structures bounded by faults [3] or adjacent to salt diapirs. In such traps, there are signs of an anomalous seismic attribute, which can be explained by the presence of hydrocarbons in oil reservoir (DHI). In several cases, the morphological features of amalgamated channel systems are well traced [5]. The genesis of HC deposits of Tertiary sediments is associated with the movement of fluids from Mesozoic sediments along faults and conservation in the encountered sand bodies.

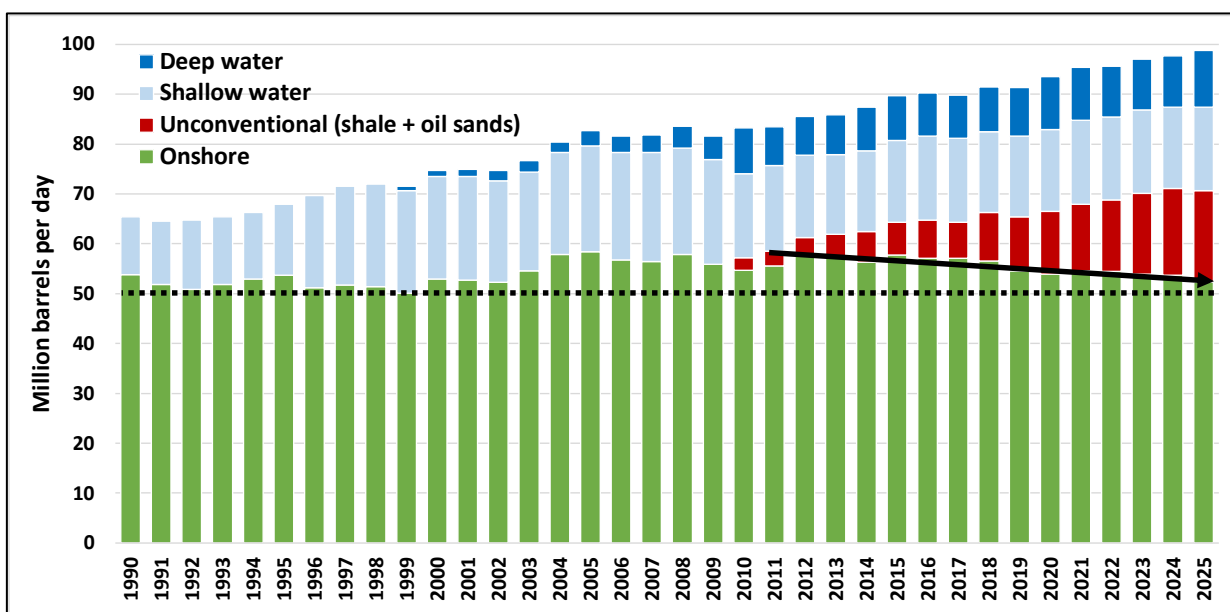


Figure 1. Global daily oil production by supply segment: comparison of oil production from conventional onshore, unconventional, shallow water and deep water. (Source 1990-2009: modified from Infield System, BP Statistical Review 2014. Source 2010-2025: modified from UCube, Rystad Energy 2019).

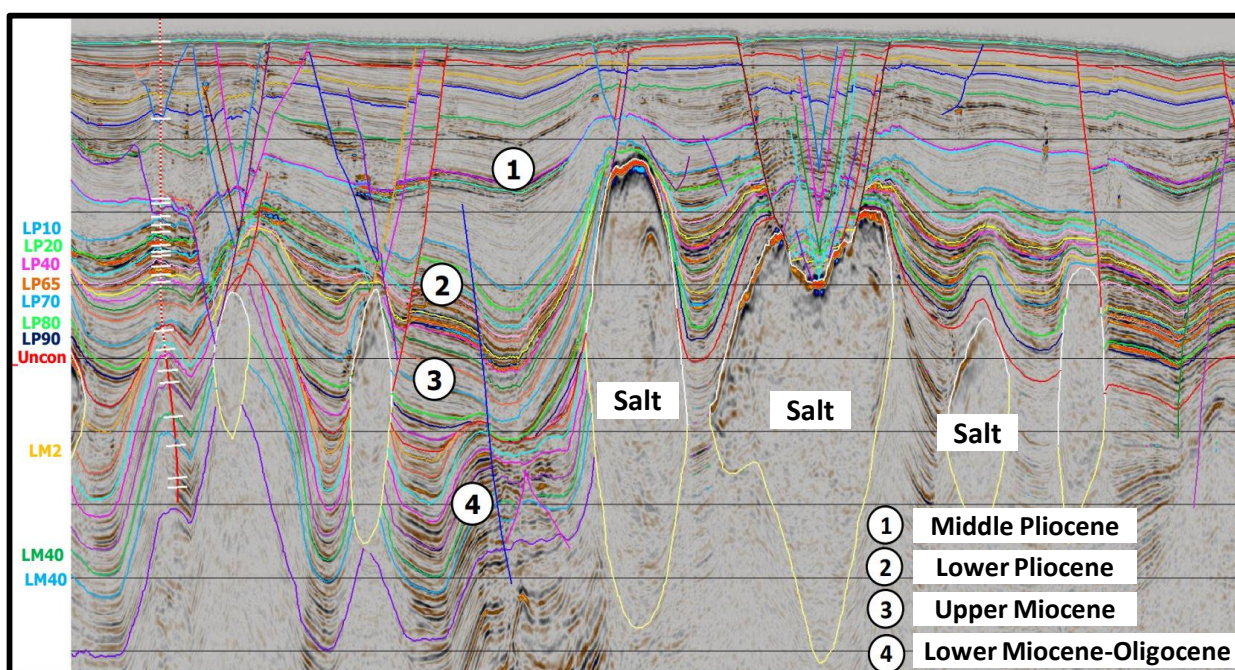


Figure 2. Example of a seismic section with the results of the structural interpretation.

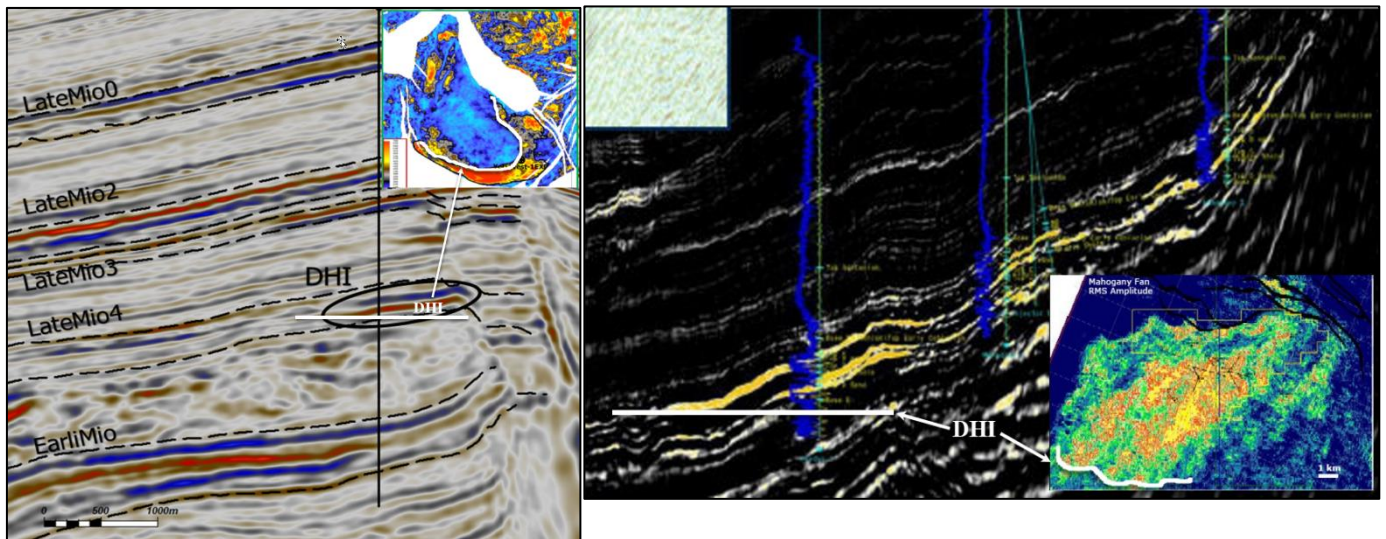


Figure 3. Identification of the DHI anomaly in the UM4 formation (left) at the Yoti prospect (Mexico) and the Turonian deposits (right) at the Jubilee field (Ghana).

Analysis of the available drilling results showed that the confirmation of the resources before and after drilling varies from 0.9 to 1.6 for prospects with DHI, averaging 1.2. Thus, we can confidently claim that a direct exploration feature of the HC presence has been found within the Salino-del-Istmo basin, which makes it possible to estimate the volume of expected HC with a high degree of probability and, accordingly, to start advanced planning for the prospect or a group of prospects development and facilities.

In modern international practice, the cost of drilling one exploratory well onshore varies from 1 to 30 MMUSD, depending on the depth and duration of the drilling. In the case of offshore drilling, the price of an exploratory or appraisal well can vary from 20 to 200 MMUSD, depending on many factors (mobilization, water depth, depth of the prospective target, downtime due to technical and weather reasons, formation evaluation program, etc.). The cost of offshore drilling rigs is dozens of times higher than onshore ones, and the daily rate for drilling platforms varies from 150 to 500 KUSD/d depending on the region and water depth. Therefore, the design of offshore exploration and appraisal wells should be planned with the possibility of further use as part of the development set of wells (for production or injection).

However, the main factor influencing the economics of a project is the development where the costs can rise to billions of dollars which in turn is critical for small and medium-sized fields. Depending on the operator's approach to the offshore development, the new field can either be started up via long tie-backs to an existing facility or by installing a new "standalone" facility such as fixed platforms (jacket platform or compliant tower) or floating platforms (TLP, SPAR, FPS or FPSO). The development wells might be set up with dry trees allowing direct access to the well at surface or wet tree production systems that can be configured in multiple ways (satellite, cluster, or daisy chain well system). Common subsea facilities can include multiphase pipelines, subsea boosting and processing, artificial lift methods and distribution systems. To accelerate the evaluation and optimization of different development concepts from a technical and economic perspective it is required to start the development system planning (FEED) within the exploration period for further preparation of the field development plan (FDP). While the economics of large and unique fields (such as Zama in the Salino-del-Istmo basin) can withstand long design periods until the first oil, then for small and medium-sized HC fields, each year before the start of production is extremely critical for maintaining a positive project NPV.

Thus, for the prospective structures of the Salino-del-Istmo basin with medium HC reserves, it is necessary to significantly optimize the process (duration) of field preparation for production. The authors propose the concept of advanced development at the stage of geological exploration (development in geological exploration), which includes the following main stages (Figures 4 - 7):

Stages for "Development-in-Exploration" [4].

1. Prospect selection with only DHI anomalies (Figure 4).
2. Assessment and selection of the highest priority (more than 10 Mtons of STOIIIP) groups of prospects (groups consist of 1-5 prospects) for further development (Figure 4).
3. Confirmation of the first prospect by the drilling results and re-evaluation of the remaining prospective groups updating (Figure 4).

4. Performing a feasibility study considering the drilling results of the first exploration well for all selected prospective groups based on a conceptual integrated model (Figure 4).

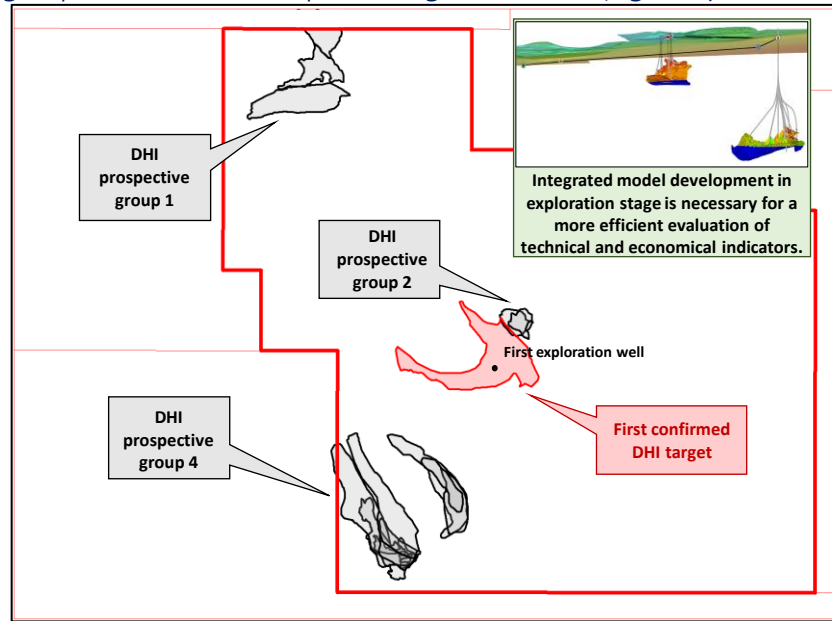


Figure 4: Selection of DHI prospective groups and confirmation of the first DHI target.

5. Preparation and drilling of all other DHI prospects (Figure 5).

6. In parallel with the process of exploration of the selected prospects, a conceptual pre-FEED is being prepared, in term of evaluating all possible options of development concept optimization by considering the use of multilateral horizontal wells, construction of a Central Processing Platform (CCP) on the location of the first drilled prospect and subsea configuration of the remaining groups of prospects with connection to the main CCP (Figure 5).

7. As the selected groups of structures are drilled, the pre-FEED is updated, and a FEED is formed for Phase 1 – production from the first drilled prospect (group of prospects). Evaluation of a scenario for possible replenishment of HC deposits [6], considering the high abnormal formation pressure of oil deposits discovered within the Salino-del-Istmo basin (Figure 5).

8. Preparation and start of pilot production:

a) The first drilled discovery can be connected to existing neighboring fields (synergy) before the completion of the production platform. For this purpose, exploration wells can be converted to injection wells (since they usually perforate OWC), and appraisal wells can be converted to production wells (since they perforate the oil/gas zone with maximum NetPay). Appraisal wells construction should be planned with the possibility of further production. The appraisal well is drilled as a vertical to perform all geological and geophysical studies and ORA testing, after which a 500-1500 m side track is drilled, than a short ORA test is performed in side track and the well is conserved before the pilot production starting. This will increase production rates at the pilot production stage and accelerate the acquisition of interference between the exploration and appraisal wells during interference well testing implementation. (Figure 5-6).

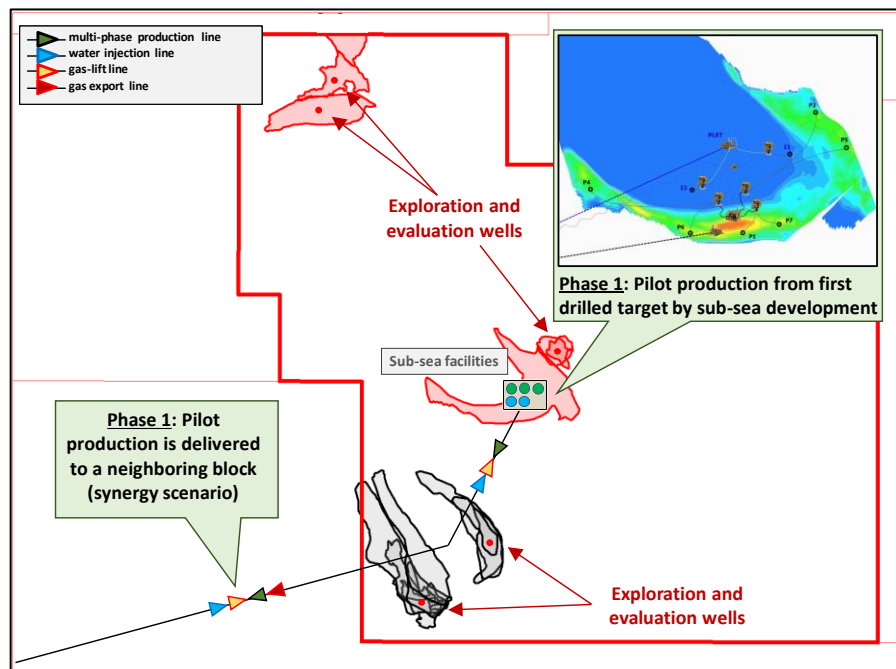


Figure 5: Exploration drilling for remaining prospective DHI groups and start of pilot production.

8. Preparation and start of pilot production:

b) By the time a production platform is installed at the first drilled prospect, the remaining prospects will be connected according (in case of success) to a technical platform located in the first drilled discovery (Figure 6).

9. Performing interference tests for wells carrying out pilot production to remove risks and uncertainties in achieving designed production levels [7] (Figure 6).

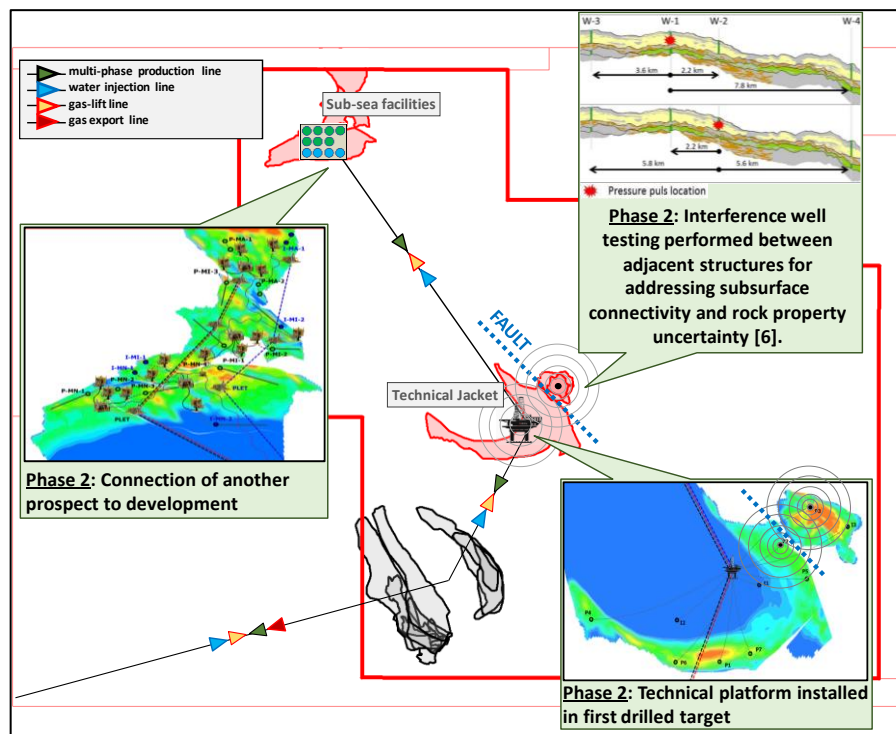


Figure 6: Involving of another discovery to pilot production and interference well testing implementation.

10. By the time the exploration stage is completed, a FEED for Phase 2 and subsequent phases is formed for all discoveries, including a scenario for the installation of an additional production platform at another prospective group, if this improves the economical indicators of the project (Figure 7).

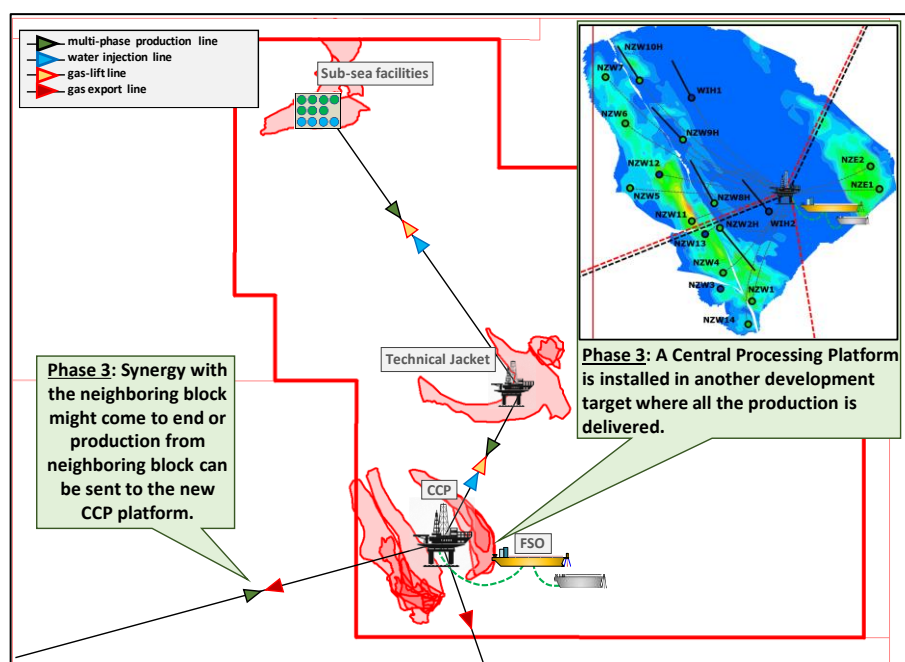


Figure 7: Development concept for involving of all prospective groups into development.

Advanced development approach (Development-in-Exploration) will definitely improve the economic performance of the Salina-del-Istmo Basin projects (including similar prospects with turbidite genesis deposits) and achieve a positive NPV even for prospects and discoveries with small HC resources. Pilot production for discoveries with small and medium resources is a key factor of the project success.

Globally, the implementation of the proposed approach will make it possible to involve in the development of already discovered, but "abandoned" due to the small resources of offshore fields. Also it will allow to increase the total world daily production of offshore fields by 3-10 MBBL and, thus, compensate the decline of onshore oil fields production from traditional reservoirs.

The success of the implementation of the "Development-in-Exploration" approach is not only focused on changing the traditional oil and gas development philosophy of the Operators but also the positive involvement of the governmental regulatory authorities. In this context, motivation and support from the government institutions will be required to accelerate implementation of these changes by establishing more flexible guidelines and permissions for Operators.

References

1. Бочкарев В.А. Концепция освоения сланцевых углеводородов – М.: ДПК Пресс, 2021. – 332 с. ISBN 978-5-91976-213-3.
2. Георгиевский Б.В., Бочкарев В.А., Ситар К.А. Управление геологическими рисками и стратегия геологоразведочных работ. М.: ОАО «ВНИИОЭНГ». – 2019. – 176 с. ISBN 978-5-6041276-7-4.
3. V.A. Bochkarev, A.V. Bochkarev. Faults and hydrocarbons potentials. M.: JSC "VNIIOENG", 2017. – 392p. ISBN 978-5-88595-156-2.
4. V. Bochkarev, A. Grubnik. Offshore "Development-in-Exploration" approach on the example of the Salino del Istmo Basin (Gulf of Mexico). Danish Scientific Journal, 82, 2024. p. 3-8. <https://doi.org/10.5281/zenodo.10899555>
5. Конюхов А.И. Геологическое строение, этапы развития и нефтегазоносные комплексы бассейна Мексиканского залива // Литология и полезные ископаемые. - 2008. – №4. – С. 425 – 440.
6. Бочкарев В.А., Бочкарев А.В. Восполняемые запасы залежей углеводородов. – М.: ОАО «ВНИИОЭНГ». – 2017. – 276 с. ISBN 978-5-905714-95-5.
7. Denis Zubarev, Ruslan Mardanov, Vitaly Bochkarev, Vyacheslav Khmelevskij. Flexible Multi-Well Interference Test Design for a Deep-Water Field. SPE Russian Petroleum Technology Conference, 22-24 October, Moscow, Russia. SPE-196837-MS.

Mathematical sciences

MATHEMATICAL MODELLING OF WEIGHT LOSS BASED ON ORDINARY DIFFERENTIAL EQUATIONS

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Abstracts

With the improvement of people's living standards and the accelerated pace of life, obesity has become more common, and scientific weight loss has come into being. In this paper, an ordinary differential equation is applied to establish a weight loss model, and the effects of diet, metabolism, work and physical exercise on body weight are discussed, providing a theoretical basis for scientific weight loss.

Keywords: BMI, ordinary differential equations, weight loss modelling, body weight, calories

1 Problem analysis

Body Mass Index (BMI)[1] is an internationally used measure of body fatness and health. The index is calculated by dividing the weight (kg) by the square of the height (m), the ratio obtained by this formula can reflect the density of the human body to a certain extent, and the provisions of the ratio of 18.5-25 for normal, greater than 25 for overweight, more than 30 for obesity. Because of the simplicity of the calculation, BMI is now commonly used to evaluate the nutritional status of the human body, the degree of fat and thin or physical development level.

Obesity is, in a sense, the excess of fat over the norm. If a person absorbs food containing too many calories, these excess calories in the body are converted to fat and weight is gained. In order to lose weight, it may seem necessary to eat less or not eat at all, but in order to maintain life, a certain amount of energy (calories) must be consumed to maintain the most basic metabolism, and calories are also consumed for work, study and physical activity. Therefore, weight loss should be based on a correct analysis of the relationship between diet, metabolism, work and physical activity. A mathematical model of weight loss is thus developed.

2 Model hypothesis

(1) Assuming that a person's daily intake of calories from food is a kJ, of which b kJ is used for metabolism (i.e., auto-consumption), while α kJ per kg of body weight must be consumed every day for work and life, and β kJ per kg of body weight must be consumed every day for physical exercise.

(2) A person's calorie stores in the form of fat are 100 per cent effective, and 1 kg of fat contains 42,000 kJ of calories.

(3) Let weight $\omega = \omega(t)$ be a continuously differentiable function of time t .

3 Modelling

It is generally believed that changes in body weight are caused by the disruption of energy conservation in the body [2]. When the body's calorie intake exceeds the body's consumption, it is a positive energy balance, and the excess calories are converted into fat and stored in large quantities in the body, resulting in an increase in body weight; on the other hand, when the body's calorie intake is less than the body's consumption, it is a negative energy balance, and when the calories intake does not satisfy the body's needs, the body tissues break down to meet the body's needs, resulting in a decrease in body weight. Obviously, the daily change in a person's body weight is equal to the body weight produced by the input of calories minus the body weight consumed by the output of calories, where the input of calories is the net absorption of calories after deducting the metabolism, and the output of calories is the total amount consumed by work, life and physical exercise.

Since 1kg of fat contains 42000 kJ of calories, a person's net absorption of fat per day is $\frac{a-b}{42000}$, and the net consumption of fat per kg of body weight per day is $\frac{\alpha+\beta}{42000}$. The change in body weight from t to $t+\Delta t$ is then known as

$$\Delta\omega = \omega(t+\Delta t) - \omega(t) \approx \frac{a-b}{42000}\Delta t - \frac{\alpha+\beta}{42000}\omega(t)\Delta t.$$

The resulting mathematical model for weight change is

$$\begin{cases} \frac{d\omega}{dt} = \frac{(a-b) - (\alpha+\beta)\omega}{42000}, \\ \omega(0) = \omega_0. \end{cases} \quad (1)$$

4 Model solving

Solving equation (1), we have

$$\int \frac{d\omega}{(a-b) - (\alpha+\beta)\omega} = \int \frac{dt}{42000},$$

Using the initial conditions $\omega(0) = \omega_0$, the solution gives

$$a-b - (\alpha+\beta)\omega = [a-b - (\alpha+\beta)\omega_0]e^{-\frac{(\alpha+\beta)t}{42000}},$$

arrange to get

$$\omega(t) = \frac{a-b}{\alpha+\beta} - \frac{a-b - (\alpha+\beta)\omega_0}{\alpha+\beta} e^{-\frac{(\alpha+\beta)t}{42000}}. \quad (2)$$

The derivation of equation (2) gives

$$\frac{d\omega}{dt} = \frac{a-b - (\alpha+\beta)\omega_0}{42000} e^{-\frac{(\alpha+\beta)t}{42000}}. \quad (3)$$

From equation (3) the effect of weight loss (fattening) can be analysed as follows.

(1) If $a-b > (\alpha+\beta)\omega_0$, i.e., the net daily absorption is greater than the total initial consumption,

$\frac{d\omega}{dt} > 0$, then weight gain occurs.

(2) If $a-b < (\alpha+\beta)\omega_0$, i.e., the net daily absorption is less than the total initial consumption,

$\frac{d\omega}{dt} < 0$, then weight loss will occur.

(3) If $a-b = (\alpha+\beta)\omega_0$, i.e. net daily absorption equals total initial consumption, $\frac{d\omega}{dt} = 0$, then

body weight remains unchanged.

(4) Taking the limit at both ends of the equation (2)

$$\lim_{t \rightarrow +\infty} \omega(t) = \frac{a-b}{\alpha+\beta}. \quad (4)$$

5 Conclusion

The results of the above analyses show that with proper control of a (eating), b (metabolism), α (work, life), and β (physical activity), it is possible to keep body weight within a certain range, and mathematically, $e^{-\frac{(\alpha+\beta)t}{42000}}$ decays very quickly, with body weight generally approximating $\frac{a-b}{\alpha+\beta}$ within a limited

period of time (e.g., 3-4 months). Therefore, in order to lose weight, it is necessary to reduce a , increase b , α and β . From a safety and health point of view, individuals should not lose more than 0.2 kg of weight per day, and health experts suggest that it is appropriate for the average person to lose 2.5 to 4.0 kg of weight per month [3]. It is necessary to point out that some diet pills on the market may have

some kind of quick-acting effect on b (metabolism), but human metabolism cannot go against the physiological laws of the human body, so some drugs are forced to drastically change the metabolism of a person, but instead, they have adverse consequences for the human body. The correct strategy for weight loss is, above all, a good diet, work and exercise habits, i.e. proper control of a and $\alpha + \beta$. Of course, for a small number of obese people and athletes, the study of metabolic changes that do not harm the body is also necessary.

References

1. Jiang Qiyuan. *Mathematical Modelling (Fourth Edition)* [M]. Beijing: Higher Education Press, 2011: 117-119.
2. Ma Chunlian. *Awareness and discussion of new perspectives on exercise weight loss* [J]. *Sports Research and Education*, 2012(12) : 120-123.
3. Ma T, Huang B, Zhou JL et al. *Reconsideration of some problems in exercise weight loss* [J]. *Journal of Jilin Institute of Physical Education and Sports*, 2009(8) : 341-345.

SUBOPTIMAL CONTROL OF INTENSIVE ELECTROLYSIS PROCESS

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СУБОПТИМАЛЬНЕ КЕРУВАННЯ ІНТЕНСИВНИМ ПРОЦЕСОМ ЕЛЕКТРОЛІЗУ

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Запропоновано метод наближеного розв'язку сингулярно-збуреної задачі оптимального керування інтенсивним процесом електролізу. Побудовано субоптимальне керування, що використовують асимптотику нульового порядку та оцінено близькість отриманого наближеного розв'язку до точного.

Процес електролізу в прикатодному шарі описується функцією $c(x, t)$ яка усередині області $Q = \{[0, \delta] \times [0, T]\}$ задовольняє рівнянню

$$\tau_r c_{tt} + c_t = D c_{xx} \quad (1)$$

з початковими умовами

$$c(x, 0) = c_0(x), \quad c_t(x, 0) = \varphi(x), \quad (2)$$

та граничними умовами $c_x(0, t) = \frac{p(t)}{a}, \quad c(\delta, t) = \psi(t), \quad (3)$

де τ_r - час релаксації, $p(t)$ - катодна густина струму розряду іонів металу, $a = Z \cdot F \cdot D$ - електрохімічна стала, $c(x, t)$ - концентрація іонів металу в об'ємі електролізера, δ - товщина прикатодного шару.

Потрібно знайти таке керування $p(t)$, що задовольняє умову

$$\int_0^T p^2(t) dt < \infty, \quad (4)$$

щоб після закінчення процесу електролізу виконувалася умова

$$c(x, T) = \theta(x),$$

а функціонал енергії

$$I[p(t)] = \int_0^T p^2(t) dt$$

набував найменшого значення.

Використовуючи [1] вдалося довести, що ця задача еквівалентна задачі з мінімальною енергією з функціоналом якості

$$I[p(t)] = \int_0^T p^2(t) dt + \frac{1}{\beta} \int_0^\delta [c(x, T) - \theta(x)]^2 dx, \quad (5)$$

$$\|p(t, \beta) - p(t)\|_{L_2(0, T)} \rightarrow 0 \text{ при } \beta \rightarrow 0.$$

Застосовуючи принцип максимуму Понтрягіна [2] для вирішення цього завдання, отримуємо, що оптимальне керування $p(t)$ в цій задачі визначається за формулою

$$p(t) = -\frac{D}{2a\beta} V(0, t), \quad (6)$$

де $V(x, t) \in$ єдиним розв'язком крайової задачі (7) – (9)

$$\begin{aligned} \tau_r V_t'' - V_t' &= DV_{xx}'', (7) \\ \begin{cases} V(x, T) = -2c_t(x, T); \\ \tau_r V_t(x, T) = -2c_t(x, T) + 2[c(x, T) - \theta(x)]; \end{cases} (8) \\ \begin{cases} V_x(0, t) = 0; \\ V(\delta, t) = 0. \end{cases} (9) \end{aligned}$$

Оскільки час релаксації τ_r є малим параметром, а задачі (1) – (3), (7 – 9) – сингулярно-збурені, то шукаємо їх розв'язки у вигляді суми регулярної складової та функції граничного шару, кожен з яких зображаємо як суму ряду за степенями τ_r

$$c(x, t) = \bar{c}(x, t) + \text{П}c(x, \tau), \quad V(x, t) = \bar{V}(x, t) + QV(x, \bar{\tau}), (10)$$

$$\bar{c}(x, t) = \sum_{i=0}^{\infty} \tau_r^i \bar{c}_i(x, t); \quad \text{П}c(x, \tau) = \sum_{i=0}^{\infty} \tau_r^i \text{П}c_i(x, \tau). (11)$$

$$\bar{V}(x, t) = \sum_{i=0}^{\infty} \tau_r^i \bar{V}_i(x, t); \quad QV(x, \bar{\tau}) = \sum_{i=0}^{\infty} \tau_r^i QV_i(x, \bar{\tau}), (12)$$

де $\tau = t / \tau_r$; $\bar{\tau} = (T - t) / \tau_r$ - швидкі змінні в околі точок $t = 0$ і $t = T$ відповідно.

Підставляючи ряди (11) і (12) до рівнянь (1) і (7), граничних умов (3) і (9), та прирівнюючи коефіцієнти при однакових степенях τ_r , окремо залежні від $t, \tau, \bar{\tau}$, отримуємо задачі для регулярних складових порядку τ_r^0 та граничних функцій

$$\begin{cases} \bar{c}_{0t} = D\bar{c}_{0xx} \\ \bar{c}_0(x, 0) = \bar{c}_0(x) \end{cases} \quad \begin{cases} -\bar{V}_{0t} = D\bar{V}_{0xx} \\ \bar{V}_0(x, T) = -2[\bar{c}_0(x, T) - \theta(x)] \end{cases} (13)$$

$$\begin{cases} \bar{c}_{0x} = -\frac{D}{2a\beta} \bar{V}_0(0, t) \\ \bar{c}_0(\delta, t) = \psi(t) \end{cases} \quad \begin{cases} V_{0x}(0, t) = 0 \\ V_0(\delta, t) = 0 \end{cases} (14)$$

$$\begin{cases} \text{П}c_{0\tau\tau} + \text{П}c_{0\tau} = 0, \quad i = 0 \\ \text{П}c_{i\tau\tau} + \text{П}c_{i\tau} = D\text{П}c_{i-1xx}, \quad i \geq 1 \end{cases} \quad \begin{cases} QV_{0\bar{\tau}\bar{\tau}} + QV_{0\bar{\tau}} = 0, \quad i = 0 \\ QV_{i\bar{\tau}\bar{\tau}} + QV_{i\bar{\tau}} = DQV_{i-1xx}, \quad i \geq 1 \end{cases} (15)$$

Щоб із отриманих рівнянь визначити члени розвинень (11) та (12), потрібно задати початкові умови. Їх отримуємо, підставляючи (11), (12) у вихідні початкові умови (2) та (8) та прирівнюючи коефіцієнти при однакових степенях τ_r .

$$\text{П}c_0(x, 0) = c_0 - \bar{c}_0(x, 0); \quad \text{П}c_{0\tau}(x, 0) = 0$$

$$QV_0(x, 0) = -2\bar{c}_t(x, T) - V_0(x, T); \quad QV_{0\bar{\tau}}(x, 0) = 2\bar{c}_t(x, T) + \bar{V}_0(x, T). (16)$$

Співвідношення для визначення коефіцієнтів i -го порядку рядів (11), (12) можна виписати формально для $i \geq 1$. Так як маємо справу з розподіленою системою, то використання кожної наступної складової розкладів (11), (12) вимагає дослідження на розв'язність та підвищення вимог до гладкості функцій [3], що входять до задачі.

Для побудови наближеного керування найпростішого виду, обмежимося дослідженням систем (13), (14) та (15), (16).

Використовуючи [2], доведена наступна теорема.

Теорема 1. Субоптимальне керування $p^0(t)$ є рішенням інтегрального рівняння із

$L_2(0, T)$

$$\beta p^0(t) = f(t) - \int_0^T k(t, \tau) p^0(\tau) d\tau, (17)$$

$$\partial_e f(t) = \frac{bD}{a} \sum_{n=1}^{\infty} e^{\lambda_n^2 D(t-T)} \gamma_n, b = \sqrt{\frac{2}{\delta}};$$

$$k(t, \tau) = \frac{D^2 b^2}{a^2} \sum_{n=1}^{\infty} e^{\lambda_n^2 D(t+\tau-2T)};$$

$$\gamma_n = \int_0^{\delta} \left(1 - \frac{x}{\delta}\right) x_n(x) dx + \frac{b S I_0}{V z F} \frac{(-1)^{n+1}}{\lambda_n^3 D} (1 - e^{-\lambda_n D T}).$$

Єдиність розв'язку рівняння (17) витікає з того, що $f(t) \in L_2(0, T)$, та додатної визначеності ядра $k(t, \tau)$. За допомогою методів розв'язування рівнянь з виродженим ядром [2] знаходимо розв'язок рівняння (17). Субоптимальне керування матиме вигляд

$$p_0(t) = \frac{b}{a} \sum_{n=1}^{\infty} (\gamma_n - g_n) e^{\lambda_n D(t-T)} - \frac{D}{2a\beta} QV^0(0, t), (18)$$

в якому константи g_n визначаються з нескінченної системи лінійних неоднорідних алгебраїчних рівнянь.

Оцінку близькості субоптимального керування задачі до оптимального дають такі теореми.

Теорема 2. Оптимальне керування задачі (1)–(5) $p(t)$ збігається до субоптимального $p^0(t)$ при $\tau_r \rightarrow 0$, і знайдуться такі сталі τ_r^0, c , що за умови $0 \leq \tau_r \leq \tau_r^0$,

$$|p(t) - p^0(t)| \leq c \tau_r \quad \forall \quad 0 \leq t \leq T.$$

Теорема 3. Якщо початкові умови задачі (1)–(5) задовольняють умовам $c_0(x) \in W_2^1(0, 1)$, $\theta(x) \in L_2(0, 1)$, то існує таке $0 < \tau_n \leq \tau_r^0$, що

$$|I[p] - I[p^0]| \leq c \tau_r^2.$$

Тут $I[p^0] = \frac{1}{\beta} \sum_{n=1}^{\infty} (\gamma_n - g_n) \gamma_n$ - відповідне субоптимальне значення функціоналу задачі.

Запропонована методика дозволила побудувати асимптотику розв'язку задачі оптимального керування для сингулярно збуреного гіперболічного рівняння. Доцільно відмітити, що використання законів керування більш високого порядку, ніж нульовий, потребує додаткових досліджень на розв'язність [4] відповідних самоспряжених задач і підвищення обмежень на гладкість функцій, що входять до задачі.

Literature

1. Egorov A.I. Fundamentals of management theory// М.: Fizmatlit, 2004. -504 p.(russian)
2. Egorov O.I., Mikhaylova T.F. Synthesis of optimal control of a thermal process with limited control//Automatics,-1990,-№3-р,57-61.
3. Babich, Yu. P., Mikhaylova T. F. Sharp Estimates for the Best Approximations of Smooth Functions in C_{2n} in Terms of Linear Combinations of the Modules of Continuity of Their Derivatives. // Ukrainian Mathematical Journal. – 2022. – Vol. 74, Iss. 4. – P. 651– 655. – DOI: 10.1007/s11253-022-02090-6.
4. Maksymenkova I. A., Michaylova T. F. On One Property of the Moduli of Continuity for Periodic Functions of Higher Orders/ Ukrainian Mathematical Journal. – 2023. – Published: 01 February 2023. – P. 651– 655. – DOI: 10.1007/s11253-023-02137-2.

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ASPECTS OF SCENARIOS FOR THE DEVELOPMENT OF CARBON NEUTRALITY IN THE SYSTEM OF NATURAL RESOURCE USE

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АСПЕКТЫ СЦЕНАРИЕВ РАЗВИТИЯ УГЛЕРОДНОЙ НЕЙТРАЛЬНОСТИ В СИСТЕМЕ ИСПОЛЬЗОВАНИЯ ПРИРОДНЫХ РЕСУРСОВ

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Abstract

Scenario modeling allows policy makers to see the implications of climate policy on emissions, energy costs, security of supply, storage, and fixed supply requirements versus variable energy supply requirements. Policy makers can use simulation to identify technology and performance gaps and make decisions about which technologies to support by understanding investment costs, lead times, and including all of their benefits and risks. Early involvement of policy makers in modeling is essential to ensure awareness, flexibility and agility to develop policies to achieve carbon neutrality by 2050. Policy agility and flexibility will be required to change paths if the technologies currently being developed do not live up to expectations. Trade-offs will need to be found between different technological options, costs, pathways, energy security and environmental protection.

Simulation necessarily entails numerous assumptions about various future events. These include intertemporal dynamics, the availability and productivity of technology, socio-political preferences, constraints and boundaries. This assumption will form the conclusions as the modellers form the scenarios. Future scenarios are based on transparent assumptions about future events

quantify dimensions and variables, especially when different stakeholders have different perspectives on issues, dynamics, or desired outcomes. These assumptions are intended to take into account various factors, such as the levels of technical, commercial and social readiness of various technologies, but they may not fully reflect the uncertainties about how they will be deployed, and such technologies may not be available in a timely manner and at expected prices.

Аннотация

Моделирование сценариев позволяет лицам, определяющим политику, увидеть последствия климатической политики для выбросов, затрат на энергию, надежности поставок, хранения и постоянных требований к поставкам по сравнению с переменными потребностями в поставках энергии. Политики могут использовать моделирование для выявления недостатков технологий и производительности и принятия решений о том, какие технологии следует поддерживать, путем понимания инвестиционных затрат, сроков выполнения заказов, а также включая все их преимущества и риски. Заблаговременное привлечение политиков к моделированию необходимо для обеспечения информированности, гибкости и стратегичности, с целью разработки политики по достижению углеродной нейтральности к 2050 году. Потребуется оперативность и гибкость политики, чтобы изменить пути, если разрабатываемые в настоящее время технологии не оправдают ожиданий. Необходимо будет найти компромиссы между различными технологическими вариантами, затратами, путями, энергетической безопасностью и защитой окружающей среды.

Моделирование обязательно влечет за собой многочисленные предположения о различных будущих событиях. К ним относятся межвременная динамика, доступность и производительность технологий, социально-политические предпочтения, ограничения и границы. Это предположение будут формировать выводы по мере того, как разработчики моделей будут формировать сценарии. Сценарии будущего основаны на прозрачности предположений касательно будущих событий, затрагивающих все соответствующие аспекты энергетической системы. Аналитики и специалисты по планированию сталкиваются трудностями при количественной оценке параметров и переменных, особенно когда разные заинтересованные стороны имеют различные взгляды на проблемы, динамику развития или желаемые результаты. Эти предположения направлены на учет различных факторов, таких, как уровни технической, коммерческой и социальной готовности различных технологий, однако они могут не в полной мере отражать факторы неопределенности в отношении путей их внедрения, и такие технологии не могут быть получены своевременно и по ожидаемым ценам.

Keywords: forest, economy, ecology, energy, environment, biodiversity, innovations, investments.

Ключевые слова: лес, экономика, экология, энергетика, окружающая среда, биоразнообразие, инновации, инвестиции

Энергетическая инфраструктура, построенная сейчас, должна соответствовать требованиям нулевого энергопотребления, чтобы избежать проблем с активами. Срок эксплуатации всех активов масштаба инфраструктуры составляет более 30 лет. Следовательно, любые объекты, построенные сейчас, должны соответствовать национальным целевым показателям выбросов или легко модернизироваться в будущем.

Учитывая временные рамки и характер этого перехода, моделирование показывает, что в течение многих лет требуется очень крупномасштабная система CCUS. Она действует как последнее средство, если переход задерживается. Что в свою очередь, позволяет продолжить работу в основных отраслях промышленности, таких как производство цемента, стали и химикатов, с трудом поддающихся сокращению, и даже при достижении углеродной нейтральности может потребоваться дальнейшее сокращение выбросов парниковых газов. Поскольку скорость, необходимая для декарбонизации, сейчас очень высока, CCUS может продлить срок эксплуатации несоответствующей инфраструктуры, ограничить чрезмерные затраты на энергетический переход и избежать социальных потрясений. [1, 10]

Энергоэффективность и оптимизация станут основой всей политики в области энергетики. Это важный элемент управления спросом на энергию в мире с нулевым уровнем выбросов к

2050 году. Что в свою очередь потребует быстрого развертывания мер по повышению эффективности и создания оптимального спроса на здания, промышленность и транспорт. Политические меры будут включать значительные инвестиции и обучение персонала для выполнения монументальной задачи. Политика должна поощрять, а не задерживать изменения в энергетической системе.

Моделирование в рамках проекта «Пути к устойчивой энергетике» показало, что прогресс был слишком медленным, для достижения углеродной нейтральности на пути к целевому показателю 1,5–2°C должны либо дополнительно сократить, либо улавливать не менее 90 Гт диоксида углерода к 2050 году «середине пути» социально-экономического прогноза 90 Гт-эквивалентны текущим глобальным выбросам CO₂ за четыре года. Необходимо внедрять политику для снижения и оптимизации спроса энергию, обезуглероживания энергоснабжения и внедрения инженерных и естественных технологий удаления углерода. [2, 16]

Исследования по Оценке жизненного цикла показывают, что не существует полностью углеродно-нейтрального энергетического решения. Все технологии требуют материалов и высокотемпературных процессов, которые приводят к выбросам парниковых газов. Решения по возобновляемым источникам энергии требуют стали, цемента и кремния. Для электромобилей и сетей в аккумуляторных батареях требуются редкоземельные металлы. Водород может попасть в атмосферу и оказать негативное воздействие. Инвестиции в энергетику могут означать увеличение выбросов сегодня, что позволит сократить выбросы в будущем. Моделирование не требует учета этого изменения в перспективах, энергетических моделях и моделях выбросов парниковых газов (GHG) в экономике, поскольку оно моделируется с использованием исторических тенденций. [3, 19]

Взаимодействие технологий : Уровни технологической готовности (TRLs) являются методом оценки зрелости технологии. Уровни коммерческой готовности (CRLs) представляют собой метод, позволяющий оценить различные показатели, которые влияют на коммерческие и рыночные условия, выходящие за рамки лишь уровня технологической зрелости. Уровни социальной готовности (SRLs) представляют собой метод, позволяющий оценить, в какой степени новые идеи и инновации находят отклик у отдельных лиц и групп людей, а также будут ли они интегрированы в общество и будут ли они принимать решения, касающиеся их применения в виде нормативного и финансового режима.

Пути устойчивой энергетике: Эталонный сценарий позволяет проанализировать вероятность достижения конкретных целей в мире по его текущей траектории. Это жизненно важная часть всех исследований. Анализ конкретных показателей, основанный на итогах базового сценария, может свидетельствовать о том, что долгосрочная цель в области эффективности (LPG), например 25-процентное сокращение энергоемкости к 2050 году, Скорее всего, это будет достигнуто с учетом наших нынешних предположений относительно темпов экономического развития и формирующихся взаимосвязей между энергетикой и экономическим развитием. Результаты исходного сценария могут также свидетельствовать о том, что при нынешнем наборе допущений и взаимосвязей конкретный LPG вряд ли будет достигнут. [4, 18]

Моделирование и анализ энергетических технологий

Энергия ветра — это возобновляемый источник энергии, который использует турбины для преобразования ветра на суше и на море в электричество.

Солнечная энергия — это возобновляемый источник энергии, который использует солнечный свет через фотогальванические элементы (PV) или набор зеркал и линз для концентрации большой площади солнечного света на получатели для выработки электроэнергии (концентрированная солнечная энергия).

Гидроэнергетика — это возобновляемый источник энергии, который охватывает широкий спектр технологий, использующих силы естественного круговорота воды.

Геотермальная энергия — это возобновляемый источник энергии, получаемый из тепла внутри земной коры. Его можно использовать для выработки электроэнергии или использовать в качестве прямого источника тепла. [5, 17]

Биомасса представляет собой возобновляемый источник энергии, изготовленный из биологических исходных материалов, которые включают твердую биомассу, биомассу сточных вод, лесные отходы, водоросли сельскохозяйственные отходы.

Атомные электростанции преобразуют атомную энергию в полезную энергию. Обычные атомные электростанции производят тепло для привода турбины для выработки

электроэнергии. Атомные станции могут обеспечивать теплом городское центральное отопление и промышленные процессы.

Природный газ — это ископаемое топливо, обычно сжигаемое для производства тепла, необходимого для работы паровой турбины. Он также имеет другие применения в тепле, кулинарии, промышленности, транспорте.

Уголь — это твердое ископаемое топливо, обычно сжигаемое для работы паровой турбины для выработки электроэнергии и тепла.

Улавливание, использование и хранение углерода (CCUS) — это процесс улавливания выбросов углекислого газа (CO_2) при производстве ископаемой энергии

и промышленных процессов для хранения глубоко под землей или повторного использования. Эта технология может сочетаться с углем, природным газом, биомассой.

Водород — это сыпучее химическое вещество, которое в настоящее время используется в основном при переработке нефти и производстве аммиака (для удобрений) и метанола. В будущем водород можно будет использовать в качестве энергоносителя и накопителя энергии.

Электричество и процесс превращения энергетической системы в электрическую посредством электрификации рассматривается как ключ к быстрому внедрению возобновляемых источников энергии. [6, 14]

Хранение электроэнергии — это улавливание энергии для последующего использования и включает в себя литий-ионные батареи, управляемые водородные активы и гидроаккумулирующие электростанции. В будущем долговременное хранение энергии может включать в себя разработки в области механического, теплового, электрохимического и химического хранения.

Энергоэффективность направлена на использование меньшего количества энергии для обеспечения того же полезного выхода для удовлетворения необходимых энергетических потребностей.

Моделирование сценариев: инструмент для обоснованного принятия решений

Взаимодействие технологий имеет решающее значение для преобразования энергетической системы. Взаимосвязь является ключом к балансированию спроса и предложения энергии с экономической целесообразностью и устойчивостью. Технологические цепочки связывают энергообеспечение от добычи, преобразования, хранения, передачи и распределения ресурсов до предоставления энергетических услуг. Количественное моделирование этих цепочек помогает определить комбинацию технологий, формирующих графики поставок и инвестиций с наименьшими затратами при соблюдении требований энергетической безопасности и климатических целей. [7, 15]

Моделирование сценариев позволяет лицам, определяющим политику, увидеть последствия климатической политики для выбросов, затрат на энергию, надежности поставок, хранения и постоянных требований к поставкам по сравнению с переменными потребностями в поставках. Политики могут использовать моделирование для выявления недостатков технологий и производительности и принятия решений о том, какие технологии следует поддерживать, путем понимания инвестиционных затрат, сроков выполнения заказов, а также включая все их преимущества и риски. Заблаговременное привлечение политиков к моделированию необходимо для обеспечения информированности, гибкости и прозрачности, с целью разработки политики по достижению углеродной нейтральности к 2050 году. Потребуется оперативность и гибкость политики, чтобы изменить пути, если разрабатываемые в настоящее время технологии не оправдают ожиданий. Необходимо будет найти компромиссы между различными технологическими вариантами, затратами, путями, энергетической безопасностью и защитой окружающей среды. [8, 11]

Моделирование обязательно влечет за собой многочисленные предположения о различных будущих событиях. К ним относятся межвременная динамика, доступность и производительность технологий, социально-политические предпочтения, ограничения и границы. Это предположение будет формировать выводы по мере того, как разработчики моделей будут формировать сценарии. Сценарии будущего основаны на прозрачности предположений касательно будущих событий, затрагивающих все соответствующие аспекты энергетической системы. Аналитики и специалисты по планированию сталкиваются с трудностями при количественной оценке параметров и переменных, особенно когда разные заинтересованные стороны имеют различные взгляды на проблемы, динамику развития или желаемые результаты. Эти предположения направлены на учет различных факторов, таких, как уровни технической, коммерческой и социальной готовности различных технологий, однако они могут не в полной мере отражать

факторы неопределенности в отношении путей их внедрения, и такие технологии не могут быть получены своевременно и по ожидаемым ценам. [9, 13]

Для целей этого проекта была применена методология моделирования для среднесрочного и долгосрочного планирования энергетической системы, анализа энергетической политики и разработки сценариев – модель MESSAGE.

В этой модели используется самая низкая системная стоимость для оптимизации энергетических систем при различных технологических и политических сценариях для достижения углеродной нейтральности к 2050 году. Политики могут захотеть использовать дополнительные критерии, отражающие местные и национальные условия, возможности и цели их энергетической системы. Это может включать предпочтение местных ресурсов, максимальное повышение энергетической безопасности, социального благосостояния и равенства между поколениями.

Сценарии, смоделированные в контексте этого проекта, представляют преобразование энергетической системы, взаимодействие технологий и смягчение последствий изменения климата в геополитически стабильном мире. Распространенной ошибкой является использование сценариев для анализа, для которого они не предназначены. Таким образом, серьезные геополитические потрясения требуют только отдельных сценариев и тестов на чувствительность, но и значительного пересмотра модели энергетической системы. Сценарии углеродной нейтральности исследуют вероятные внутренне согласованные траектории развития до 2050 года. [7, 16]

Моделирование использует упрощенное представление реальных энергетических систем. Это моделирование объединяет географические районы, секторы экономики и технологии для формирования суждений о необходимых будущих технологиях, изменениях образа жизни и общественно-политическом признании. Естественно, количественная оценка включает в себя предположения в условиях неопределенности. Поскольку будущее неизвестно, моделирование должно быть не отдельным проектом, а непрерывным процессом, основанным на появлении новых идей.

Обычное управление энергетическими системами ЕЭК ООН, не приведет к требуемым изменениям. Учитывая долговечность существующей энергетической инфраструктуры и нехватку времени для достижения углеродной нейтральности, роль «гарантии будущего» становится все более важной и актуальной. Ограничения критических сырьевых ресурсов, необходимых для энергетического перехода, добавляют неопределенности и сложности к суждениям, которые необходимо сделать. [11, 16]

Сценарий углеродной нейтральности, смоделированный для этой публикации, устанавливает потенциальный путь к достижению углеродной нейтральности к 2050 году с использованием «средней» социально-экономической перспективы для определения спроса на энергию. Модель начинается с существующих энергетических систем ЕЭК ООН и учитывает стоимость различных энергетических технологий и сроки реализации для оценки технологий и мощностей, необходимых для энергоснабжения с наименьшими системными затратами для поддержки основных предположений об экономическом росте.

При наложении ограничений, таких как выбросы парниковых газов, соответствующие нулевым выбросам к 2050 году, структура энергоснабжения изменится для достижения сценария с нулевым выбросом углерода. Модель также детализирует инвестиции в энергетическую инфраструктуру и торговлю от добычи ресурсов до распределения.

Модель учитывает эффект масштаба. Затраты на энергию и время разработки технологий основаны на оценках экспертов в области технологий. Рассчитанная «стоимость» включает поправку на возврат инвестиций для представления инвестиционного обоснования и состоит из оценки «затратного обучения» за счет повышения эффективности, оптимизации и экономики за счет масштаба. [4, 16]

Модель учитывает спрос на энергию, технологии и инфраструктуру для достижения нулевых выбросов с использованием технологий с низким и нулевым выбросом углерода наряду с существующими энергетическими технологиями.

Определения сценариев;

Базовый сценарий (REF). Этот сценарий разработан на основе набора исходных допущений, основанных на исторических тенденциях и текущих политиках. Он описывает оценку мира в нынешнем виде. Базовый сценарий позволяет анализировать вероятность достижения миром определенных целей на его текущей траектории. Будущие выбросы определяются относительной экономикой портфеля текущих и будущих альтернатив поставок, а также темпами технологического обучения и инноваций и предположениями с тенденциями, лежащими в основе

базового сценария. Во всей публикации результаты сценариев углеродной нейтральности сравниваются с базовым сценарием.

Сценарий углеродной нейтральности (CN). Сценарий углеродной нейтральности назначает обязательное ограничение углеродной нейтральности к 2050 году и направлен на ограничение глобального повышения температуры менее чем на 1.5°C к 2100 году. В этом сценарии оценивается целесообразность обеспечения к 2050 году нулевого уровня выбросов углерода в соответствии с технологическими, инновационными и инфраструктурными допущениями, заложенными в базовом сценарии. Экономически менее привлекательными становятся варианты поставок, основанные на ископаемом топливе. Возобновляемая и атомная энергия в значительной степени заменяет ископаемые виды топлива. Учитывая портфель будущих вариантов предложения, инноваций и темпов освоения технологий в рамках базового сценария, сценарий углеродной нейтральности сводит внедрение этих технологий к минимуму. Побочные эффекты регулирования спроса смягчают давление на предложение.

Инновационный сценарий Углеродной нейтральности (CNI). Будущее, характеризующееся углеродной нейтральностью, заметно отличается от исходного сценария и предположений о справедливых технологиях. Инновационный сценарий углеродной нейтральности фокусируется на потенциальных преимуществах инноваций и политик внедрения, которые ускоряют освоение рынком инновационных технологий.

Это включает - Улавливание, использование и хранение углерода (CCUS) с использованием декарбонизированных ископаемых видов топлива с использованием улавливаемого CO_2 , переработанного в циклической углеродной экономике или хранящегося, и использование прямого улавливания CO_2 из атмосферы.

Атомная энергетика с крупномасштабными конструкциями реакторов и новыми Малыми модульными реакторами (ММР), а также дополнительные энергетические услуги помимо электроэнергии, такие как переход на синтетическое топливо, технологии и промышленные процессы. Водород с ролью синтетического топлива и водорода в качестве топлива для прямого и косвенного конечного использования.

Углеродная нейтральность с первого взгляда еще далек от достижения углеродной нейтральности, производит 39% глобальных выбросов CO_2 и исторически имеет высокие выбросы, включая страны с самым высоким уровнем экономического развития в мире. Несмотря на позитивные обязательства стран, регион по-прежнему сильно зависит от ископаемого топлива. И по-прежнему, на ископаемые виды топлива приходится более 80% энергоснабжения ЕЭК ООН. Хотя мощность устойчивой энергетики быстро растет, темпы роста недостаточны.

В базовом сценарии на Западную Европу и Северную Америку будет приходиться более 75 % общих выбросов CO_2 ЕЭК ООН в 2050 году. На секторы электроэнергетики и транспорта приходится более 60 % выбросов ЕЭК ООН из-за продолжающейся зависимости от ископаемых видов топлива. [11, 16]



Рисунок 1 Технологические, коммерческие и социальные уровни готовности

Более богатые страны также должны стремиться к отрицательному выбросу углерода, чтобы прогресс в достижении углеродной нейтральности и экономического развития различается в субрегионах ЕЭК ООН. Следовательно, высокоразвитые субрегионы должны не только стремиться к достижению индивидуальных целей, но также необходимо поддерживать страны, для которых достижение углеродной нейтральности является более сложной задачей.

Выбросы CO₂ по секторам

Углеродная нейтральность требует сокращения выбросов во всех странах и во всех секторах. Отраслевые выбросы промышленности, зданий и транспорта должны быть значительно сокращены.

Некоторые сектора вносят больший вклад, чем другие. Крупные отрасли, такие как производство электроэнергии, транспорт и промышленные процессы, вносят наибольший вклад в выбросы CO₂. Это связано с их сильной зависимостью от ископаемого топлива. В сценарии углеродной нейтральности трансформированное ископаемое топливо, электроэнергетическая инфраструктура и землепользование способствуют компенсации выбросов CO₂ в сочетании со значительным сокращением выбросов в других секторах.

Выбросы CH₄ по секторам

Сельское хозяйство, лесное хозяйство и другие виды землепользования (AFOLU) по-прежнему являются крупными источниками выбросов метана. Снижение добычи угля, нефти и газа, снижает выбросы от поставок и извлечения жидких и твердых веществ в сценарии углеродной нейтральности. Выбросы отходов также значительно сокращаются за счет более существенного контроля метана. [13, 16]

Выбросы метана имеют значение. Сразу после выброса метан (CH₄) в 120 раз мощнее, чем углекислый газ (CO₂), загрязняющий климат. Как и CO₂, содержание метана в атмосфере в настоящее время находится на рекордно высоком уровне. Это второй по распространенности антропогенный парниковый газ после CO₂. Высокий потенциал глобального потепления метана означает, что его утечки в атмосфере должны быть сведены к минимуму. При коэффициенте утечки около 3-4% преимущество замены угля, в том, вероятно, исчезает. Расширенный мониторинг и отчетность позволили бы создать более надежные механизмы для решения этой проблемы. Нефтегазовый сектор играет важную роль в регулировании метана и более широкой декарбонизации энергетической системы. Сокращение добычи ископаемого топлива будет способствовать сокращению выбросов CO₂ и CH₄.

Выбросы CO₂ необходимо будет значительно сократить во всех секторах и во всех регионах за счет использования всех низкоуглеродных и нулевых технологий. Ни один сектор экономики не может быть проигнорирован, и ни один вариант технологии не может быть исключен. Необходимо будет принять меры для решения масштабной задачи, стоящей впереди. Хотя декарбонизация энергоснабжения имеет решающее значение для достижения углеродной нейтральности, и это лишь один из многих секторов, в которых необходимо действовать уже сейчас. Более эффективное землепользование, естественные поглотители углерода и технологии улавливания углерода требуют достаточной поддержки и инвестиций. Промышленные процессы и конечное использование, включая транспорт и здания, сокращают выбросы CO₂. [10, 16]

Углеродно-нейтральное будущее достижимо при правильной политике, стимулах и взаимодействии технологий. Для его масштабирования с беспрецедентной скоростью потребуются различного рода технологии. Необходимые технологии уже существуют, и многие из них экономически выгодны при добавлении соответствующей нормативно-правовой базы. Тем не менее, углеродная нейтральность будет сложной, но представимой.

Эффективность определяется с точки зрения экономики, эластичности цен и спроса, изменения образа жизни, интенсивности (МДж/ВВП) и инженерной эффективности. Это не относится к термодинамике.

Под энергоэффективностью понимается обусловленное ценами сокращение спроса на энергию в результате дополнительных затрат на систему по сравнению с базовым сценарием. Это включает как технологические, так и поведенческие показатели на высоком уровне агрегирования, которые моделируются через итеративную связь между энергетической системой и нисходящей макроэкономической моделью для каждого региона, необходимые для достижения углеродной нейтральности к 2050 г. [4, 16]

В целом, замены механизма поставок и в развитии технологий с низким и нулевым выбросом углерода недостаточно для достижения углеродной нейтральности. Преобразование

энергетической системы для определения приоритетов должно включать в себя инфраструктуру конечного использования, такую как электромобили, зарядная инфраструктура, тепловые насосы, топливные элементы, системы хранения.

Все регионы сокращающие спрос за счет масштабных инвестиций в инфраструктуру с более низкой энергоемкостью и повышенной энергоэффективности, значительно сокращают непрерывное использование ископаемого топлива. Субрегионы начинают внедрения CCUS и водородной инфраструктуры, расширяют масштабы возобновляемой и ядерной энергетики, а также внедряют инфраструктуру для гигантской выработки электроэнергии.

Таблица 1

Уровень технологической, коммерческой и социальной готовности

Технологии	Необходимо к 2050 году в регионе ЕЭК ООН	Совокупный среднегодовой темп роста 2020–2050 гг.	Эквивалент	Уровень технологической готовности	Уровень коммерческой готовности	Уровень социальной готовности
Ветер	500,000 ветряных турбин мощностью 2,240 ГВт, вырабатывающих 6,750 ТВт·ч	Мощность: 6,4% Генерация: 7,6%	Одиннадцать миллионов тонн стали, или 6% мирового производства стали в 2020 году.	90	60	50
Солнце	7 миллионов панелей коммунального масштаба общей мощностью 2,650 ГВт, вырабатывающих 4,430 ТВт·ч	Мощность: 8,6% Генерация: 9,5%	2,8 миллиона футбольных полей с солнечными батареями равны площади Бельгии. (0,07%) всего региона ЕЭК ООН.			
Гидроэнергетика	Мощность производства электроэнергии в 25 раз больше, чем в 2020 году (120 ГВт в 2050 году)	Мощность: 1,4% Генерация: 1,5%	Добавление чистой мощности 250 ГВт, что эквивалентно 13 «Плотидам Трех ущелий».			
Геотермальная энергия	Мощность производства электроэнергии в 25 раз больше, чем в 2020 году (120 ГВт в 2050 году)	Мощность: 11,3% Генерация: 11,3%	Глобальная геомощность электроэнергии в 2020 году: 14,1 ГВт. Расширение ЕЭК ООН в 8-9 раз превышает нынешнюю глобальную пропускную способность			
Биоэнергетика	Снижение на 25 ГВт электроэнергии из биомассы без CCUS по сравнению с	Вместимость без CCUS: (-2,3%) Генерация: (-1,8%)	Непрерывный переход на биомассу с CCUS. Общее производство биомассы удвоится			

	сегодняшним уровнем и увеличение на 27 ГВт био-массы с CCUS (сегодня < 1 ГВт)		по сравнению с сегодняшним уровнем к 2050 году (> 72% с CCUS)			
Атомная энергия	Общая мощность 604 ГВт, выработка 4,400 ТВтч	Мощность: 2,6% Генерация: 2,9%	Добавление чистой 390 ГВт			
Ископаемое топливо	Снижение на 54% (-740 ГВт) мощностей, работающих на ископаемом топливе, не оснащенных CCUS, но 420 ГВт новых мощностей, оборудованных CCUS	Без CCUS Мощность: (-2,5%) Генерация: (-8%)	Генерация с CCUS: 2,810 ТВтч			
CCUS	Текущие глобальные выбросы CO ₂ за два года (уловлено 46 Гт CO ₂)	46 Гт CO ₂ для хранения соответствует прибл. 25% объема мировых природных запасов к 2020 г.				
Водород	К 2050 г. используется около 7,68 ЭДж или 64 Мт H ₂ –практически с 0 в 2020 г	Используется 4,1%	США, 3,97 1) 730 480 полетов Сатурна V (Аполлона-11) на Луну заполнить 3,5 миллиона дирижаблей Гинденбурга Эксплуатировать в течение одного года 7,5 миллиона грузовиков класса 8 (тяжелых грузовиков), оборудованных топливными элементами, в США, проезжая в среднем 62 750 миль на автомобиль в год: Текущие грузовики класса 8,			

			зарегистриро- ванные в милли- она.			
Энерго эффек- тив- ность	Двукратное снижение ко- нечной энерго- емкости по- сравне нию с истори- ческими тен- денциями	Улучшение (снижение ко- нечной энерго- емкости): 2,5%	Снижение об- щего FE на 32 EJ (-20%) при ро- сте ВВП на 70%			

Эта таблица включает в себя уровень технологической, коммерческой и социальной готовности, который представлен в информационных технологических резюме ЕЭК ООН. Уровни готовности основаны на Рамочной классификации ресурсов ООН (РКООН) — универсально приемлемой и применимой на международном уровне схеме устойчивого управления всеми энергетическими и минеральными ресурсами, при использовании этих рамок для оценки того, на чем сосредоточить инвестиции и какие инновационные технологии

Инвестиции необходимые для технологий с низким и нулевым уровнем выбросов углерода

Углеродная нейтральность требует значительного сдвига в распределении инвестиций в будущие энергетические системы. Моделирование показывает, что инвестиции в добычу ископаемого топлива направляются в другие секторы энергетической системы. Инвестиции в возобновляемые источники энергии увеличиваются в четыре раза, а инвестиции в энергоэффективность растут и составляют четверть от общего объема инвестиций в энергетику. Значительный рост инвестиций также наблюдается в ядерной энергетике, CCUS и водороде. [15, 16]

Все регионы должны перенаправить ресурсы сейчас, пока не стало слишком поздно. Значительные инвестиции в энергоэффективность и передачу, распределение и хранение приносят пользу всем заинтересованным сторонам. Потребители могут извлечь выгоду из более низких затрат на энергию с более энергоэффективными домами. Поставщики энергии и отрасли также могут снизить затраты на производство энергии за счет модернизированной передачи и хранения энергии.

Политики и финансовый мир должны разработать инвестиционные рамки для всех низкоуглеродных энергетических проектов. Правительствам следует поддерживать проекты развития с соответствующей структурой распределения рисков и облегчать доступ к недорогому финансированию, чтобы ускорить внедрение инновационных технологий. [16, 19]

Для обеспечения благоприятных инвестиционных сигналов и привлечения частного финансирования в проекты с высокими капитальными затратами, необходима последовательная политика и рыночные механизмы. Политики должны быть наделены полномочиями и поощряться за принятие решительных инвестиционных решений.

Библиографический список использованной литературы

1 Хашир Б.О., Апсалимова С.О., Хуажев О.З. Формирование региональной концепции стратегического развития медико-экологической безопасности в сфере услуг устойчивого лесопользования. Краснодар. РИО «КубГТУ». 2017. 187с.

3 Хашир Б.О., Апсалимова С.О., Хуажев О.З. «Зеленая» экономика при формировании социально-экономических услуг и медико – экологических систем эффективного лесопользования. Краснодар. ООО «Издательский дом - Экоинвест». 2016. 218 с.

4 Хашир Б.О., Апсалимова С.О., Хуажев О.З. Медико-экологическая безопасность в развитии природопользования. Palmarium Academic Publishing - OmniScriptum Group. Рига. Латвия. 2018. 207с. www.omniscryptum.com

5 Khashir B.O., Apsaliyeva S.O., Khuazh O.Z., A.V. Stygun. Medical and Ecological Assessment of the Formation of the Carcinogenic Risk from Air Pollution in Megacities. International Journal of Engineering and Advanced Technology (IJEAT) Volume 9 Issue-1, Bhopal (M.P.), India. October 2019. C. 4978-4982. www.ijeat.org.

6 Хашир Б.О., Апсалимова С.О., Хуажев О.З. Тенденции развития социально-экономических форм медико-экологической безопасности в сфере услуг эффективного природопользования РИО "КубГТУ". 2016. 200 с.

- 7 Системы здравоохранения: улучшение деятельности ВОЗ. Женева. 2018. www.who.int
- 8 Таллиннская хартия: системы здравоохранения для здоровья и благосостояния. Европейское региональное бюро ВОЗ. Копенгаген, 2018. www.euro.who.int
- 9 Финансирование систем здравоохранения: путь к всеобщему охвату населения медико-санитарной помощью. ВОЗ. Женева. 2018 www.who.int
- 10 Lawrence, A. 2016. Social aspects of the forest sector workforce: a literature review in support of the Rovaniemi Action Plan. Available at: <http://www.unece.org/>
- 11 Mladovsky, P., Srivastava, D., Cylus, J. et al. (2017) Health Policy Responses to the Financial Crisis in Europe. Copenhagen: WHO Regional Office. www.euro.who.int for Europe on behalf of the European Observatory on Health Systems and Policies.
- 12 Stuckler, D., Basu, S. and McKee, M. (2017) Budget crises, health, and social welfare programmes, *British Medical Journal*, 340: c3311.
- 13 UNECE/FAO. 2014. Rovaniemi Action Plan for the Forest Sector in a Green Economy. Available at: <https://www.unece.org/>
- 14 Технологическое взаимодействие в рамках Концепции углеродной нейтральности в регионе ЕЭК ООН. Женева. 2021 www.who.int
- United Nations Statistical Commission, 2011. *International Recommendations for Energy Statistics (IRES)*. New York: United Nations.
- 15 United Nations, 2021. *Transforming Extractive Industries for Sustainable Development*. In U. S. General (Ed.) p. (18) New York: United Nations.
- 16 United Nations Economic Commission for Europe, 2021. *Geologic CO2 storage in Eastern Europe, Caucasus, and Central Asia: An initial analysis of potential and policy*. Geneva: United Nations.
- 17 United Nations Economic Commission for Europe, 2021. *Carbon Capture, Use and Storage Technology Brief*. Geneva: United Nations.
- 18 Vančo, M. 2017. *Green Jobs in the Forest Sector*. Presented at: Forest Europe. Ministerial Conference on the Protection of Forests in Europe. <http://europeanforesters.eu/>
- 19 WHO Regional Office for Europe. Declaration. Third Ministerial Conference on Environment and Health, London, 2015. Copenhagen, WHO Regional Office for Europe (<http://www.euro.who.int>. 8 February 2015).

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ОСОБЕННОСТИ РАЗВИТИЯ УГЛЕРОДНОЙ НЕЙТРАЛЬНОСТИ В СИСТЕМЕ ПРИРОДНЫХ РЕСУРСОВ**Хашир Э.А.***Московский государственный университет имени М.В. Ломоносова***Апсалиямова С.О.***кандидат медицинских наук,**Кубанский Государственный Медицинский Университет***Майкопарова С.Ч.***НОЦ «Институт леса»***Хашир Б.О.***доктор экономических наук, профессор,**Кубанский Государственный Технологический Университет***Хуаж О.З.***доктор технических наук, профессор,**НОЦ «Институт леса»***Abstract**

Complex global energy systems are at the heart of any economy, in terms of supply, then national energy systems are not isolated, but are part of optimized interconnected intra- and inter-regional systems. These systems are characterized by the presence of natural resources and technologies that can affect sustainable growth, namely a changing technological landscape driven by low-cost technologies, as well as environmental and geopolitical issues that significantly affect the structure and policy options of the energy system. Once energy systems begin to change, it will take significant time for industrial and downstream users to adjust their activities to the new energy systems.

Clean and affordable energy technologies are advancing rapidly, but most are still at an early stage of implementation, while technological options exist for most states, prohibitive costs, regulatory barriers and social pressures hinder large-scale deployment.

Аннотация

Сложные глобальные энергетические системы лежат в основе любой экономики, с точки зрения предложения, то национальные энергетические системы не изолированы, а являются частью оптимизированных взаимосвязанных внутри- и межрегиональных систем. Эти системы характеризуются наличием природных ресурсов и технологий, которые могут повлиять устойчивый рост, а именно, меняющийся технологический

ландшафт, обусловленный дорогами технологиями, а также экологическими и геополитическими проблемами, которые существенно влияют структуру и варианты политики энергетической системы. Как только энергетические системы начнут меняться, промышленным пользователям и потребителям нижнего звена потребуется значительное время, чтобы приспособить свою деятельность к новым энергетическим системам.

Технологии экологически чистой и недорогой энергии быстро развиваются, но большинство из них еще находятся на ранней стадии внедрения, в то время как технологические варианты существуют для большинства государств, непомерно высокие затраты, нормативные барьеры и социальное давление препятствуют крупномасштабному развёртыванию.

Keywords: forest, economy, ecology, energy, environment, biodiversity, innovations, investments.

Ключевые слова: лес, экономика, экология, энергетика, окружающая среда, биоразнообразие, инновации, инвестиции

Повышение энергоэффективности, возобновляемые источники энергии, высокоэффективные технологии сжигания ископаемого топлива с процессом улавливания, использования и хранения углерода, атомная энергетика, водород, комплексное и устойчивое управление природными ресурсами — все это часть решения по достижению углеродной нейтральности, однако только смелые, незамедлительные и устойчивые действия могут во время декарбонизировать энергетическую систему во избежание климатической катастрофы.

Энергия имеет решающее значение для поддержания мира, сотрудничества, устойчивости и качества жизни в нашем регионе. Эксперты нашли четкие пути для политиков к созданию энергетической системы с нулевым уровнем выбросов углерода. [1, 16]

Международное сотрудничество имеет существенно важное значение для оказания поддержки в создании устойчивых энергетических систем ускорении перехода к использованию энергии в целях достижения углеродной нейтральности на платформу для участия в эксклюзивном прозрачном диалоге, обмене передовым опытом и обучении друг у друга, для совместного достижения энергетических целей в рамках Целей устойчивого развития ООН, для того чтобы подготовить общество и построить необходимую инфраструктуру и лучшим образом использовать наши природные ресурсы. Масштабы и сложность этих проблем становятся все более очевидными с каждым днем, равно как и предотвращение катастрофических изменений климата и достижение цели по ограничению температуры глобального потепления до 1,5°C.

Развитие данных технологий требует новой нормативно-правовой базы в поддержку немедленной коммерциализации. Основы политики также должны включать юридически связывающие обязательства в отношении расширения международной передачи технологий, согласованных стандартов и определений для «зеленого» водорода, энергоэффективности и энергосбережения. Все решения должны оцениваться с учетом существующих и предстоящих целей чистых нулевых выбросов углерода и климатической нейтральности, при этом вся энергетическая инфраструктура должна быть построена в соответствии с нулевым энергопотреблением. Интеграция инновационных энергетических технологий наряду с преобразованием энергетических рынков и перерабатывающих отраслей — это вызов и возможность. [2, 15]

Инвестиции, необходимые для достижения низкоуглеродной экономики, окупятся с финансовой точки зрения и позволят избежать неисчислимых издержек, связанных с экономическими, социальными и человеческими потрясениями из-за климатической катастрофы.

Приблизительно 80% первичной энергии в настоящее время приходится на ископаемое топливо, хотя разные страны будут по-разному поддерживать различные технологии, нам необходимо поставлять устойчивую энергию для решения проблемы изменения климата и обеспечения качества жизни на глобальном уровне, при этом поддерживать в принятии мер по ускорению трансформации и обмена передовым опытом в области развития лесных и сельских районов, особенно городов, промышленности, зданий и транспорта, одновременно достигая целей Повестки дня ООН в области устойчивого развития на период до 2030 года и целей Парижского соглашения по климату. [3, 14]

Основные цели достижения углеродной нейтральности заключаются в следующем:

- Информирование о спектре вариантов и решений для достижения углеродной нейтральности

- Необходимо поддержание усилий по достижению углеродной нейтральности и привлечение инвестиций в проекты экологически чистой инфраструктуры при наращивании потенциала экономик регионов для достижения общих целей

- При этом климатические модели показывают, что текущие национальные действия и международные климатические цели, установленные в Парижском соглашении по климату и на Конференция ООН по вопросам изменения климата, не обеспечивают углеродной нейтральности и ограничения глобального потепления до $1,5-2^{\circ}\text{C}$ следовательно, есть достижимые пути к разработке и созданию углеродно-нейтральных энергетических систем посредством взаимодействия технологий и углеродно-нейтральные энергетические системы

- диверсификации поставок первичной и конечной энергии;

- ускоренный отказ от традиционных ископаемых видов топлива;

- электрификация всех секторов за счет возобновляемых источников энергии и ядерной энергии;

- повсеместное внедрение технологий с низким и нулевым выбросом углерода, улавливание, использование и хранение углерода, водород и ядерную энергетику нового поколения, решения по хранению энергии.

- передачу и внедрение технологий;

- институциональный потенциал для планирования и проведения амбициозной трансформации энергетических систем;

- участие и принятие со стороны всех заинтересованных сторон для создания безопасных, доступных и углеродно-нейтральных энергетических систем.

- повышать осведомленность о преимуществах всех технологий с низким и нулевым уровнем выбросов углерода;

- условия для финансирования справедливого перехода к углеродно-нейтральным энергетическим системам, соответствующим потребностям

В этом случае действия должны начаться уже сейчас, чтобы максимально использовать все технологии с низким и нулевым уровнем выбросов углерода для достижения углеродной нейтральности к 2050 году.

Важное значение имеет координированное международное сотрудничество для достижения углеродно-нейтральных энергетических систем, с обеспечением столь необходимую эксклюзивную и нейтральную платформу для разработки правил, стандартов и норм для системных изменений образа жизни и инфраструктуры, с поддерживающей политикой, стимулами и нормативно-правовой базой поощряющее региональное и субрегиональное техническое сотрудничество в секторах энергетики, промышленности, строительства и транспорта для проектов, представляющих общий интерес, и государственно-частного партнерства. [4, 13]

При этом совершенно очевидно, что влияние человеческого фактора имеет отношение к нагреванию атмосферы, океана и суши. Сейчас или никогда, если мы хотим ограничить глобальное потепление на $1,5^{\circ}\text{C}$; это будет невозможно без немедленного и глубокого сокращения выбросов во всех секторах. Изменение климата приводит к экстремальным погодным явлениям и последующим социальным и экономическим потрясениям во всех регионах мира. В то же время устойчивые энергетические системы имеют решающее значение для обеспечения качества жизни и лежат в основе реализации Повестки дня ООН в области устойчивого развития на период до 2030 года.

Климатические модели показывают, что текущая политика сокращения выбросов углерода и определяемые на национальном уровне вклады (NDCs) не соответствуют тому, что требуется для достижения цели ограничения глобального потепления на $1,5-2^{\circ}\text{C}$. Существует несоответствие между согласованными странами целями в области энергетики и климата в соответствии к целям Парижского соглашения и уже фактически достигнутого прогресса, при этом остаётся мало времени, чтобы ограничить последствия изменения климата. [5, 12, 16]

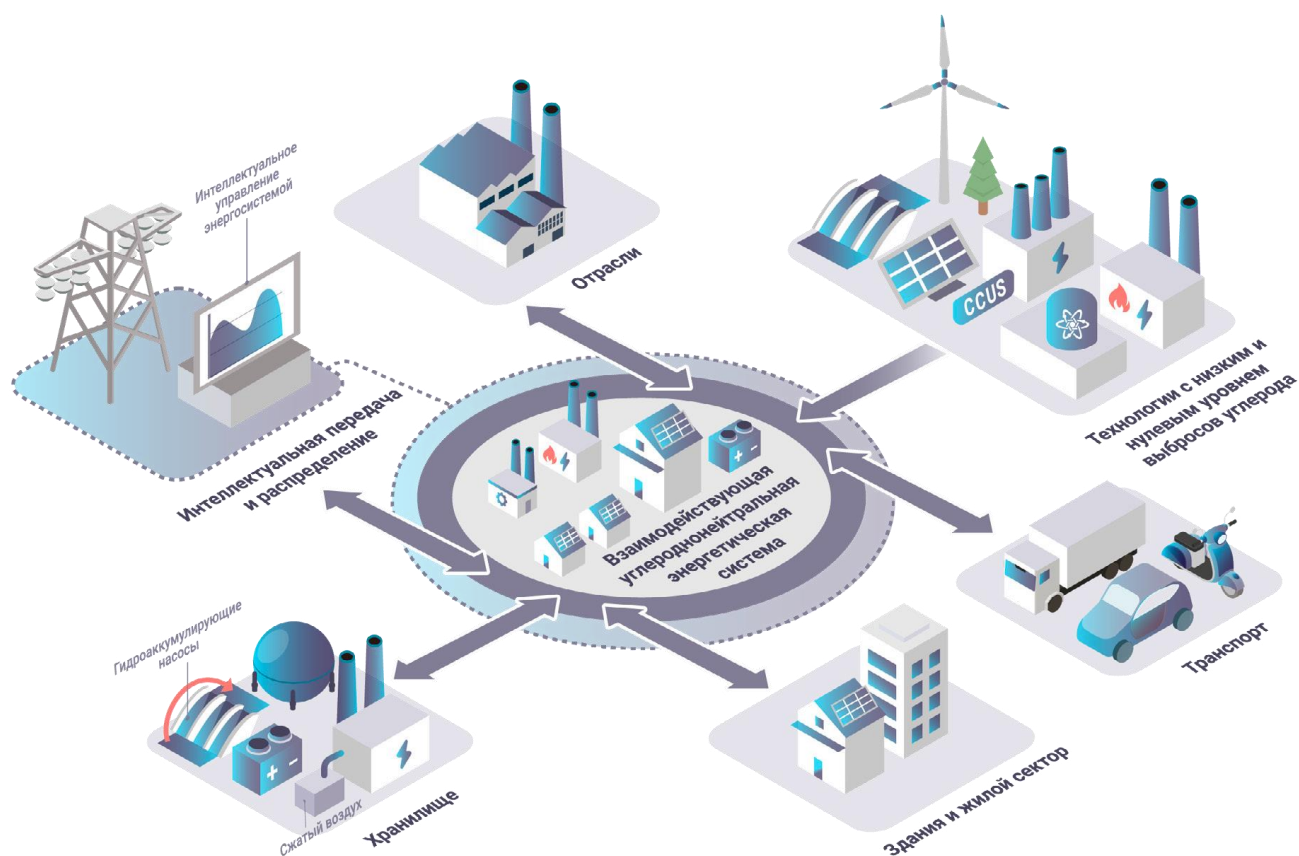


Рисунок 1 Углеродно- нейтральная энергетическая система будущего

Сложные глобальные энергетические системы лежат в основе любой экономики, с точки зрения предложения, то национальные энергетические системы не изолированы, а являются частью оптимизированных взаимосвязанных внутри- и межрегиональных систем. Эти системы характеризуются наличием природных ресурсов и технологий, которые могут повлиять устойчивый рост, а именно, меняющийся технологический ландшафт, обусловленный недорогими технологиями, а также экологическими и геополитическими проблемами, которые существенно влияют структуру и варианты политики энергетической системы. Как только энергетические системы начнут меняться, промышленным пользователям и потребителям нижнего звена потребуется значительное время, чтобы приспособить свою деятельность к новым энергетическим системам.

Технологии экологически чистой и недорогой энергии быстро развиваются, но большинство из них еще находятся на ранней стадии внедрения, в то время как технологические варианты существуют для большинства государств, непомерно высокие затраты, нормативные барьеры и социальное давление препятствуют крупномасштабному развертыванию.

Существуют инновационные способы производства энергии с низким и нулевым уровнем выбросов углерода, включая технологии возобновляемых источников энергии, водород, ископаемое топливо, улавливание, использование и хранение углерода (CCUS) и атомную энергетику. Множественность выбора также требует комплексного подхода к выбору оптимального сочетания технологий. Со стороны спроса также произошла некоторая декарбонизация за счет системной эффективности, электрификации энергетической системы и цифровизации. [6, 11, 16]

Инновационные меры в промышленности, транспорте и строительстве, оказывают ключевую роль, в ускорении разработки, развертывании и распространении технологий, а также утверждение политики для перехода к энергетическим системам с низким уровнем выбросов, в том числе путем быстрого развертывания и выработки чистой энергии и принятия мер по повышению энергоэффективности, в том числе активизации усилий по поэтапному отказу от использования угольных электростанций и отказа от неэффективных субсидий на ископаемое топливо при одновременном оказании целевой поддержки беднейшей и наиболее уязвимой

половине населения в соответствии с национальными условиями и признании в необходимости помощи для обеспечения справедливого анализа, основанный на результатах моделирования, а также исследуются различные пути, с помощью которых можно достичь нулевого уровня выбросов углерода за счет технологического взаимодействия и осуществления Повестки дня на период до 2030 года. [7, 10, 16]

Следует отметить, что в процессе моделирования, проведенного для целей настоящего доклада, предполагалось, что технологии будут обеспечивать декарбонизацию в установленные сроки и в полном объеме, если разработка и внедрение технологии каким-либо образом задерживаются или если технология исключается повестки дня, необходимо будет пересмотреть прогноз достижения углеродной нейтральности, при меняющемся ландшафте энергетических технологий которые влияют на энергетические системы

Пути достижения углеродной нейтральности совместимы с национальными интересами. должны в срочном порядке завершить разработку своих нынешних путей и адаптировать свои энергетические системы в соответствии с целями Парижского соглашения по климату, а трансформация энергетических систем должна начаться уже сейчас и не может быть осуществлена изолированно.

Углеродная нейтральность означает достижение нулевого уровня выбросов углерода с целью ограничения глобального потепления до 2°C (стремление к 1,5°C) в соответствии с Парижским соглашением, а также требует тщательного балансирования фактических выбросов углерода удалением с помощью естественных поглотителей, инженерных технологий утилизации углерода и устранением выбросов углерода.

Согласно Парижскому соглашению по климату углеродная нейтральность определяется как достижение баланса между антропогенными выбросами из источников и абсорбцией поглотителями выбросов парниковых газов во второй половине этого столетия. В контексте этого проекта углеродная нейтральность относится к достижению чистых нулевых выбросов углерода, которые ограничивают глобальное потепление до 1,5–2°C, путем уравнивания зарегистрированных выбросов углерода (в основном двуокиси углерода и метана) с удалением углерода через естественные поглотители или искусственные технологии удаления углерода, такие как CCUS, биоэнергетика с улавливанием и хранением углерода (BECCS) и прямой захват воздуха (DAC), а также за счет устранения выбросов углерода посредством перехода к пост-углеродной экономике. [8, 16]

Углеродная нейтральность не является конечным результатом, это неотъемлемая часть пути к стабилизации концентрации парниковых газов в климате. Однако в качестве отдельной цели, одной политики углеродной нейтральности будет недостаточно для ограничения глобального потепления. Если углеродная нейтральность будет достигнута слишком поздно, для устранения превышения понадобятся чистые отрицательные выбросы углерода. Есть надежда, что в будущем достижение углеродной нейтральности позволит управлять выбросами углерода с течением времени, и его необходимо будет периодически пересматривать и решать такие вопросы, как исторические выбросы. [9, 16]

Устойчивые энергетические системы, основанные на трех столпах, таких как энергетическая безопасность, качество жизни и экологическая устойчивость, защитят общество от будущих рисков. Энергетическая безопасность, связана с обеспечением энергии, необходимой для экономического развития, качество жизни относится к обеспечению недорогой энергии, доступной для всех в любое время; а экологическая устойчивость относится к ограничению воздействия энергетических систем на климат, экосистему и здоровье. Быстрый переход к устойчивой энергетике требует тщательного принятия решений, чтобы найти баланс между всеми тремя столпами для выполнения общепризнанной Повестки дня в области устойчивого развития на период до 2030 года.

Системы устойчивой энергетики и углеродной нейтральности необходимы для анализа взаимодействия технологий. Моделирование и комментарии экспертов исходят из того, что темпы экономического развития будут сохранены и каждая страна будет иметь свои энергетические предпочтения и пути перехода, основанные на обеспеченности природными ресурсами, технологической и инфраструктурой основе, культурном наследии, исторической закономерности экономического развития и нормативно-правовой базе.



Рисунок 2 Система углеродной нейтральности

Обязательство по обеспечению доступа к недорогим, надежным, устойчивым и современным источникам энергии для всех включено в Цели ООН в области устойчивого развития (ЦУР). Этот подход охватывает ЦУР и подчеркивает взаимосвязь между различными аспектами устойчивой энергетики и компромиссы между тремя столпами. [7, 11]

Поиск баланса между тремя столпами является сложной социальной, политической, экономической и технологической задачей. Диалог по устойчивой энергетике станет важным шагом для стран в определении компромиссов и синергии для обеспечения энергетической безопасности, качества жизни и экологической устойчивости. Хотя простых ответов нет, необходимо срочно найти баланс между этими конкурирующими, но взаимосвязанными интересами.

Достижение консенсуса по переходу энергетики к углеродной нейтральности является сложной проблемой. Выбор политики влияет на существующие и новые энергетические технологии и экономический рост и зависит от наличия национальных энергетических ресурсов. Все более сжатые временные рамки означают, что идеальные пути достижения углеродной нейтральности становятся все менее осуществимы без нанесения ущерба обществу. Поскольку каждая страна имеет уникальные обстоятельства, необходимо обеспечить равный доступ к ресурсам для достижения углеродной нейтральности.

Способность адаптироваться к такому сложному переходу жизненно важно для разработки механизмов достижения консенсуса между заинтересованными сторонами в отношении обеспечения своевременного и быстрого принятия решений. Быстрый переход может разрушить общество, если политики не используют все доступные варианты. Могут потребоваться даже нежелательные варианты.

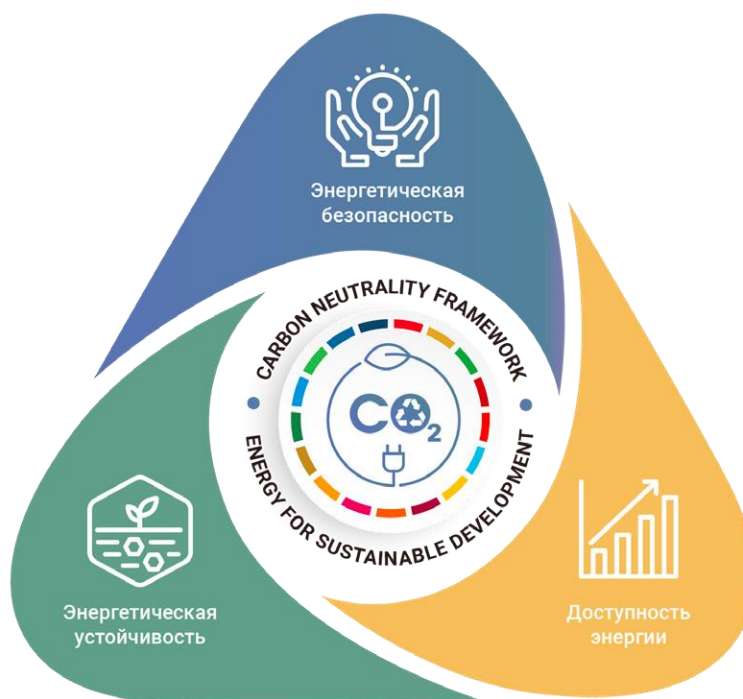


Рисунок 3 Энергетическая Трилемма как основа для достижения углеродной нейтральности

Углеродная нейтральность достигается за счет сочетания технологий с низким и нулевым уровнем выбросов углерода и изменений в социальном поведении. Спрос на энергию будет определяться экономической активностью, изменением образа жизни и повышением энергоэффективности, низкоуглеродным топливом, интеллектуальными технологиями и электрификацией всех секторов, что поддерживает комплексный подход к энергетическим технологиям, чтобы представлять интересы всех стран-членов, максимизировать синергию различных источников энергии. [19]

Ископаемые виды топлива в настоящее время преобладают в энергоснабжении из-за устаревшей инфраструктуры, простоты транспортировки, хранения, инфраструктуры и плотности энергии. Существующие и новые альтернативные низкоуглеродные и безуглеродные технологии необходимо использовать для поддержки устойчивого развития. Устойчивые инновационные решения, такие как CCUS, водород и атомная энергетика нового поколения, должны быть расширены, чтобы соответствовать стоимости и технической конкурентоспособности традиционных технологий за счет инновационного прогресса, экономии масштаба и более тесной увязки с рыночным спросом. [19]

Анализ, основанный на результатах моделирования, показывает, что расширенный набор имеющихся технических вариантов в поддержку разработки политики и международного сотрудничества в области энергетики, проанализированные решения и технологии включают энергоэффективность, возобновляемые источники энергии, ископаемое топливо, ядерную энергию и водород, а также подходы к связыванию углерода, такие как CCUS, BECCS и прямой захват воздуха.

Использование исследования по Оценке жизненного цикла (LCA) для подтверждения своего подхода. LCA сравнивает технологии на основе воздействия на окружающую среду в течение всего срока службы: от тех, которые имеют наименьший углеродный след, до тех, которые требуют значительного улавливания и хранения углерода, чтобы быть углеродно-нейтральными. Почти наверняка в переходный период потребуются все технологии с низким и нулевым выбросом углерода. Например, политики могут перейти к водородной экономике с той скоростью, с которой электролизеры используют низкоуглеродную энергию ветра и солнца, а также атомную энергию. Они также могут разделить инвестиции, используя водород из природного газа с CCUS для ускорения инфраструктуры водородной экосистемы. Хранение аккумуляторов и улучшенное управление распределенными ресурсами могут стабилизировать и оптимизировать

электроэнергию в сети. Ископаемое топливо с CCUS и атомной энергетикой в качестве управляемых источников энергии могут выполнять функцию базовой нагрузки и обеспечивать гибкость для прерывистых возобновляемых источников энергии, таких как ветер и солнечная энергия, а также обеспечивать надежность энергетической системы.

Для достижения углеродно-нейтральной энергетической системы в регионе необходимо быстросоздать все доступные в настоящее время низкоуглеродные и нулевые технологии для энергоснабжения, а также повысить эффективность системы. Это включает преобразование энергоснабжения путем установки технологий CCUS на заводах, работающих на ископаемом топливе, расширение масштабов проектов по возобновляемым источникам энергии, развертывание атомной энергетик, запуск крупномасштабных устойчивых водородных проектов и внедрение других технологий. [18]

Кроме того, национальные сети и межсетевые соединения должны быть усилены и расширены в соответствии с сочетанием энергоснабжения требований транснационального равновесия. Для достижения углеродной нейтральности к 2050 году и реализации Повестки дня на период до 2030 года необходим расширенный набор технологий. У всех энергетических технологий есть недостатки, которые можно свести к минимуму, если использовать их совместно и стратегически.

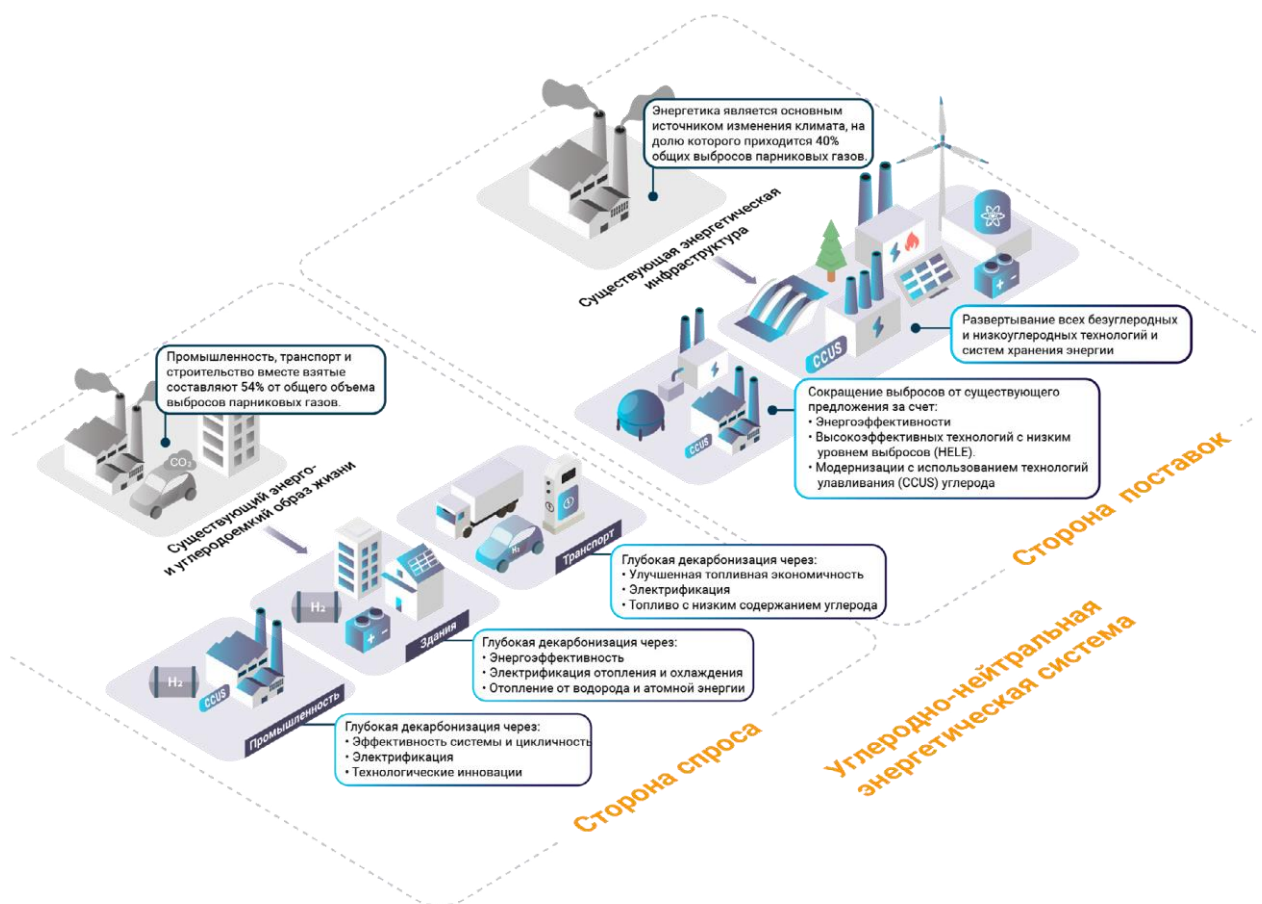


Рисунок 4 Действия по достижению углеродно-нейтральной энергетической системы

Углеродная нейтральность, в конечном счете, потребует значительных изменений в том, как работает экономика, что потенциально может привести ко многим непредвиденным последствиям. Любое быстрое внедрение изменений требует координации развития технологий, коммерциализации и общественного признания. [1, 16]

«Уровни готовности» — это обычно используемый показатель для описания того, что необходимо решить во время внедрения изменений, любое быстрое внедрение изменений требует координации развития технологий, коммерциализации и общественного признания

Уровни технологической готовности (CRLs) представляют собой метод, позволяющий оценить различные показатели, которые влияют на коммерческие и рыночные условия, выходящие за рамки лишь уровня технологической зрелости. Уровни социальной готовности (SRLs)

представляют собой метод, позволяющий оценить, в какой степени новые идеи и инновации находят отклик у отдельных лиц и групп людей, а также будут ли они интегрированы в общество и будут ли они принимать решения, касающиеся их применения в виде нормативного и финансового режима.

Библиографический список использованной литературы

1 Хашир Б.О., Апсалимова С.О., Хуажев О.З. Формирование региональной концепции стратегического развития медико-экологической безопасности в сфере услуг устойчивого лесопользования. Краснодар. РИО «КубГТУ». 2017. 187с.

3 Хашир Б.О., Апсалимова С.О., Хуажев О.З. «Зеленая» экономика при формировании социально-экономических услуг и медико – экологических систем эффективного лесопользования. Краснодар. ООО «Издательский дом - Экоинвест». 2016. 218 с.

4 Хашир Б.О., Апсалимова С.О., Хуажев О.З. Медико-экологическая безопасность в развитии природопользования. Palmarium Academic Publishing - OmniScriptum Group. Рига. Латвия. 2018. 207с. www.omniscryptum.com

5 Khashir B.O., Apsaliyeva S.O., Khuazh O.Z., A.V. Stygun. Medical and Ecological Assessment of the Formation of the Carcinogenic Risk from Air Pollution in Megacities. International Journal of Engineering and Advanced Technology (IJEAT) Volume 9 Issue-1, Bhopal (M.P.), India. October 2019. C. 4978-4982. www.ijeat.org.

6 Хашир Б.О., Апсалимова С.О., Хуажев О.З. Тенденции развития социально-экономических форм медико-экологической безопасности в сфере услуг эффективного природопользования РИО "КубГТУ". 2016. 200 с.

7 Системы здравоохранения: улучшение деятельности ВОЗ. Женева. 2018. www.who.int

8 Таллиннская хартия: системы здравоохранения для здоровья и благосостояния. Европейское региональное бюро ВОЗ. Копенгаген, 2018. www.euro.who.int

9 Финансирование систем здравоохранения: путь к всеобщему охвату населения медико-санитарной помощью. ВОЗ. Женева. 2018 www.who.int

10 Lawrence, A. 2016. Social aspects of the forest sector workforce: a literature review in support of the Rovaniemi Action Plan. Available at: <http://www.unece.org/>

11 Mladovsky, P., Srivastava, D., Cylus, J. et al. (2017) Health Policy Responses to the Financial Crisis in Europe. Copenhagen: WHO Regional Office. www.euro.who.int for Europe on behalf of the European Observatory on Health Systems and Policies.

12 Stuckler, D., Basu, S. and McKee, M. (2017) Budget crises, health, and social welfare programmes, British Medical Journal, 340: c3311.

13 UNECE/FAO. 2014. Rovaniemi Action Plan for the Forest Sector in a Green Economy. Available at: <https://www.unece.org/>

14 Технологическое взаимодействие в рамках Концепции углеродной нейтральности в регионе ЕЭК ООН. Женева. 2021 www.who.int

United Nations Statistical Commission, 2011. International Recommendations for Energy Statistics (IRES). New York: United Nations.

15 United Nations, 2021. Transforming Extractive Industries for Sustainable Development. In U. S. General (Ed.) p. (18) New York: United Nations.

16 United Nations Economic Commission for Europe, 2021. Geologic CO2 storage in Eastern Europe, Caucasus, and Central Asia: An initial analysis of potential and policy. Geneva: United Nations.

17 United Nations Economic Commission for Europe, 2021. Carbon Capture, Use and Storage Technology Brief. Geneva: United Nations.

18 Vančo, M. 2017. Green Jobs in the Forest Sector. Presented at: Forest Europe. Ministerial Conference on the Protection of Forests in Europe. <http://europeanforesters.eu/>

19 WHO Regional Office for Europe. Declaration. Third Ministerial Conference on Environment and Health, London, 2015. Copenhagen, WHO Regional Office for Europe (<http://www.euro.who.int>. 8 February 2015).

Pedagogical sciences

INTEGRATION OF BUSINESS INNOVATIONS IN THE TRAINING OF FUTURE PRIMARY SCHOOL TEACHERS: THE PATH TO PROFESSIONAL EXCELLENCE

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Abstract

The article discusses the meaning, content and features of education and training of primary school teachers in higher educational institutions based on business innovations. In modern educational discourse, the issue of introducing business innovations into primary education teacher training programs is becoming increasingly relevant. In the traditional education system, social, production, economic processes and conditions are not studied in depth and are not taught while preparing future teachers. This problem shows the need to form an effective training system based on business innovations in accordance with the requirements of modern professionally oriented educational institutions. During the program-correction experiment, the author emphasizes the need to introduce "business innovation" into training courses to ensure quality education and training of specialists adapted to modern society. The article describes the importance of business innovations in forming the professional training of future primary school teachers through the changes taking place in the field of education in Kazakhstan. One example of the successful implementation of this idea is the opening of an innovative business club called "Smart Coach" at the Abay Kazakh National Pedagogical University, Institute of Pedagogy and Psychology. The club was launched to create an innovative environment in which students develop entrepreneurial skills and learn new methods in education. Also, current reforms in the field of education being implemented in the country are aimed at creating conditions for the formation of high morals, leadership qualities, preparation for professional development and innovative activities of future teachers. This article aims to examine existing research and scholarship to clarify the significance of integrating business innovation into teacher education and its potential implications for primary education. Moreover, educational organizations require specialists who have received special economic training in business organization and who have sufficient motivation to organize business in educational institutions. Thus, at present, in the educational space of universities, an orientation towards business innovations, ways of considering preparation for professional activity, is relevant. In addition to emphasizing the importance of integrating business innovations into teacher education, it's crucial to highlight the broader impact such initiatives can have on society. By equipping future educators with entrepreneurial skills and innovative teaching methods, this approach not only enhances the quality of education but also foster a culture of creativity and adaptability essential for navigating the complexities of the modern world.

Keywords: primary school, business innovation, professional activity, professional specialist, business club, future teacher

Introduction. The concept of education in Kazakhstan opens the way to changing the current status of education to a qualitatively different one, different from the previous one. One of the possible scenarios for the development of education in the period from 2023 to 2029: from traditional educational programs to preparing students for the future, focusing on updating the value aspect of the content of education, developing global competencies, emotional intelligence, critical thinking, entrepreneurial and financial literacy of students, and differentiation and individualization of learning.[1] Educational programs will continue to be improved to include modules aimed at developing entrepreneurial skills and basic soft skills. Particular attention will be paid to developing the creative and entrepreneurial potential of students. However, there are a number of problems, including the issue of training teaching staff for professional activities with an emphasis on business innovation. Solving these problems requires an integrated approach and active integration of innovations into the education system.

Main part. Increasing entrepreneurial literacy, starting at the primary school level, is an economically rational and relevant, necessary measure. This is because the future of the country's economy is in the hands of professionals. We need specialist teachers who have received special economic training in higher educational institutions and who have sufficient motivation to organize a profession. Professor Isabel Welp from the Technical University of Munich accurately conveyed the importance of entrepreneurship for individuals and society with the following thoughts: "Entrepreneurship is a need of society. This philosophy, based on personal initiative and the understanding that entrepreneurship is not limited to just finding a job, helps a person find his place, builds respect for him and opens the way to true innovation, finding the necessary steps to make the world a better place" [2]. According to scientist Bell Robin, the quality of education in this area can help improve the economic situation of developing countries [3].

Entrepreneurship education can be defined as the development of behavior, attitudes and abilities, and a range of efforts to improve entrepreneurial attitudes, skills and thinking to solve problems such as creativity, innovation, business startup and idea generation. as the pinnacle of entrepreneurial education [4].

Business innovation, characterized by the creation and implementation of new ideas, processes and products, has long been recognized as the driving force behind growth and competitiveness in various industries. In recent years, scholars have increasingly focused on the relevance of the principles of business innovation in the educational field. The parallel between the corporate world and education leads researchers to believe that educators can benefit from adopting innovative approaches to address the changing needs of students and navigate the complexities of today's classrooms. Teaching entrepreneurship was first introduced in the Harvard Business School back in 1945 and has since gained popularity (Mwasalwiba, 2010). It is nowadays widely taught across the globe with special attention in developed countries such as the United States, the United Kingdom, Germany, and the Netherlands. Entrepreneurship courses and programs are offered at universities, high schools, secondary schools, and even at primary schools. This growing interest in entrepreneurship education is due to the fact that the latter has been found to lead to students and young individuals nurturing a lasting interest for entrepreneurship (Torimiro and Dionco-Adetayo, 2005).

The term "entrepreneurship education" is commonly used in the United States and Canada, whereas in the United Kingdom and some parts of Europe, the term "enterprise education" is preferred (Gibb, 1993). This field is very young, emergent, and in its infancy phase (Low, 2001); it is, hence, natural that it is facing epistemological, theoretical, pedagogical, and practical challenges (Fiet, 2007)

Methods. One important aspect of business innovation relevant to education is **the development of an entrepreneurial mindset** among educators. Scholars such as Draycott and Ray (2011) emphasize the importance of instilling qualities such as creativity, adaptability, and risk-taking in teachers similar to those valued in entrepreneurial ventures. By cultivating an entrepreneurial mindset, educators are better equipped to embrace change, experiment with new teaching methods, and create a culture of innovation in educational institutions. Business innovation refers to innovative methods and strategies applied in a corporate environment to improve efficiency and competitiveness. The application of these innovations in education can bring new approaches to classroom management, individualization of learning and the use of technology in the learning process.

In "The Role of Business Education in Promoting Innovation," scholars Stephanie Essig and Erica Francis (Essig & Francis, 2016) discuss how business education can promote innovation in a variety of fields, including education. The authors emphasize the importance of implementing innovative teaching methods and collaborating with the business community to ensure effective learning.

Moreover, **the principles of design thinking**, widely used in business to solve complex problems and develop products, promise significant results in improving pedagogical practices. Researchers such as Brown (2008) advocate the application of design thinking methodology in education to enable teachers to empathize with students, identify their needs, and co-create innovative solutions to educational problems. By integrating design thinking into teacher preparation programs, educators can develop a deeper understanding of learner-centered pedagogy and improve their teaching practices accordingly.

Technology integration is another key aspect of business innovation with profound implications for education. As highlighted by Zhao (2018), the rapid development of digital technologies presents both opportunities and challenges for educators. Teacher preparation programs that emphasize technology integration equip educators with the necessary skills to effectively use digital tools, improve teaching effectiveness, and develop students' digital literacy. By using technology-based learning methods,

teachers can create dynamic learning environments that accommodate diverse learning styles and prepare students for success in the digital age.

Moreover, the **collaborative nature** of business innovation highlights the importance of networking and partnerships within the education community. Researchers such as Fullan (2016) advocate a collaborative approach to educational innovation in which educators collaborate with peers, industry professionals, and community stakeholders to exchange ideas, share best practices, and co-create innovative solutions. By cultivating a culture of collaboration, teacher preparation programs can foster a sense of collective responsibility among educators and promote a continuous cycle of professional learning and growth.

Implications for primary education. In the context of primary education, integrating business innovation principles into teacher training holds enormous potential for transforming teaching practice and improving student learning outcomes. By equipping elementary school teachers with entrepreneurial thinking, design thinking skills, technological knowledge, and collaboration skills, teacher preparation programs can empower them to create dynamic learning environments that promote creativity, critical thinking, and problem-solving skills among young students.

The literature synthesis highlights a compelling rationale for integrating business innovation principles into teacher education programs, particularly in primary education. By adopting an entrepreneurial mindset, using design thinking methodologies, integrating technology, and fostering collaboration, educators can develop innovative teaching practices that meet the diverse needs of students and prepare them for success in an ever-changing world. Going forward, further research and concerted efforts are needed to examine implementation strategies and the effectiveness of incorporating business innovation into teacher education, with a focus on its impact on primary education pedagogy and student outcomes.

According to these literatures, business innovation in primary schools includes the following aspects:

1. **Entrepreneurial Mindset for Teachers:** Fostering an entrepreneurial mindset among elementary school teachers involves developing creativity, adaptability, and risk-taking. This allows educators to embrace change, experiment with new teaching techniques, and create innovative classroom environments.

2. **Applying Design Thinking Methodology:** Design Thinking provides teachers with tools to understand student needs, empathy, and co-create solutions to educational problems. This helps create learner-centered curricula and improve teaching techniques.

3. **Integrating technology into learning:** The use of modern digital technologies allows teachers to create interactive learning materials that are personalized for each student and provides new opportunities for learning and assessment.

4. **Collaboration and Partnership:** Fostering a collaborative culture among teachers, administrators, parents, and the community encourages the exchange of ideas, the transfer of best practices, and the co-creation of innovative solutions.

Application of these principles in practice includes:

- Organizing trainings and master classes for teachers on the development of entrepreneurial thinking, including methods for encouraging creativity, adaptability and readiness for change.

- Introduction of design thinking methodology into the pedagogical process, through the organization of special courses, workshops and projects that allow teachers to practice empathy, problem definition, and co-creation of solutions.

- Integration of modern technologies into the educational process: Introduction of interactive whiteboards, use of educational applications and online platforms for learning and assessment of progress.

- Creation of educational communities and cooperation networks: Organization of business clubs, regular meetings, forums and seminars where primary education teachers can exchange experiences, share best practices and work together to solve educational problems.

The implementation of these methods in practice will create a stimulating, innovative environment in primary schools, conducive to effective learning and development of students.

Research results. Based on these conclusions and the results of our experiment, we opened a business innovation club "Smart Coach" for students of the educational program "Primary Education with Business Innovation" of Abai KazNPU. The goal of the club is to provide students with the development of business innovative knowledge and skills in the field of professional activity. Club objectives:

- developing in students the ability to think entrepreneurially and see opportunities for realizing their potential;

- *developing skills in inventing business ideas and creating a business plan and developing them to the level of entrepreneurial activity;*
- *development of business modeling skills among future specialists, increasing enthusiasm for private entrepreneurship, training in personal professional growth, development of soft skills, training in self-research.*

- *formation of research skills and use of modern information technologies.*
- *development of entrepreneurial skills through participation in master classes of business trainers of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken", etc.;*

Students' participation in practical classes focused on business innovation allows them to independently determine the criteria for a successful business and gain knowledge that will help them create individual business strategies in modern conditions. In addition, meeting with entrepreneurs and businessmen enriches students' business communication experience and contributes to the development of their organizational and communication skills. Such connections help students expand their network of business contacts and receive practical advice from experienced specialists. Currently, this approach is mainly offered by private universities, which use innovative technologies such as simulation games and VR reality to create students' first business projects [5,6]. Students can choose a company or business project for which they currently work, or submit their own project and develop it under the guidance of a program mentor. If there is no project, the mentor will suggest it. It is very important to have personal guidance from a mentor throughout the learning process[7]. Reviews of the content of entrepreneurship courses have shown that effective teaching methods include case studies, individual presentations, group projects, formal lectures, seminars, guest speakers, online learning and group discussions (Fayolle et al., 2008; Lonappan et al., 2011 ; Solomon, 2008) [8]. All this helps students develop a more complete and practically oriented understanding of business and develop the skills necessary for successful entrepreneurial activity. That is why the formation of qualified specialists is a pressing issue. This is only possible with the formation of an entrepreneurial mindset. It includes the following personal qualities: motivation; active life position, responsibility; creativity; a bunch of; stress tolerance (Sousa & Almeida, 2014) [9]. An innovative club for future primary school teachers can have a positive impact on the professional growth of students. Here are a few reasons why the business innovation club is important for future teachers:

- ***Development of Entrepreneurial Skills:*** *The Business Innovation Club allows students to become familiar with the concepts and principles of entrepreneurship. They can study various aspects of business such as planning, marketing, finance and resource management. Developing these skills will help future teachers be flexible and innovative in their practice and will help them develop their own educational projects or programs.*

- ***Exchange of experience and knowledge:*** *Within the club, future teachers have the opportunity to exchange experience, knowledge and ideas with colleagues and experts in the field of business innovation. This allows them to expand their knowledge, learn about best practices and technologies, and receive feedback and constructive advice on their projects and ideas.*

- ***Networking and Partnerships:*** *The Business Innovation Club provides aspiring educators with the opportunity to develop valuable professional connections and partnerships. They will be able to meet people from the business sector, representatives of startups, innovative companies and other educational institutions. These connections can open up new opportunities for collaboration, resource sharing, and joint project development.*

- ***Development of innovative thinking:*** *The Business Innovation Club promotes the development of innovative thinking of future teachers. They learn to think creatively, find new ways and solutions, and adapt to a rapidly changing educational environment. This helps them better prepare students for the challenges of the modern world and provide quality education that meets the demands of today.*

- ***Integration of modern technologies and methods:*** *within the circle, future teachers can get acquainted with modern technologies and methods that help to effectively use innovations in their practice.*

The innovative business club Smart Coach prepares future primary school teachers to improve the quality of education, develop creative thinking and readiness for modern challenges in the field of education. It is important to create and implement educational programs that serve as training for future entrepreneurs. Such programs should include not only a theoretical basis, but also practical assignments, projects, cases, work with real business situations and the opportunity to collaborate with enterprises and the business sector. They also promote the development of communication, decision-making, resource management, adaptability and creative thinking skills.

As part of the development of entrepreneurial thinking and practical skills of students of specialty 6B01302 "Primary education with business innovation," a master class on the topic "Entrepreneurship and Marketing" was organized. A joint event with the innovative business club "Smart Coach" took place on November 20, 2023. The master class brought together leading experts in the field of entrepreneurship and marketing. Students received valuable practical advice and delicacies from the experience of professionals, including information about government grants and the importance of marketing in entrepreneurship.

Discussion. During the event, modern methods of developing competitive specialists, strategies for attracting clients, product placement and creating unique offers on the market were actively discussed. Students showed deep interest in topics related to innovative business, which confirms their potential readiness for entrepreneurial activity. Particular attention is paid to the students' presentation of their own startup projects. Each project - "Paraqtime", "Ai-Qadam" and "Zholdas" - represents innovative ideas in the field of education and child development. This indicates not only the academic achievements of the students, but also their readiness for entrepreneurial activity. The master class "Entrepreneurship and Marketing" had a positive impact on the students, inspiring them to further develop their ideas and professional skills in the field of entrepreneurship and marketing. Experts assessed the students' training at a high level, expressing confidence in the successful use of their startup projects in the future. The master class confirmed the importance of an innovative approach in education and entrepreneurship, as well as the relevance of the topic for modern educational programs.

Conclusion. To summarize, it can be argued that the integration of business innovation in education is not only the next step in the development of the educational system, but also a strategic investment in the future of society. It is a collaboration between education and business to create a sustainable and innovative environment that promotes the prosperity of both students and society as a whole.

References

1. Concept of the development of higher education and science in the Republic of Kazakhstan for the years 2023-2029, approved by the Resolution of the Government of the Republic of Kazakhstan No. 248 of March 28, 2023 <https://adilet.zan.kz/kaz/docs/P2300000248>
 2. Adam Bluestein, «The Success Gene: Why Some Family Businesses Thrive Year after Year after Year», <http://www.inc.com/magazine/20080401/the-success-gene.html>, accessed January 17, 2015; and <http://www.husseyseating.com>, accessed January 17, 2015.
 3. Bell, R. (2016) Curriculum development & teaching approaches in entrepreneurship education. In: Summit forum on entrepreneurship education in universities: international experiences and local practice on entrepreneurship education. Wenzhou University, Wenzhou
 4. Fayolle, A. and Gailly, B. (2008). From craft to science: Teaching models and learning processes in entrepreneurship education. *Journal of European Industrial Training*, 32(7), 569-593.
 5. Costin, Y., O'Brien, M.P., & Slattery, D.M. (2018). Using simulation to develop entrepreneurial skills and mind-set: An exploratory case study. *International Journal of Teaching and Learning in Higher Education*, 30(1), 136-145.
 6. Safin, R.S., Shaidullina, A.R., Alikhanova, R.A., Muskhanova, I.V., Yusupkhadzhiyeva, T.V., Dzhamalkhanova, L.A., Mezhidova, F.V., Nigmatzyanova, V.M., & Akhmetov, L.G. (2016). Innovative entrepreneurship in education: A new look in the students training content and existing problems. *International Review of Management and Marketing*, 6(2), 51-56.
 7. Falyakhov, I. (2018). Corporate qualification of the mentor in the dual education system. *Journal of Social Studies Education Research*, 9(2), 89-103.
 8. Fayolle, A. and Gailly, B. (2008). From craft to science: Teaching models and learning processes in entrepreneurship education. *Journal of European Industrial Training*, 32(7), 569-593.
 9. Sousa, M.J., & Almeida, M.D.R. (2014). Entrepreneurial skills development. *Recent Advances in Applied Economics*, 135-139.
- Here is the full literature list with proper citations:
10. Mwasalwiba, E. S. (2010). Entrepreneurship education: A review of its objectives, teaching methods, and impact indicators. *Education + Training*, 52(1), 20-47.
 11. Torimiro, N., & Dionco-Adetayo, E. (2005). The relationship between management education and entrepreneurial capacity building: A survey of Nigerian business schools. *Journal of Management Development*, 24(4), 365-379.

12. Gibb, A. A. (1993). *Developing enterprising behavior in the university*. *International Journal of Entrepreneurship Education*, 1(1), 22-46.
13. Low, M. B. (2001). *The adolescence of entrepreneurship research: specification of purpose*. *Entrepreneurship theory and practice*, 25(4), 17-26.
14. Fiet, J. O. (2007). *Education for entrepreneurs: cognitive biases, heuristics, and the limits of human understanding*. *Journal of Business Venturing*, 22(5), 687- 98.
15. Draycott, M. C., & Rae, D. (2011). *Enterprise education in schools and the role of competency frameworks: a literature review*. *Educational Review*, 63(4), 517-533.
16. Essig, C., & Francis, D. (2016). *Teaching entrepreneurship: Impact of business training on microfinance clients and institutions*. *World Development*, 77, 311-327.
17. Brown, T. E. (2008). *Design thinking*. *Harvard Business Review*, 86(6), 84-92.
18. Zhao, F. (2018). *The impact of entrepreneurship education on entrepreneurial intentions of engineering students*. *European Journal of Engineering Education*, 43(3), 351-365.
19. Fullan, M. (2016). *The NEW meaning of educational change (5th ed.)*. Routledge.

THE IMPORTANCE OF USING GRAPHIC METHODS IN THE PHYSICS TEACHING PROCESS IN SECONDARY SCHOOL

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Abstract

The article shows that the graphical representation of functional dependencies is an invaluable tool for the development of students' thinking, a more detailed understanding of physical phenomena and laws. Classification of graphic problems and the order of working with graphics are given. Graphing is finding an approximate solution to a problem by constructing a graph. The graphical calculation is simple, the solution process and the result are clear, but the accuracy is not very good. Reading and understanding graphs is very important and graphs are the international language of engineering.

Keywords: physical events, graphic problems, functional dependencies, problem solving, practical skills

Physics problems refer to a specific problem that can be solved with the help of logical thinking, mathematical calculations and experiments based on the laws of physics. In many methodical literature, the subject was considered as a system of tasks aimed at the study of physical phenomena, the formation of concepts, the development of logical thinking of students and the practical application of their knowledge.

During physics teaching in high school, problem solving plays an important role in learning the subject in depth and increasing students' interest in the subject. The main purpose of the case is for students to understand in depth the compliance with the laws of physics and to analyze the physics events they have learned. They must be able to apply this to practical problems.

Solving problems in the learning process (creating problem situations, forming practical skills and habits, transferring new knowledge, repeating and generalizing, knowledge control, developing students' creative abilities), extracurricular work (association, evenings, debate and physics SSC) and Extracurricular Studies (Olympiad) It is aimed to develop the mental activities of students by performing them in their own activities.

According to the basic axioms of the methodology, children acquire knowledge better when they apply it in practice. Problem solving is a practical activity. The subject therefore acts as a criterion for mastering knowledge. From problem solving skills, we can understand how the student understands the essence of the problem and what laws of physics she can see while solving those problems. Experience shows that the student understands the physical meaning of various concepts only when she mentally studies examples.

Many years of experience shows that it is extremely important to instill and develop problem-solving skills in students from the moment the physics course is first taught (Grade VI). The fact that our teachers with pedagogical experience attach special importance to problem solving in their daily activities proves this once again. For this reason, both our scientists working in the field of physics teaching methodology and our experienced teachers always recommend that the teaching of the subject should be concluded with problem solving and that this should be taken into account when assigning homework.

Prepare a plan for problem solving:

- transferring the problem situation to an appropriate physical theory, determining whether it is possible to replace the data in the problem text with the model specified by the given theory;
- To determine the regularities (rules, principles) of the objects and events in the subject and to write their mathematical expressions;
- Check whether the received system equations are sufficient to find the unknowns in the problem, add new equations if necessary.

In the solution phase, the mathematical expression of the quantity sought is determined with the help of formulas and the solution plan is created.

Implementation of the plan:

- Finding the unknown, solving the system of equations in general;
- bringing physical quantities into the BS unit system;
- To calculate the unknowns by writing down the values of the quantities in the general equation obtained.

Checking the result - the accuracy and correctness of the answer obtained as a result of solving the problem is checked.

During the solution research phase, the answer and its physical meaning are analyzed. Although this stage is often treated superficially by teachers, it has great didactic possibilities. Students are more mentally active at this stage. They discuss not one but multiple solutions to the problem.

One of the methods and tools used in solving physics problems is the graphical method. Graphical way – traditionally different images, diagrams, etc. It is applied to the solution of problems given by. The application of problem solving and graphical methods in students' independent studies in physics lessons plays an indispensable role in establishing a connection between physics and mathematics subjects. Graphical representation of functional dependencies is aimed at the development of students' thinking. During the formation of physical regularities, dependencies between quantities are expressed in the form of analytical tables or graphs.

Graphing tasks and problems are basically divided into 4 groups: graph reading, graphing tasks, problem solving by graphical method and graphical representation of measurement results. Each is used for a specific purpose. It is not possible to say exactly which part of the physics course and which subjects will be used in teaching these or other task and problem groups. Graphical problems can be used in all grades. However, the graphical method does not reduce the role of the algebraic problem-solving method in teaching physics.

To simplify problem solving, to visualize physical events related to problem solving, to increase students' ability to use it by choosing the appropriate scale and working with a ruler, to give students the habit of correct measurement and the ability to approximately determine the degree of error of the result obtained. A better understanding of functional dependence and, as a result, the development of functional thinking in students is the use of the graphic method. is one of its advantages.

Our observations show that the problems that students have difficulty in solving problems in physics teaching are graphic problems. The lack of a theory for the solution and application of graphic problems creates some problems in the use of such problems in schools. In order to find and solve existing problems, it is important to show the solution stages of graphic problems, determine the solution method, show the ways of using them in the education process, and reveal their meanings based on concrete examples.

Graph comes from the Greek word **"graphikos"** meaning **drawn**. Plots are of various types depending on the type of plane coordinate system. In most cases, charts are created in the rectangular Cartesian coordinate system. Graphing is finding an approximate solution to a problem by constructing a graph. The graphical calculation is simple, the solution process and the result are clear, but the accuracy is not very good.

Teaching physics in schools should be done by establishing connections between physical events. For this, students need to master and understand the dependency between quantities. These dependencies are necessarily taken into account when formulating physical laws. These dependencies can be expressed in the form of an analytical table or graph.

The graphical representation of functional dependencies is an invaluable tool for the development of students' thinking and a more detailed understanding of physical phenomena and laws. Graphs graphically visualize the progression of physical laws. Representing functional dependencies between quantities graphically requires students to have a high level of mathematical literacy.

If every possible value of the variable x corresponds to only one value of the variable y , such a relationship between x and y is called a functional relationship or function. x is the value of the argument and y is the value of the function. In physics, physical quantities play the role of arguments and functions. In order to create a graph of the dependence between two physical quantities, it is necessary to know the graphs of some functions known from high school mathematics courses.

Appropriate and correct use of graphics has an important place in the polytechnic education of students, in their work in production and in their vocational training.

Graphical representation of physical phenomena and laws on which the operating principles of various technological processes, machines and devices (devices) are based is quite common. In modern times there are very few books on the management of mechanical engineering, metal technology,

automobiles and electro-radio engineering in which scientific principles in this and other parts of the technique are not graphically related. Technical reference dictionaries often provide charts and graphs. Such tables and graphs are reflected in the passports of many devices. It is clear from here that reading and understanding the graphs is very important. It is the international language of graphics technology.

It is also necessary to show the psychological aspect of the issue under consideration. Widespread use of the graphic method not only develops children's memory and thinking, but also improves their visual and motor activity, the ability to perform drawings quickly, regularly and quickly.

Graphical tasks that replace various calculations require little logical thinking when looking at calculations. Considering this point of view, the graphic method should be widely applied in classes consisting of students who have various logical difficulties in active activity forms. At this stage, the gradual assimilation of the principles of the graphic method becomes a skill, and the student uses it in her practical activity. When teaching students the basics of physics, it is impossible to master without solving various tasks graphically. The role of graphs in analyzing the results of a series of laboratory studies is unique.

Graph problems have been classified in various ways by Methodists. Classification according to the table below has been deemed appropriate.

Depending on the situation of the matter compiled according to structure	Request example and problem solving					
Table information	Creating a graph of the dependence of the traction force on the speed of the vehicle, based on the data in the table					
	$v, \text{ m/sec}$	1,6	2,2	3,7	4,4	5,3
	$F, \text{ kN}$	47,0	32,5	21	13,7	12,5
Functional dependency	Plotting $v_x(t)$ in equation of motion $x = 5 + t - t^2$ assuming $x_0 = 0$					
Measurement and observation	Mathematically graphing the quadratic periodic change of length of a dancer by varying its length					
Event or process diagram Definition	The figure shows the $x(t)$ dependence of the moving object. 1st chart, How are parts 2 and 3? Is it characterized?					
In the given chart functional analytical expression of dependence	According to the data in the chart writing the equation of motion.					
Based on chart Unknown amount find	From the object's speed graph $v, \text{ m/sec}$ Finding the momentum of motion					

With the help of a ready-made graph, students can determine the values of physical quantities without making mathematical calculations. However, calculating with a formula can be difficult for them.

Modern science and technology use graphics very widely, so every student, no matter where she studies in the future or where she works after graduation, will definitely have to work with graphics.

It is possible to choose graphs suitable for different age groups in physics classes. "Graph" is generally understood as a line that visually describes the dependence of one quantity on another quantity. It is necessary to teach students not only the ability to create graphs freely, but also the ability to solve questions about the quantities sought on a ready-made graph, the "correct language". "Line language" is precise, concise and concise. You just need to learn and use it.

In the process of teaching physics, the graphic method can be used not only in lessons but also when students do their physics homework.

How to work with charts:

a) Correctly determine the axes according to information content (quantities, units of measurement)

b) Select a single part (these parts may be different on the axes) or set the price of one part on the given axes

c) Determination of the nature of dependencies (fixed or variable).

Literature

- 1. Imanov S.Ş. Teaching methodology of physics in high school. Baku, ASPU, 2004*
- 2. Sh. Alizade, I. Ismayilov. Physics teaching methodology (general issues). Baku - 2018*
- 3. D. Aliyeva, R. Hasanova. Creating the concept of functional dependence between physical quantities in students. Physics, mathematics and informatics teaching. Scientific-theoretical and methodical collection #4. 2019*
- 4. D. Aliyeva, A. Nuseynova. Application of the algorithm in solving graphic problems. Teaching of physics, mathematics and informatics No. 3. 2023*
- 5. D. Aliyeva, C. Mammadli. The role of graphic issues in the implementation of the content standards of the chapter "Magnetic field" in the 7th grade. International scientific and practical journal September 10, 2022 Almaty. Kazakhstan ENDLESS LIGHT in SCIENCE*

MAIN PROBLEMS OF CULTURAL AND EDUCATIONAL TOURISM

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Abstract

Tourism industry is rapidly developing around the world. People travel to different destinations and sights. Cultural and educational tourism is one of the main type of tourism. It helps people to develop their knowledge about different cultures and historical events. This paper discusses the main problems in the development of cultural and educational tourism and ways to solve them. The main results obtained during the study demonstrate the relevance of the chosen research direction, as well as the need for the development of this industry in the subjects of the Republic of Kazakhstan.

Keywords: tourism, cultural and educational tourism, historical sites, cultural heritage socio-economic impact of tourism.

Cultural and educational tourism is one of the most popular types of recreation and leisure. Cultural-educational tourism is a niche sector within the broader tourism industry that focuses on providing visitors with opportunities to explore the cultural heritage and educational resources of a destination. People travel different countries and destinations to explore their sights and cultural heritage. Cultural and educational tourism opens opportunity to develop people's horizon and cultural knowledge.

This article is aimed to analyze cultural and educational tourism and identify main problems in the field of cultural and educational tourism.

The aim of the article defines following objectives:

- to identify the concept of Cultural and Educational tourism by analyzing definitions;
- to analyze Cultural and Educational tourism in Kazakhstan;
- to define main problems in Cultural and Educational tourism.

Definitions and Conceptual Frameworks:

Several scholars have attempted to define cultural-educational tourism and provide conceptual frameworks to understand its dynamics. For instance, Richards (2011) defines cultural tourism as "the movement of people to cultural attractions away from their normal place of residence, with the intention to gather new information and experiences to satisfy their cultural needs." This definition emphasizes the role of cultural experiences and learning in tourism activities.

Similarly, McKercher and du Cros (2002) propose a framework for understanding cultural tourism that includes various dimensions such as tangible heritage (e.g., historical sites, monuments), intangible heritage (e.g., performing arts, festivals), and creative arts (e.g., visual arts, crafts). They argue that cultural-educational tourism involves interactions with these diverse cultural elements to facilitate learning and appreciation.

Motivations and Experiences of Cultural-Educational Tourists:

Research suggests that cultural-educational tourists are motivated by a desire for learning, personal enrichment, and cultural immersion (Pearce, 2005). They seek authentic experiences that enable them to interact with local communities, traditions, and customs. Weaver and Lawton (2007) highlight the role of interpretation and storytelling in enhancing the educational value of cultural tourism experiences. Effective interpretation techniques can help visitors contextualize historical and cultural information, making it more meaningful and memorable.

Cultural-educational tourism in Kazakhstan is an emerging field that holds significant potential for promoting the country's rich cultural heritage, diverse traditions, and historical landmarks.

Cultural Heritage and Tourism Development in Kazakhstan:

Kazakhstan boasts a diverse cultural heritage shaped by its nomadic past, Silk Road history, and multi-ethnic population. Scholars such as Sharipova (2016) emphasize the importance of cultural

heritage preservation and promotion in Kazakhstan's tourism development strategies. Efforts to safeguard historical sites, traditional crafts, and intangible cultural practices contribute to the attractiveness of Kazakhstan as a cultural-educational tourism destination.

Cultural and educational destinations in Kazakhstan:

Petroglyphs of Tanbaly: The Tanbaly Petroglyphs, designated as a UNESCO World Heritage Site, showcase a plethora of ancient rock carvings spanning from the Bronze Age to the Iron Age. Additionally, archaeological digs at Koskuduk and Baskukkuk in Mangyshlak have unearthed artifacts from the same historical era. Further insight into the region's evolution is provided by the necropolises of Koshkar-Ata and Kalipan.

Silk Way and Otyrar ruins: In ages past, the northern branch of the Great Silk Road was adorned with numerous oasis cities, each a testament to the thriving trade routes of yore. Among these relics, the ancient medieval caravanserai atop Mount Sherkala in western Kazakhstan stands as a renowned symbol. Despite the Silk Road's eventual demise, local reverence for this site persists, underscoring its enduring significance. Beyond facilitating the exchange of goods, these routes played a pivotal role in disseminating technologies, ideologies, and religions, including Buddhism, Nestorian Christianity, Manichaeism, Zoroastrianism, and early Islam. Along the way, numerous towns and supporting infrastructures were established. Evidence of the caravans' journeys lies in the remnants of Otyrar, located in southern Kazakhstan. Adjacent to this historic site, Sairam has flourished as a vibrant hub for over three millennia.

Mausoleums: Mausoleums as Khoja Ahmed Yassawi, Aisha Bibi, Arystan Bab and others are also main representatives of cultural and educational tourism in Kazakhstan. Especially, the 14th-century mausoleum of Khoja Ahmed Yasawi, situated in nearby Turkestan, holds immense religious significance and reverence. For believers, making seven pilgrimages to this sacred site is considered equivalent to a journey to Mecca. It offers a tangible connection to the rich history of Sufism in Kazakhstan. In addition, The Mausoleums of Karakhan and Dautbek stand as some of the oldest religious structures in Kazakhstan. According to folklore, Dautbek, the commander-in-chief of the Karakhanid army, was the son-in-law of Shah-Mahmud Buhr Karakhan, hence their tombs are situated in close proximity to one another.

Museums: Fascinating relics are housed in Kazakhstan's museums: such as the ancient Golden Man displayed at the National Museum in Almaty, intricately crafted string dombras showcased at the Kazakh Museum of Folk Musical Instruments, and the pottery workshop found at the Ethnographic Museum of Kyzylort in Shymkent.

World Heritage Site	Location	Year Inscribed	Description
Petroglyphs of Tanbaly	Mangystau Region	2004	Home to thousands of ancient rock carvings dating from the Bronze Age to the Iron Age, providing insight into prehistoric cultures and artistic expressions.
Mausoleum of Khoja Ahmed Yasawi	Turkestan	2003	A holy and revered site, the mausoleum is dedicated to the influential Sufi mystic Khoja Ahmed Yasawi and is considered an architectural masterpiece of the Timurid era.
Saryarka – Steppe and Lakes of Northern Kazakhstan	Akmola and Karagandy Regions	2008	Encompassing the vast steppe ecosystem and numerous lakes, this site serves as a critical habitat for migratory birds and showcases the unique natural landscapes of Kazakhstan.
Silk Roads: the Routes Network of Chang'an-Tianshan Corridor*	From Central Asia to Zhetysay region in Central Asia	2014	The Silk Road emerged around the 2nd century BCE and endured until the 16th century, forming a vast network of trade routes that linked diverse societies across Asia, the Subcontinent, Central Asia, Western Asia, and the Near East. This UNESCO World Heritage site encompasses the corridors stretching from Chang'an/Luoyang, the capitals of China during the Han and Tang dynasties, to the Zhetysay

<i>World Heritage Site</i>	<i>Location</i>	<i>Year Inscribed</i>	<i>Description</i>
			<i>region of Central Asia, encompassing parts of China, Kazakhstan, and Kyrgyzstan. Kazakhstan boasts eight listed sites within this heritage corridor.</i>

Table 1 - the UNESCO World Heritage Sites recognized in Kazakhstan along with their locations, years of inscription, and brief descriptions.

Motivations and Experiences of Cultural-Educational Tourists in Kazakhstan:

Research on tourist motivations and experiences in Kazakhstan's cultural-educational tourism sector is limited but growing. Studies by local scholars like Alipova (2019) suggest that tourists are drawn to Kazakhstan for its unique cultural landscapes, UNESCO World Heritage Sites such as the Mausoleum of Khoja Ahmed Yasawi, and opportunities for cultural immersion with Kazakh nomadic traditions.

Furthermore, the revival of cultural festivals, folklore performances, and handicraft demonstrations enhances the authenticity of cultural experiences for tourists (Khakimzhanova & Nurgalieva, 2018). Interactions with local communities, homestay experiences, and participation in cultural workshops contribute to meaningful and educational encounters for visitors interested in exploring Kazakhstan's cultural diversity.

Problems in Cultural and Educational tourism in Kazakhstan:

Tourism is developing in Kazakhstan. Every year Kazakhstan is open to tourists from different countries and cultures. Cultural and educational tourism is one of the main aspects of tourism in Kazakhstan as people travel there to explore variety of historical and cultural sites. However, there are several problems in cultural and educational tourism:

1. In many destinations of cultural and educational tourism, there is no so-called "anchor" to hold a tourist for more than one day. If the average duration of a tourist's stay at the resort is about 10 days, then even in the most famous cities with world-class cultural monuments, like Turkestan or Venice, it is rarely more than two days, and if we talk about small towns or historical villages, tourists rarely stay there for more than a few hours. Tourists choose places of interest in advance, which they must definitely visit. Thus, after visiting any attraction or destination, they rarely return again, because this object has already been included in their "collection" of tourist impressions.

2. Tourist resources (architectural objects, engineering structures, natural objects, etc.) may have "natural" and "artificial" attractiveness. "Artificial attractive objects" can also be created. Therefore, it is more important to promote a variety of tourist products that reflect the potential tourist opportunities of a city or region. Therefore, more "poor" destinations for cultural and historical resources follow the path of cultural emulation, creating specially monuments of tourist interest, provoking the appearance of a "new model", for example, "Karlaga camp" in Karaganda (Kazakhstan), etc.

3. In addition, the value scale of cultural and historical resources is extremely mobile, depending on the prevailing ideology of the era, therefore, tourist resources can not always maintain a high level of attractiveness in the system of modern tourism, a good example of "museums of local lore" and their fate in tourism

4. The tourist infrastructure in many especially small towns is not sufficiently developed. We are talking not only about tourist accommodation facilities, but also about catering establishments, transport accessibility of some facilities, and the almost complete absence of roadside service.

5. The problem of seasonality in cultural and educational tourism. This problem is acute not only for the type of tourism in question, but also for tourism in general. Seasonality is understood as a steadily recurring cyclical nature of tourist activity characteristic of a given place, associated with changes in recreational conditions.

Seasonality in tourism has the following signs:

- The main tourist season is called the period of the most dense flow of tourists to the destination;*
- According to the intensity of the tourist flow, the following seasons or periods are distinguished: "peak" is the most favourable period for tourist trips, it is characterised by the maximum density of the tourist flow with the most comfortable conditions for them. For example, for cultural and educational tourism, this is the summer or spring season;*

"high" – there is a fairly high demand for tourist services, however, the flow of tourists is no longer so intense, activity is on the decline;

"low" - is the season of decline in activity in the tourist market, this period is characterised by a decrease in prices for tourist services;

"dead" - is the period when the demand for tourist services becomes as low as possible, for example, for cultural and educational tourism - this is the season of late autumn or winter.

- Countries, regions, cities and individual destinations that are more developed in terms of tourism have a longer tourist season, the unevenness of the tourist flow is not so obvious;

- Factors influencing seasonality in tourism:

- natural and climatic;

- economic;

- social;

- demographic;

- psychological;

- political situation, international environment, etc.

6. Not enough attention is paid to territorial branding as an object of cultural and educational tourism.

Territorial branding itself is an important factor in promoting the territory, it is based on political, economic, socio-cultural potential and natural and recreational resources, as well as on brands of goods and services localized in a certain geographical area. A tourist brand is a regional brand that defines the image of a given region, it is associative information that is stored in the memory of consumers of the brand, that is, everyone who has ever encountered it. Often the administration of the region or the local The Tourism Committee is limited to creating a bright emblem. And, after all, competition for tourists includes creating and maintaining an image. The image of any tourist place is very strongly influenced by its visual image created by cinema and television, music, or celebrities.

Thus, a developed logo is not enough, branding is a much broader concept

The branding of the region is aimed at:

- attraction of external and development of internal markets,

- purposeful formation of consumer perception of the uniqueness of the territory,

- increasing the recognition of the territory, the beneficial presence of its image in the media.

The functions of the tourist brand of the territory are that it should reflect the important advantages of the territory. The brand should combine the population, cultural traditions, economic and political activities, communication with the internal and external environment, should combine the development strategies of the territory and the values that it is ready to offer to people.

The process of branding territories is a complex multifunctional set of actions that must take into account many factors on which the success of the entire branding campaign depends.

This creates major difficulties and problems in the industry, such as:

- replacing a comprehensive brand project with a logo development or PR program;

- lack of involvement of residents in the branding process;

- absence or shortage of qualified performers of the branding project;

- lack of implementation of the developed recommendations.

7. The last issue is the lack of clear regulations for the work of travel agencies. After the cancellation of licensing of tourist activities, travel agents do not have documents confirming their professional status, which leads to a decrease in the degree of trust on the part of consumers, as well as on the part of tour operators. The main problem of travel agencies is poor-quality provision of information to tourists, since often their main goal is to earn money, and not to satisfy the needs of the client as much as possible.

It is possible to minimize the negative impact of the above factors on the basis of an integrated approach that provides for a combination of long-term measures aimed at the development of tourist infrastructure, and medium and short-term measures aimed at the formation and promotion of a variety of tourist products reflecting the potential tourist opportunities of a city or region.

In conclusion, cultural and educational tourism is one of the main types of tourism which is being developed around the world. People travel to explore historical and cultural sites and broaden their horizon and develop their knowledge. Tourism in Kazakhstan is growing faster than in past, and people travel to Kazakhstan to explore its historical sites and UNESCO's World Heritage sites. However, there some problems in cultural educational tourism as lack of accommodation, seasonality, problems with branding and travel agencies.

Literature

1. Balabanov I.T., Balabanov A.I. *Tourism economics. Textbook.* - M.: Finance and Statistics, 2003. - 176 p. (accessed 22.11.2023).
2. Logvina E.V. Problems of seasonality in tourism and ways to overcome them in the conditions of Economics and Management] 55 sanctions policy in Crimea/ [Electronic resource], access mode <https://cyberleninka.ru/article/n/problemy-sezonnosti-v-turizme-i-puti-ih-preodoleniya-v-usloviyah-sanktsionnoy-politiki-v-krymu> (accessed 22.11.2023)
3. Formation of the brand of the territory as a resource for the development of the municipality. [Electronic resource], access mode <https://evgenysolomin.livejournal.com/203438.html> (accessed 22.11.2023)
4. Alipova, G. (2019). Tourist Motivation for Cultural Tourism in Kazakhstan: A Case Study of International Tourists Visiting Almaty. *Journal of Tourismology*, 5(1), 47-62.
5. Khakimzhanova, G., & Nurgalieva, M. (2018). Kazakh National Crafts as a Factor of Developing Cultural and Educational Tourism. *Man in India*, 98(7), 1989-1997.
6. McKercher, B., & du Cros, H. (2002). *Cultural tourism: The partnership between tourism and cultural heritage management.* New York, NY: Haworth Hospitality Press.
7. Richards, G. (2011). Cultural tourism: A review of recent research and trends. *Journal of Hospitality and Tourism Management*, 18(1), 109-120.
8. Richards, G., & Munsters, W. (2010). *Cultural tourism research methods.* CABI.
9. Sharipova, A. (2016). Cultural Tourism: Experience of Kazakhstan and Perspectives for Development. *Vestnik KazNPU. Series of Social, Economic and Humanities Sciences*, 3(137), 160-165.
10. Weaver, D. B., & Lawton, L. J. (2007). Twenty years on: The state of contemporary heritage tourism research. *Tourism Management*, 28(3), 589-592.

INTERRELATION OF GAME TECHNOLOGIES AND MOTIVATION TO LEARN A FOREIGN LANGUAGE

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Abstract

This article considers the use of gaming technologies in foreign language lessons, creating and using game situations in educational process, that contribute to increasing the motivation of students.

Keywords: *gaming technology, communication activities, linguistics, motivation, online resources, offline games.*

Learning a foreign language in modern society is becoming more and more in demand. Gaming technology is one of the most effective and successful among modern educational technologies. This concept refers to the quality of activity, which is characterized by a high level of motivation, the need to acquire knowledge and skills, the effectiveness and interest of students.

L. S. Vygotsky, A. N. Leontiev, D. B. Elkonin and others were engaged in the development of the theory of the game, its methodological foundations, its significance for the development of the student in Russian pedagogy.

By the nature of the game techniques are most often used: plot, role-playing, business, imitation. According to the subject orientation, games in all school disciplines are distinguished. Game technologies stimulate interest in learning language material.

To organize communication within the framework of the game, it is necessary to form these skills in the conditions of the educational process.

Today, a modern foreign language lesson is a complex didactic work with the use of computers, Internet technologies, modern technological means.

The educational motivation of schoolchildren is very important in the formation of a personality, because without it, effective educational activity and the development of the student's abilities for self-improvement, self-development, self-education are impossible. The complexity of the study of motivation is due to the fact that the student is encouraged to study a complex of motives that not only enrich each other, but also oppose each other. Motivation is formed, changed and rebuilt in the process of activity. The success of educational activity is determined by motivation, which has a great impact on the effectiveness of the educational process.

It is possible to motivate children at an early stage of language learning through positive emotions. Positive emotional experiences arise when it is possible to evoke love for the language being studied. But sometimes in certain categories of students endowed with strong-willed qualities, negative emotions caused by dissatisfaction with the task, can stimulate activity in the right direction.

The effectiveness of mastering foreign language is directly dependent on the activity of students, involving them in all types of speech activity, so that they listen to foreign language speech as much as possible, speak, read and write in a foreign language. The teacher needs a constant creative approach to solve educational tasks so that the educational activity itself, organized by him, is interesting for students and not only caused high motivation that ensures their activity in the classroom, but also retains its influencing force during extracurricular time.

Zoltan Derney, a Hungarian-born British researcher, professor of psycholinguistics at the University of Nottingham, who is also known for his research on the motivation of learning a second language, wrote in his book "Motivational strategies in the language classroom", that certain conditions must be created before starting any attempts to cause motivation. In his opinion, the following three motivational conditions should be present:

- 1. proper behavior of the teacher and his good relations with students,*

2. a pleasant and friendly atmosphere in the classroom,
3. a close-knit group of students with established group norms.

Of course, these three conditions are interrelated, because you cannot have a pleasant atmosphere in the classroom if there is tension between you and the students. Zoltan Derney also gives several possible options for the development of students' motivation.

In the first strategy, the professor suggests demonstrating and telling about your passion for a foreign language and how it affects you personally; try to share with your students that you value learning a second language and that it is a meaningful experience that brings pleasure and enriches your life. In the second strategy, he says that it is necessary to take the education of children very seriously. Show students that you care about their success. Believe that your students can achieve more. In this strategy, the quality of the relationship between the teacher and the students is very important. Teachers who support their students, who respond to their problems and who manage to establish relationships of mutual trust and respect are more likely to inspire students in the learning process.

The professor gives several tips that will help establish contact between the teacher and students:

- greet children and remember their names;
- smile at them;
- pay attention to interesting features of their external type (for example, a new haircut);
- learn something special about each student and sometimes mention it;
- take an interest in their life outside of school;
- find out birthdays;
- send notes/homework to absentee students.

Professor Dernei says that our relationships with students depend on our good relationships with their parents. For most children, parents' opinions matter, and therefore parents can be allies in any motivational strategies [1]. Dr. Gavin Reid, an educational psychologist from Canada, in his book "Motivating learners in the classroom: ideas and strategies," presents possible strategies for developing motivation: 1. Try to use different approaches to learning. Some children are good at learning visually, but for others it may be difficult. You can provide assignments to students, giving them the opportunity to use their own approach to learning in the classroom. 2. Creativity needs to be encouraged. Gavin Reid says that many creative people only begin to think seriously about their education after leaving school. This is because the exam system often does not encourage creativity. The modern education system provides little opportunity to be distracted by creativity, but in turn, for many students, a creative approach is the main one motivating factor in learning. 3. Ensure gradual achievement of success. Success is an important factor in motivation and successful learning. The teacher needs to motivate students so that they find the path to success. 4. Be prepared to tell students about their own personal progress. Progress is a personal matter for each student, because the result of one person's progress cannot be the result for someone else. It is important that the criteria for progress are individualized. 5. Learners must believe in their abilities. Self-confidence is crucial to achieving any degree of success and motivation, but often the education system is focused only on assessment. This factor can completely destroy any element of self-confidence, so it is important to recognize any achievements, no matter how small they may seem to others. They can be significant for an individual student. Often those who seem to have achieved a lot have surprisingly low levels of self-confidence. This may be because they are not receiving the positive comments that they really need. The key here is not to take it as a job title, but to provide ongoing feedback so that trainees can develop and maintain self-confidence. 6. It is necessary to correctly select tasks according to the age and interests of students. Students can quickly lose motivation if the task is interesting to them, but beyond their ability, and vice versa. 7. The author advises using different learning styles in the classroom. Each lesson should contain elements of auditory, visual, tactile and kinesthetic interaction. 8. Some children need some pressure to be motivated, for example you can set deadlines and create an element of competition. 9. Gavin Reid talks about using group work in foreign language classes. Working in groups can be a great motivational tool, but at the same time it is important to ensure that the group work provides a positive experience for everyone involved. 10. The teacher helps to develop responsibility and independence of students. This is important because it gives learners some control over their learning. It is control that stimulates responsibility and allows students to move from external to internal motivation. 11. It is necessary to encourage student choice. This is part of a plan to give students independence in their learning. [2].

Authors of the book "Best practice in motivation and management in the classroom"

Thus, to summarize, we can say that the effectiveness

mastering any type of activity depends on the child's motivation for this type of activity. Activities are more effective and produce better results if the student has strong, vibrant and deep motives. The game method can be called a valuable method of stimulating interest in learning, which is based on the creation of game situations in the educational process.

Bibliography

1. *Dörnyei Zoltán Motivational Strategies in the Language Classroom Cambridge University Press, 2001.*
2. *Gavin Reid Motivating learners in the classroom: ideas and strategies. Paul Chapman Publishing, 2007.*
3. *Akhramenko E.V. The use of games in teaching a foreign language / E.V. Akhramenko // Young scientist. - 2018. - No. 45 (231). - P. 225-227.*
4. *Savelova M.S. Formation of positive motivation in English lessons in the conditions of the Federal State Educational Standard // Young scientist. - 2014. - No. 13. - S. 283-285.*

Philological sciences

ASPECTS OF LANGUAGE LEARNING AND SECTIONS OF LINGUISTICS

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Abstract

All languages of mankind are a means of communication between people; their structure and functioning are determined by the features of the structure and functioning of the human brain, organs of speech and hearing, which are the same for all people. The emergence and development of languages also depends on the basic patterns of socio-economic and cultural-historical development common to all peoples. This causes the presence in the systems of different languages of universal features, that is, those that are found in every human language (for example, the presence of vowels and consonants, division into syllables, communication through sentence-statements, etc.). Therefore, linguistics is divided into general and particular.

Keywords: language, linguistics, types of linguistics, fundamental information, language learning

General linguistics deals with the properties inherent in any language and builds a theory applicable to different languages. It seeks to determine the essence and nature of the language, to find out the origin of languages and the general laws of their development and functioning, to give a classification of languages, and also develops methods for their study.

Private linguistics comprehensively studies any one language or group of languages that are close in origin and / or geographical location. For example, Russian studies studies the Russian language, romance studies - related Romance languages (French, Italian, Spanish, Romanian, Moldavian, etc.), German studies - Germanic languages (German, English, Swedish, Danish, etc.).

Private linguistics can be synchronic and diachronic.

Synchronic linguistics (from the Greek "syn" - "together" and "chronos" - "time") is a description of a language at a certain moment of its existence, referring to any era. For example, one can study the Russian language of the beginning of the 21st century without any connection with its history, and this will be a synchronic description. A description of the Old Russian language of the 12th century can also be synchronic if it is carried out without any comparison with the language of an earlier or later era, for example, the 11th, 13th, or 21st centuries.

Diachronic linguistics (from the Greek "dia" - "through", "through" and "chronos" - "time") considers the facts of the language in a historical aspect, in chronological order, that is, it studies the language in development. Diachronic, for example, will be the study of the formation and development of the system of cases in the Russian language.

General and private linguistics are closely related. Theoretical knowledge is born in the process of practical study of specific languages. The results of these studies serve as a basis for identifying and understanding the most important general theoretical problems. In turn, the obtained theoretical conclusions have an impact on the improvement of the principles and methods of studying specific languages. In order to better understand the history, structure and functioning of a particular language, it is necessary to understand the general laws of origin and development, the structure and functioning of human languages in general: after all, each language is only a part of the general linguistic picture of mankind. That is why the study of a specific language - Russian, English, Spanish, Arabic, Japanese and any other - is necessarily supplemented by the study of theoretical problems that general, or theoretical, linguistics considers.

Therefore, the study of individual languages and groups of languages (Russian studies, German studies, Indology, Arabic studies, etc.), that is, private linguistics, and the theory of language are in constant interaction: everything new that linguists find in the languages they study is immediately comprehended and included in the theory of language; each new theoretical achievement is widely

included in the practice of studying specific languages, is reflected in interpretations and definitions, and leads to changes in the study and teaching of languages.

It is also customary to single out theoretical and applied linguistics.

The general, fundamental information about the language obtained in theoretical linguistics is used by applied linguistics for practical purposes in various fields of human activity: in medicine, psychology, technology, teaching languages, translation, creating writing for non-literate peoples, advertising, linguistic examination of texts, etc.

Linguistics as a science includes a number of separate disciplines, among which are the disciplines that study the internal structure of the language, and the disciplines that study the functioning of the language in society.

The former include, for example, phonetics, lexicology and grammar. Phonetics studies the sounds of speech and intonation, lexicology studies the vocabulary of a language, grammar studies the structure of a word (morphology) and the structure of a sentence (syntax).

Sociolinguistics is one of the disciplines related to the functioning of language in society. Sociolinguistics is a special branch of linguistics that studies the impact of the social environment on the language and speech behavior of people. Sociolinguistics is interested in how people use language units: how age, gender, social status of a person, his education, general cultural level, place of residence and other factors external to the language influence the characteristics of language use.

In the second half of the 20th century, a number of other new branches of linguistics arose: text linguistics, which studies the organization and functioning of entire texts; psycholinguistics, which studies language in its connection with the human psyche; cognitive linguistics, the subject of which is language as a means of storing and organizing knowledge about the world; mathematical linguistics, which studies the language in order to adapt it to communicate with a computer, phonosemantics, which studies the perception of certain sounds of a language by a person, neurolinguistics, which studies the speech functions of the brain, ethnolinguistics, which studies the connection of a language with national characteristics of the thinking and behavior of the people, and a number of other linguistic disciplines.

All these areas exist in close interaction with each other and help to better understand the language - a complex and diverse phenomenon.

The place of linguistics among other sciences

Linguistics is included in the range of humanitarian disciplines related to the study of man and human society, and interacts with them.

Linguistics has the closest and most ancient ties with philology, of which it is an integral part, as well as with philosophy, logic, and history.

For philosophy, the most important question is about language as an instrument of thinking and cognition, this aspect is also studied in linguistics. In turn, philosophy gives linguistics the general methodological principles of language learning, substantiates the requirements of comprehensiveness in the study of the object, historicism, concreteness, and practical verification of results.

The correlation of logical forms of thinking with the linguistic forms of their expression is a problem common to linguistics and logic, with which linguistics has been associated since the time of Aristotle.

At the intersection of history (the science of the processes of changing the social structures of society) and linguistics, a deeply developed discipline arose - historical linguistics. Closely interact with linguistics and other sciences of the historical cycle.

So, thanks to archeology, many monuments of writing have been discovered, for example, birch bark letters of ancient Novgorod. Ethnography develops general principles for the functioning of language in societies of various types. When studying a particular language, a linguist cannot help but draw on data about the life and culture of the people who speak it.

Linguistics as a science of linguistic communication is closely related to sociology - the science of the laws of development and functioning of society.

Natural language is a sign system, therefore linguistics is often considered as one of the most important branches of semiotics - the science of signs and sign systems.

Thus, there is a close relationship between linguistics and the sciences of the humanities cycle.

Linguistics is also connected with the natural sciences. The most ancient is the connection of linguistics with physiology, which studies the structure of the speech apparatus, the formation of speech sounds in it, the perception of sounds by the organs of hearing. Linguistics is also connected with one of the branches of physics - acoustics, already in Ancient Greece, speech sounds were studied in terms of their height, strength and duration, i.e. on an acoustic basis. In addition, linguistics is associated with

biology, one of the significant theories of which is the theory of evolution, with mathematics, which allows developing a statistical theory of language, and with other natural sciences.

Thus, linguistics has connections with almost all areas of modern knowledge.

Literature

1. Abdullayeva E. K. "Fundamentals of language and linguistics", Ganja-2023
2. Gasimova S.F. "Comparison as an aspects of linguistics", Ganja-2023
3. Kriwaczek, P. *Babylon: Mesopotamia and the Birth of Civilization*. St. Martin's Griffin, 2012.
4. Scarre, C. & Fagan, B.F. *Ancient Civilizations*. Pearson, 2007.
5. Безлепкин Н. И. *Философия языка в России: К истории русской лингвофилософии*. СПб.: Искусство-СПб., 2001.
6. *Введение в языковедение: Хрестоматия*. — М.: Просвещение, 2000.

THE ESSENCE AND STRUCTURE OF CONCEPT

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Abstract

In the article we gave explanations and comments about the terms and concepts of cognitive linguistics. We tried to critically analyze the ideas and opinions expressed in the scientific literature about the essence and structure of the concept. It is important to form the theoretical base of the research by taking into account the acceptable ideas and conclusions put forward in those considerations. These ideas and considerations, taken mainly from the theory of linguo-psychological unity, form the scientific basis of our research.

Moreover, in the article there are brief comments about the terms conceptosphere and verbal sphere of the concept, which are apparently similar to each other. We emphasized that the term conceptosphere was used in both senses and moments until the theory of linguological-psychological unity. At the same time, we noted that it is more correct to use the term conceptosphere in the sense of the totality of all concepts existing in a language. In cognitive linguistics, this tradition has already been sufficiently established, and it is better not to break this tradition.

Keywords: *concept, cognitive linguistics, consciousness and thinking, extralinguistic factors, language units*

Modern linguistics recognizes that the role of concept in cognitive linguistics is very important. It should not be forgotten that each psycholinguistic school and even each researcher may have their own explanations and interpretations regarding the concept. Perhaps the reason for these different approaches is that the concept "is a purely theoretical category that cannot be observed visually, and this aspect allows us to put forward different opinions about it" [11, p. 29-30]. It is also a fact that at one time issues that could not be visually observed or proved through experiments were not considered as research objects of psychology.

S. Askoldov-Alekseev is of the opinion that the concept is a unit of thinking and includes or replaces numerous objects, actions and thinking operations in the process of thinking [2, p. 4].

We believe that a concept cannot simply be a unit of thought, if it is a unit of thought, it must also be a unit of understanding. Because understanding and thinking are a single process and it is impossible to imagine them separately. Even as stated in the theory of linguistic-psychological unity, understanding and thinking are two sub-acts of a single act.

D. Likhachov uses the term concept to express the synthesized thinking units that are only his own and reflect the realities of the real world, depending on the individual's educational level, personal ability, social and professional experience. According to his opinion, the concept consists of the synthesis of different semantics of the lexeme in the individual consciousness of the language carrier. In terms of the understanding of words, the concept creates real opportunities in overcoming obstacles and barriers, which express a different shade for each individual [8, p. 4].

Based on this opinion of D. Likhachev, it is possible to say that the concept does not arise based on the semantics of the word. It consists of a general synthesis of a set of meanings acquired later by an individual's personal life experience. The scientist believes that the concept performs an exceptional function in the process of communication through language.

In his research, Vladimir Karasik summarizes the opinions expressed by various experts about the concept. According to his own opinion, concepts are mental structures that typify a large part of human experience and preserve it in memory [6, p. 59]. V. Karasik believes that the concept is the social experience that an individual "forms on the basis of the information he receives" [6, p. 128] or the quantum of knowledge gained by living [6, p. 361].

Both D. Likhachev's and V. Karasik's considerations are bold steps towards understanding and explaining the general essence of the concept. But these ideas cannot be considered the last and final ideas about the concept.

S. Vorkachov believes that the term "concept" supported by N. Arutyunov, S. Askoldov-Alekseev, D. Likhachov, Y. Stepanov, V. Neroznak, S. Lyapin, V. The term "lingvokulturema" supported by Vorobyov, the term "mythologema" supported by V. Bazilev, the term "logoepistema" supported by Y. Vereshagin and V. Kostomarov are constantly in conflict with each other. Among them, the concept and term "concept" is the most active and has the right to exist. In terms of frequency of development, this term is superior to all other newly created terms [13, p. 41].

Based on this opinion of S. Vorkachov, it is clearly observed that there are certain disputes and disagreements about the names of terms and concepts that express cognitive processes, as well as differences of opinion about the essence of the concept.

According to A. Zalevskaya, the concept is a dynamic perceptual-cognitive-affective structure existing in the human mind, and it is fundamentally different from either the concept or the meaning [14, p. 39]. A. Zalevskaya singles out the individual character of the concept and notes that the concept is the personal gain of the individual.

Accepting the second opinion of A. Zalevskaya, that is, considering the concept as a personal gain of the individual, means that it is meaningless and useless to investigate separate concepts on the basis of cognitive linguistics. Regarding this issue, Mayil B. Asgarov writes: A. Zlevskaya is a very valuable, old and experienced scientist who has been working in the field of psycholinguistics since the 1970s. He was the first professional psycholinguist to accept the theory of linguological-psychological unity, and in this respect, we owe him our loyalty. But it is impossible for us to accept his reasoning that "the concept is the personal gain of an individual".

Mayil B. Asgarov justifies his opinion that it is equally wrong to consider the concept as individual or human. If the concept were an individual gain, it would have to be explored again and again in each individual base of a nation. That is, there would be ten million variants of the "mother" concept in the Azerbaijani language base if we consider only North Azerbaijan, and 70 million if we consider all the Azerbaijanis of the world.

On the other hand, if the concept were human, then there would be no need to study the same concept in different language bases. A concept explored in one language database would be applicable to other languages as well. But in fact, we see that the most popular concepts, such as "family" and "relative" concepts, which should be treated the same in almost all peoples and nations, have different sub-concepts and different verbal spheres in different languages of the world.

Let's note again that if the concept was the result of individual experience or the same, human thing for all individuals, nations, then there would be no need to study different concepts in different languages. But we see the complete opposite. We even come across cases where the same concept is studied comparatively in different languages.

According to another opinion of S. Vorkachev, the concept is a minimal operational unit of thought and at the same time a unit of collective knowledge, but also has the potential to be expressed in language.

M. Pimenova believes that what a person knows, guesses and thinks about the units of the external and internal world is the so-called concept itself. A concept is not the whole of reality, but only an idea of a part of it [10, p. 8].

In fact, the set of these ideas put forward by S. Vorkachov and M. Pimenova corresponds to the concept of the image of intelligence that we find in the theory of linguistic-psychological unity. We will talk about this later.

Z.D. Popova believes that the associative connection with the name of the concept belongs to the verbal sphere of the concept, in no case can it enter its content, it simply reflects them through language units and allows to describe its content. The researcher also puts forward such an idea that the concept may not have any substantive name or name expressed by language units.

Following this idea, we want to make such a generalization, taking into account the considerations put forward by S. Vorkachov and M. Pimenova a little earlier. The problem of whether the concept has a name or not can be easily solved on the basis of the theory of linguistic-psychological unity. Contrasting concepts with incomplete, complete and expanded intellectual codes that enable understanding and thinking, it is possible to say that a concept without a verbal expression is equivalent to an incomplete code, and a concept with a verbal expression or a name is equivalent to a complete code. We will talk about the concept equivalent to the augmented intelligence code later.

Apart from the concept, V. Krasnykh mentions another cognitive unit such as "cognitive structure". The researcher believes that the cognitive base is formed from cognitive structures that have the potential to encode and protect information. V. Krasnykh is of the opinion that cognitive structures are

elementary units. The researcher considers them, on the one hand, the most basic and important units, and on the other hand, indivisible stable units. According to the researcher, cognitive structures form the basis of human competencies and shape them [7, p. 64].

V. Krasnykh distinguishes two types of cognitive structures: phenomenological and linguistic. According to him, phenomenological cognitive structures form the system of knowledge and ideas related to all linguistic and extra-linguistic phenomena. The researcher includes historical events, real personalities, laws of creation of the world, works of art, etc. to the phenomena considered here. According to his opinion, language and speech competences of a person are based on cognitive structures of linguistic nature. They form knowledge about the laws of language. Knowledge of syntax, vocabulary, phonetic-phonological laws and rules is also added here [7, p. 64].

Z.D.Popova and I.A.Sternin present the concept as a non-continuous mental structure and consider it the basic unit of the individual's thought code. Researchers list the main features of the concept as follows:

- 1) has a sufficiently normalized internal structure,
- 2) it is the result of the cognitive activity of an individual within a social group,
- 3) it is encyclopedic information of an integrative nature related to the reflected object or being,
- 4) it is the interpretation of the information presented by the collective consciousness,
- 5) reflects the position of public consciousness regarding the object or being.

These points mentioned are more like a summary of opinions put forward by different experts than independent research results. There is a logical contradiction between the second point given here and the fourth and fifth points. That is, the second point is almost a modified form of the well-known opinion of A. Zalvskaya and to some extent it echoes the opinions of M. Pimenova. The fourth and fifth statements mostly reflect S. Vorkachev's views.

We should also note that sometimes the terms concept, understanding, word, meaning are considered the same and these terms are used interchangeably as if they were synonyms. Sometimes there are attempts to present them as completely different things that have nothing to do with each other, putting a Chinese wall between them.

N.D. Arutyunova uses the terms "concept" and "understanding" as synonyms in many cases: "The concept of reality itself, like other concepts of religious consciousness ... acts as a sign of some units expressed by symbols" [1, p. 24]. L.O. Butakova behaves in the same way in some cases: "a concept is a term related to practical or household philosophy and usually appears as a result of social traditions, folklore, religion, ideology, life experience, and artistic images" [4, p. 67].

A.L. Babushkin notes that such behavior has already taken the form of a tradition: "recently, linguists almost do not use the term "understanding" in its classical sense at all, instead they are more inclined to talk about the category of thinking called concept" [3, p. 14].

Most researchers prefer to distinguish between these concepts. Some sources say: understanding is something people understand and agree on, and the main purpose here is to be able to find a "common language" when discussing problems in the future; and the concept has a completely independent character, people have certain hesitations when restoring it [5, p. 45].

When Y.S. Stepanov compares the concept with the understanding, he comes to the conclusion that the concept is the structural unit of the human mind with a larger capacity; the concept "is a complex unit and in terms of its structure consists of the concept itself on the one hand, and on the other hand the sum of the value that a person gives to this concept" [12, p. 40-43].

V. I. Karasik, just like Y. S. Stepanov, believes that these terms have a completely different meaning and capacity: "A concept is an idea about things and beings and reflects their general and important features, while a concept is not just an abstract sign, at the same time, it is an idea that includes concrete-associative and emotional-evaluation features" [6, p. 24].

According to S.X.Lyapin's conclusion, the concept can be interpreted as "secondary or derivative form creation that reflects the existence of a person in the world", as well as signs, symbols, representations related to relevant concepts. He believes that "a person has concepts, images, behavioral stereotypes, values, ideas, etc. when he lives, communicates, thinks, acts in the world ... at the same time he lives, communicates, thinks, acts in the world of concepts, compared to which the traditional essence of concepts, images, behavioral stereotypes and so on is individual, projected or reduced form has essence" [9, p. 11].

This opinion of S.X.Lyapin means that reality in imagination is richer against the background of similarity between reality in life and reality in imagination. Indeed, as a result of the fact that the pictures in the imagination are fuller and more attractive than in life, novels based on life are more interesting

than real life, and the picture in the painting is more beautiful than in real life. These facts once again prove that the dream world, which is the result of human imagination and thinking potential, is richer than the real world.

Despite all this, most researchers do not oppose these terms and even note that there is an internal connection between the concept and the understanding. These inner forms are one of the learned aspects of the concept. As a result, it turns out that the concept provides mutual understanding between people, and concepts are built on more general thoughts and are structurally based on both the concept and the (cultural, sensory, life, household, social and other) experiences gained by the person himself.

References

1. Arutyunova N. D. *Truth: background and connotations* // *Logical analysis of language. Cultural concepts*. - M.: Nauka, 1991. - p.21–30.
2. Askoldov S. A. *Concept and word* // *Russian literature. From the theory of literature to text structure. Anthology*. - M., 1997. - p. 267-279.
3. Babushkin A.P. *Conceptual types of meanings* // *Contrastive studies of vocabulary and phraseology of the Russian language*. - Voronezh, 1996, - p. 14.
4. Butakova L. O. *Conceptual and semantic analysis of Russian proverbs and sayings about honor / dishonor* // *Welt im der Sprache* / resp. ed. E. A. Pimenov, M. V. Pimenov. - Landau: Verlag Empirische Padagogik, 2005. - p. 62–88.
5. Demyankov, V. Z. *Notion and concept in fiction and in scientific language* // *Questions of Philology*. - 2001. No. 1. - p. 35–47.
6. Karasik V.I. *Language circle: personality, concepts, discourse*. - M.: Gnosis, 2004. - 477 p.
7. Krasnykh V. "Ours" among "strangers": myth or reality? - M.: "Gnosis", 2003. - 375 p.
8. Likhachev D.S. *Logical analysis of language. Cultural concepts*. - M., 1991. - p.280-287.
9. Lyapin S. X. *Conceptology: towards the development of an approach* // *Concepts. Scientific works of Tsentroconcept*. Vol. 1. - Arkhangelsk, 1997. - p. 11-35.
10. Pimenova M.V. *Soul: features of conceptualization* - Kemerovo, 2004. 385 p.
11. Popova Z.D., Sternin I.A. *Cognitive linguistics*. - M.: AST: "East-West", 2007. - 226 p.
12. Stepanov Y.S. *Constants: Dictionary of Russian culture*: Ed. 3 e, rev. and additional – M.: Academic Project, 2004. - 992 p.
13. Vorkachev S. G. *Anglica selecta: selected works on linguistic concepts*. - Volgograd: Paradigma, 2012. - 205 p.
14. Zalevskaya A. A. *Psycholinguistic approach to the problem of the concept* // *Methodological problems of cognitive linguistics*. - Voronezh, 2001.

Political sciences

IMPROVING THE QUALITY OF LIFE OF OLDER PEOPLE IN KAZAKHSTAN AND CENTRAL ASIA IN THE CONTEXT OF SOCIOLOGY (USING THE EXAMPLE OF EASTERN EUROPE)

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Problems and priorities for ensuring social protection in the region

Compared to other regions, social protection systems in Europe and Central Asia, including social protection floors, have traditionally been well developed and have high levels of coverage. However, there are significant differences between countries in levels of social protection spending, sources of funding, adequacy of benefits and the role of social partners. Some countries, including most EU member states, have mature and comprehensive social protection systems, usually consisting of a well-organized social insurance system and a social protection system characterized by universal coverage (European Commission, 2017a). However, in some countries, fiscal consolidation measures may jeopardize the progress achieved. In other parts of the region, especially in Central Asia, social protection systems face challenges such as limited coverage, insufficient benefits, budgetary constraints and weak administrative capacity, and therefore fail to lift people out of poverty and informality. (Gassmann, 2011).

Overall, national policy discussions raise the issue that social protection systems in the region are increasingly facing challenges of coverage, adequacy and financial sustainability. Changes in the world of work and the aging population are having an increasing impact on the financial sustainability of social protection systems and on sustainable development in general. In particular, the rise of non-standard forms of employment, including part-time work, fixed-term work and low-wage work, as well as the emergence of new forms of employment (for example, fulfilling orders received via the Internet) have a negative impact on social protection coverage and benefit levels. as many workers remain outside the social protection system, both now and in the future (ILO, 2016 b; Degryse, 2016).

Younger generations face particular challenges due to demographic dynamics and structural changes in the labor market, including a shift to precarious work, as well as the long-term effects of the global recession following the financial crisis. As a result of recent reforms, young people have found themselves in a situation where they will have to shoulder an increasing share of the costs of paying pensions to an increasing number of pensioners; however, their pension may be reduced compared to that of current pensioners (European Commission, 2017a). These implications must be taken into account to ensure intergenerational equity and maintain social cohesion in the region.

One challenge is the inadequacy of benefits in many countries, preventing even those in employment from escaping poverty (ILO, 2017f). For example, in some Central and Eastern European countries, families receive low child welfare benefits, preventing significant increases in income security for families with children (Bradshaw and Hirose, 2016).

Moreover, although pension systems in many countries provide universal coverage of social or minimum pensions, pension levels are often below the poverty line, which fails to prevent poverty in old age (European Commission, 2015c).

Recently, some countries have introduced reforms to extend the coverage of social protection systems to those previously excluded or receiving inadequate benefits, including part-time workers and the self-employed (European Commission, 2017b, 2016B). . Other countries, especially in Central Asia, are rebuilding their social protection systems after the transition to market economies in the 1990s and adapting them to current conditions, making significant efforts to close coverage gaps, improve the adequacy of benefits and improve the sustainability of systems (UNICEF, 2015b). Further efforts are needed to create comprehensive social protection systems.

The main issue discussed in the region concerns old-age pensions. Although many countries have achieved universal social protection coverage for older people, some countries face challenges to the sustainability and adequacy of pension systems. In the process of fiscal consolidation, European countries have made a number of changes to state pension systems, which relate to increasing the insurance period for receiving a full pension, increasing and equalizing the established retirement age for men and women, and reducing pension amounts.

EU Member States have focused on measures to ensure the financial sustainability of pension systems, but the adequacy of benefits is a major concern (European Commission, 2015c, 2015d). In particular, there is a problem with the adequacy of women's pension assumptions, given that women, on average, contribute for a shorter period and at a lower rate throughout their lives (partly due to the persistent gender wage gap), while that their life expectancy is higher.

In addition, as a result of parametric reforms of public pension systems, future retirees in many European countries will receive smaller pensions (ILO, 2014a), which will reduce the responsibility of the state for providing income security in old age. In contrast, some countries in Eastern and Central Europe have moved away from pension privatization reforms initiated in the 1990s and have fully or partially nationalized their pension systems.

In recent years, measures have been taken to ensure the long-term sustainability of such systems. The focus is on contributions and the level of benefits is directly related to actual contributions made, raising concerns about the adequacy of benefits (Hirose and Hetteš, 2016). Some Central Asian countries have begun to introduce private pension systems; for example, in 2014, Armenia introduced a funded pension system, which is mandatory for workers.

Europe has comprehensive social protection systems that provide universal (or near-universal) coverage in at least one area of social protection (excluding health). For example, in Kazakhstan, France and Sweden, the entire population receives at least one type of social protection benefit. Other countries experience incomplete social protection coverage, such as Armenia, Azerbaijan and Georgia, where less than half the population receives at least one type of social protection benefit.

Child and family benefits

Although many countries in the region provide universal social protection coverage for children, on average, 88 percent of all children under 14 years of age have actual access to social protection benefits (see Figure 6.34). Universal coverage is achieved in 21 countries through different means: for example, Austria, Finland and Estonia have universal systems, Belgium and the Russian Federation have a combination of social and insurance benefit systems, and Kazakhstan and Poland have social benefits (see also Fig. 2.4). However, actual coverage of child benefits is significantly lower in countries such as Armenia, Kyrgyzstan and Tajikistan.

Maternity protection

Compared to other regions, countries in Europe and Central Asia have achieved high rates of effective coverage of cash maternity benefits. Maternity protection is one of the areas of social protection that has a high level of actual coverage in this region. On average, coverage of working women with cash maternity benefits is 81 percent. Most countries, especially EU member states, provide cash maternity benefits to all working women.

Many countries have achieved universal coverage through social insurance systems (eg Austria, Belgium, Iceland and Cyprus); other countries (including the UK, Malta, Portugal and Croatia) supplement social insurance with social protection programmes. In Central Asia, maternal health remains a challenge. For example, in Azerbaijan, Georgia and Kyrgyzstan, more than 75 percent of working women still do not have access to maternity benefits.

Social security for the unemployed

On average, 42.5 percent of unemployed people in Europe and Central Asia receive unemployment benefits (see Figure 6.36). The figure is 57 percent in Eastern Europe, 46 percent in Northern, Southern and Western Europe, and only 12 percent in Central and Western Asia. Low coverage can be explained by a number of factors, including high levels of long-term unemployment in some countries, significant levels of informal employment in others, and the fact that many unemployed people are not registered with employment services.

In a number of countries, social unemployment insurance is supplemented by social assistance; Thus, in Austria, Germany and Ireland the actual coverage of the unemployed reaches 100 percent, in other countries the actual coverage is lower - from 80 percent in Belgium, 73 percent in the Netherlands and 62 percent in Malta to 45 percent in Spain. In contrast, in other parts of the region, especially Central Asia, only a small number of unemployed people (on average 12 percent) actually receive unemployment benefits. However, the unemployed retain the right to receive general social benefits.

Disability pensions

The share of pension recipients among persons with severe disabilities is estimated at 87 percent. A comparison of different parts of the region shows that the highest coverage (about 98 percent) is in Eastern Europe, followed by Northern, Southern and Western Europe with coverage of about 92 percent; in Central and Western Asia, just over half of the eligible population has access to disability pensions.

In most countries with universal coverage, cash disability pensions are provided through social insurance mechanisms (e.g. Belgium, Hungary and Italy), through a combination of social insurance and universal social protection systems (e.g. Azerbaijan, Bulgaria and Latvia) or through means-tested social protection systems (eg in Armenia, Ireland and Finland). In other countries, including Georgia, only social benefits are available. In other parts of the region, especially in Central and Western Asia, only half of the population with severe disabilities actually receives pensions.

Old age pensions

Europe and Central Asia have achieved relatively high coverage of old-age pensions. On average, 95.2 percent of people of retirement age receive a pension (see Figure 6.38). Despite the overall positive trend, some countries still face challenges in expanding pension coverage; this is particularly the case in Central and Western Asia, where effective coverage now averages 82 percent.

Most countries where all older people actually receive social security pensions are located in Northern, Southern and Western Europe, but there are examples of universal old-age pension coverage also in countries in Eastern Europe, Central and Western Asia (for example, Kyrgyzstan, Slovakia and the Czech Republic).

For example, the Netherlands, Poland and Romania have pension insurance systems; in other countries, insurance pensions are supplemented by social pensions, which are received by all older people (for example, in Denmark) or only those whose income does not exceed a specified limit (for example, in Belgium, Israel and Malta). Some countries, particularly in South-East Europe, continue to have problems providing old-age pensions to older people.

Social help

Countries in the region differ in the extent to which vulnerable categories of the population are covered by social assistance, which in this case are defined as all children and adults outside the social insurance system and people of retirement age who do not receive insurance pensions. While countries such as Belgium, Kazakhstan, Slovenia, Finland, France and Sweden provide universal coverage for vulnerable groups, other countries in the region, such as parts of Central and Western Asia, have significantly less coverage.

On average, every third representative of vulnerable groups of the population is not covered by the social protection system. At the same time, there are some positive trends in the region, such as the gradual expansion of social benefits to families living in poverty in Kyrgyzstan and Tajikistan.

Government spending on social protection of the population excluding healthcare

On average, the region's total government spending on social protection (excluding health care) is higher than in other regions, amounting to about 16.5 percent of GDP (see Figure 6.40). The share of social protection expenditure in GDP has increased in many countries, in particular as a result of the recession and high unemployment (ILO, 2017f). In other countries, the share of such expenditures in GDP has fallen significantly as a result of fiscal consolidation measures.

There are significant differences between countries in the region: while in Finland and France total spending on social protection is approximately 23 percent of GDP, in the Russian Federation it is about 11 percent, in Armenia - 5.1 percent, in Kazakhstan - 3.9 percent. In fact, a comparison of parts of the region shows that the leaders are the countries of Northern, Southern and Western Europe, where the level of spending is 17.7 percent of GDP; they are followed by Eastern European countries (12.5 percent of GDP). At the same time, in Central and Western Asia the level of spending on social protection is relatively low (9 percent of GDP).

As the structure of government spending on social protection excluding health shows, in most countries a significant part of it goes to providing the elderly population with a guaranteed income (see Figure 6.41), which is partly explained by the demographic composition of the population. Overall, Europe has the highest proportion of older people in the world, but there are significant differences across the region.

In Northern, Southern and Western Europe, older people make up 19.6 percent of the population, and in Eastern Europe - 14.6 percent; However, in Central and Western Asia, older people make up only 7.7 percent of the population. Accordingly, the share of government spending allocated to social protection of the elderly population varies significantly in the countries of the region.

Expenditures on social protection for people of working age include unemployment benefits, work injury benefits, disability pensions, maternity benefits and general social assistance. People of working age constitute the largest category of the population, but in some countries (eg Albania, Bosnia and Herzegovina, Bulgaria, Greece, Malta and Ukraine) spending on benefits for working-age people represents

only a small part of total spending. In contrast, countries such as Armenia, Belgium, Denmark and Finland provide a more balanced distribution of social protection spending across age groups.

There is significant variability in spending on child social protection. While in the UK this figure is approximately 3.8 percent of GDP, in other countries the share of spending on family and child benefits is lower. In Northern, Southern and Western Europe, public spending on child welfare amounts to about 2.5 percent of GDP, in Eastern Europe - 1.1 percent of GDP (see Figure 2.3). Countries in Central and Western Asia have a strikingly low share of government spending on child benefits (0.8 percent of GDP), especially given the high proportion of children in the population in this part of the region (25 percent).

Because child poverty is a serious problem for countries in the region, current levels of public spending on social protection appear insufficient to adequately provide children and families with income security, including in high-income countries. This is of particular concern in Central and Western Asia, where a quarter of the population is made up of children, as inadequate income security can seriously impede children's development (UNICEF, 2015b, 2017).

Prospects for the development of social protection in the region

Our brief analysis of the state of social protection systems in Europe and Central Asia shows that the region has made progress in building comprehensive social protection systems, including social protection floors as set out in the ILO Recommendation.

No. 202. At the same time, there is a significant coverage gap and insufficient benefits, especially in terms of ensuring adequate coverage of the self-employed and people with non-standard forms of employment, including its new forms. To achieve the goals identified under the Sustainable Development Goals, special attention needs to be paid to the following measures:

- High-income and upper-middle-income countries that have already achieved high levels of benefit coverage and adequacy must maintain their progress and ensure that ongoing and future reforms do not compromise benefit coverage and adequacy; At the same time, sustainable mechanisms for financing systems should be ensured through an effective combination of social insurance and budget financing. In this way, the challenge of maintaining an appropriate balance between adequate benefits and financial sustainability can be achieved;

- Countries where coverage and benefit levels are still low should focus on extending coverage to populations outside the scope of systems to achieve universal coverage, while ensuring that benefit levels are sufficient to meet the needs of the population. In some countries, this will require increased efforts to combat informality and transition to the formal economy, and to ensure sustainable financing mechanisms through a combination of social insurance and public welfare systems;

- To accelerate progress towards SDG 1.3 and related targets, greater attention should be given to closing coverage gaps and increasing benefit levels. Some countries – notably Azerbaijan, Belgium, Germany, Georgia, Denmark, Norway, Portugal, Slovenia, Turkey, Finland, France, Montenegro, Switzerland, Sweden and Estonia – already prioritize social protection in their national voluntary reviews of implementation of the 2030 Agenda;

- all countries in the region should step up efforts to ensure adequate social protection coverage for people regardless of their form of employment, with an emphasis on strengthening social protection for the self-employed and workers in non-standard forms of employment, including new forms of employment. Innovative solutions are needed to adapt social protection mechanisms to the characteristics of these groups of workers and labor market dynamics.

Conclusion

At the same time, the world faces a number of fundamental challenges, such as demographic changes, low economic growth, migration, conflict and environmental problems. Employment models are changing rapidly, new forms are spreading with limited guarantees of job and income protection, in which the worker is deprived of adequate social protection.

Growing income instability, including among the middle class, and decent work deficits have significantly undermined faith in social justice and undermined the unspoken social contract in many countries around the world, while in others fiscal consolidation policies threaten long-term progress. achieved in the implementation of the human right to social security and other rights.

These problems can and should be solved. Without extending social protection to those previously excluded and adapting systems to new forms of work and employment, it will be impossible to eliminate decent work deficits and reduce insecurity and vulnerability across society. Modern life is unthinkable without social protection. Social protection measures not only support the realization of the human right to social security, but are also an economic and social necessity.

Well-designed social protection systems help reduce poverty and inequality while maintaining social cohesion and political stability. The importance of social protection for inclusive economic growth is highlighted by vigorous efforts to strengthen social protection systems in low- and middle-income countries in Africa, Asia and Latin America and the Caribbean. Progress made in establishing social protection systems, including minimum levels, shows that society is capable of providing at least basic social security to all people, steadily increasing its coverage and level.

I hope that the article will be useful to those working in the social security sector and will serve as a source of evidence-based information for policymakers in their work to strengthen social protection and social justice and promote sustainable development.

References

1. Abu Alghaib, O. Forthcoming. *Building social protection floors for persons with disabilities: Lessons learned from non-contributory programmes in Argentina, Ethiopia, Ghana, Indonesia, the Kyrgyz Republic and South Africa*, ILO discussion paper (Geneva, ILO).
2. Acemoglu, D.; Shimer, R. 2000. "Productivity gains from unemployment insurance", in
3. *European Economic Review*, Vol. 44, pp. 1195–1224.
4. Adascalitei, D.; Domonkos, S. 2015. "Reforming against all odds: Multi-pillar pension systems in the Czech Republic and Romania", in *International Social Security Review*, Vol. 68, No. 2, pp. 85–104. DOI: 10.1111/issr.12066.
5. ADB (Asian Development Bank). 2009. *Social assistance and conditional cash transfers: The proceedings of the regional workshop (Manila)*.
6. —. 2013. *The Social Protection Index: Assessing results for Asia and the Pacific (Manila)*.
7. Adesina, J. 2010. *Rethinking the social protection paradigm: Social policy in Africa's development*
8. (Dakar, *European Report on Development*).
9. Adioetomo, S.; Mont, D.; Irwanto. 2014. *Persons with disabilities in Indonesia: Empirical facts and implications for social protection policies (Jakarta, University of Indonesia and TNP2K)*.
10. Alderman, H.; Yemtsov, R. 2013. *How can safety nets contribute to economic growth?*, Policy Research Working Paper, No. WPS 6437 (Washington, DC, World Bank).
11. Alfars, L. 2016. "Our children do not get the attention they deserve": A synthesis of research findings on women informal workers and child care from six membership-based organizations, WIEGO Child Care Initiative Research Report (Durban, WIEGO).
12. Altiparmakov, N. 2014. *Disappointing performance of pension privatization in Eastern Europe*, Working Paper. Available at: www.bancaditali.it.
13. Atkinson, A.B. 1999. *The economic consequences of rolling back the welfare state* (Boston, MIT Press).
14. AU (African Union). 2015a. *Addis Ababa Declaration on Social Protection for Inclusive Development*, No. STC-SDLE-1/Min/ (Addis Ababa).
15. —. 2015b. *Agenda 2063: The Africa we want* (Addis Ababa).
16. Babajanian, B.; Hagen-Zanker, J. 2012. *Social protection and social exclusion: An analytical framework to assess the links*, Background note (London, Overseas Development Institute).
17. Banks, L.M.; Polack, S. 2014. *The economic costs of exclusion and gains of inclusion of people with disabilities: Evidence from low and middle income countries* (London, International Centre for Evidence in Disability).

Psychological sciences

THE INFLUENCE OF EXCITEMENT LEVELS ON STUDENTS' COGNITIVE INDICATORS

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Abstract

The article presented herein forms a segment of a broader research endeavor undertaken by the young researchers of the "Science Group" at Western Caspian University. The primary objective of our investigation was to scrutinize the impact of anxiety indicators on cognitive performance. Participants in our study comprised students aged 17-21 years, enrolled in diverse courses. A key impetus for our research was to explore the temporal effects of stress and arousal levels on cognitive functionality. Somatic alterations occurring within our body at optimal excitement levels positively influence the enhancement of our cognitive functions (such as attention, memory, and the process of memorization), thereby boosting our productivity, albeit within certain limits. However, when stress becomes excessive and chronic, it elicits a contrary response. When the level of excitement surpasses the optimal threshold, a decline in cognitive functions is observed, indicating an inverse relationship.

Keywords: exam stress, optimal level of excitement, individual excitement, situational excitement, short-term memory, attention.

INTRODUCTION

Excitement, as a physiological response, varies depending on the situation at hand. Literature indicates that specific regions in the brain exhibit activation preceding and following an event. During such periods of excitation, the focus of investigation is primarily on pyramidal neurons, which are located in the cerebral cortex, the outermost layer of the brain. These neurons are also present in deeper layers of the brain and participate in the process of excitement. One of the reasons for the acceleration of heart rate during excitement is the release of hormones into the bloodstream by the endocrine glands. The initial response to excitement involves the nervous system stimulating the release of hormones such as adrenaline, noradrenaline, and cortisone, which can be interpreted as a preparatory state for stress (Karamova N.Y., 2010). The Yerkes-Dodson Law, formulated by psychologists Robert M. Yerkes and John Dillingham Dodson in 1908, establishes a direct correlation between an individual's productivity and their level of excitement. According to this law, heightened levels of arousal can enhance an individual's performance up to a certain threshold. Beyond this point, if the level of arousal becomes excessively high, performance tends to decline. The law suggests that the most effective strategy to augment arousal and performance is to engage in tasks that maintain alertness (**Figure 1**). (Robert M. Yerkes, John Dillingham Dodson, 1908).

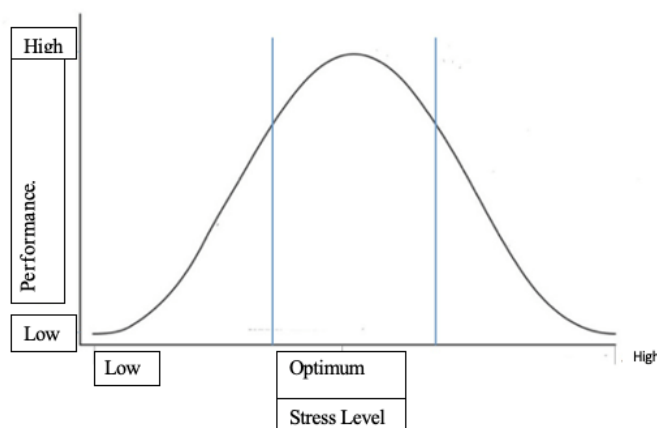


Figure 1. Yerkes-Dodson Law (Yerkes and Dodson, 1908).

Certain studies indicate that the intensity of examination-related anxiety exhibits variability contingent on experience. The anxiety level experienced during an initial examination may exhibit a gradual decline following extensive practice. A study undertaken at the University of Zadar revealed no significant alteration in the stress levels of psychology students during examinations conducted within the same quarter. However, considering the brief interval between examinations within a single quarter, this result is not deemed entirely accurate (Zadar, Croatia Received June 20, 2011). Consequently, this phenomenon is the subject of ongoing long-term research. Research conducted by Carreras, P. and Fernandez Castro focused on the adaptation to examination stress among first and second-year university students. The findings revealed that the anxiety levels of first-year students surpassed those of second-year students (Carreras, P. and Fernandez Castro, J. 1998).

The primary objective of this research is to investigate the underlying mechanisms of emotional regulation, specifically focusing on the modulation of excitement. By comprehending the nature of arousal, we can gain valuable insights into the strategies employed for emotion regulation, particularly in the management of intense positive emotions. It is noteworthy that anxiety is frequently encountered within social contexts, such as meetings or group activities. Therefore, an exploration into the realm of emotion is instrumental in elucidating its role in social interaction and communication. This understanding can potentially enhance our ability to navigate and respond to various emotional states effectively.

RESEARCH METHOD

In an endeavor to examine the correlation between cognitive metrics and the degree of arousal, our initial approach involved the utilization of situational and individual arousal assessments, as devised by Spielberger-Khan. It is observed that an elevated level of arousal can precipitate psychosomatic disorders, whereas a diminished level of arousal can result in a state of depression and reduced motivation. The arousal scale, a significant contribution by Ch. D. Spielberger and Yu. L. Khan, has been instrumental in this study. The Russian adaptation of this scale, referred to as the Reactive and Personal Anxiety Scale, gained prominence through its inclusion in STAI (1976, 1978). This technique was further adapted and standardized by Yu.L. Khanda. The test facilitates the determination of anxiety as a consequence of situational (reactive) arousal and personal arousal, thereby enabling an investigation into their impact on cognitive functions.

Situational anxiety, a universal human experience, is typified by a spectrum of emotions, including tension, anxiety, and nervousness, elicited in response to specific environmental contexts. These emotional responses, varying in intensity, are transient and subject to change over time as they represent an individual's emotional reaction to the prevailing situation. On the other hand, individual arousal is a stable attribute, influenced by an individual's temperament, character, upbringing, and the capacity to employ specific strategies in response to external stimuli. This constant value underscores the inherent variability in human responses to similar situations.

The test under consideration is composed of two distinct blocks of questions. The first block, comprising 20 questions, is designed to capture the respondent's current emotional state. The second block, also containing 20 questions, seeks to understand the respondent's typical emotional state. The indicators for Situational Anxiety (SH) are computed using the formula $\Sigma 1 - \Sigma 2 + 50$. Here, $\Sigma 1$ represents the sum of scores from items 3, 4, 6, 7, 9, 12, 13, 14, 17, 18 on the scale, while $\Sigma 2$ is the sum of scores from all remaining items (1, 2, 5, 8, 10, 15, 16, 19, 20). The indicators for Individual Excitement (FH) are calculated using the formula $\Sigma 1 - \Sigma 2 + 35$. In this case, $\Sigma 1$ is the sum of scores from items 22, 23, 24, 25, 28, 29, 31, 32, 34, 35, 37, 38, 40 on the scale, and $\Sigma 2$ is the sum of scores from the remaining items (21, 26, 27, 30, 33, 36, 39). During interpretation, the results are evaluated as follows: scores up to 30 indicate low excitement, scores between 31 and 45 suggest medium excitement, and scores of 46 and above denote high excitement. A significant deviation from the average level of arousal, particularly high arousal, signifies a propensity to experience intense arousal in situations where the individual's expertise is being evaluated. In such instances, it is recommended to reduce the subjective evaluation of the situation and issues, focus on deep contemplation of the activity, and foster a sense of confidence in success.

The assessment is typically administered to individuals aged 16 and above. The demographic under investigation in our study comprised individuals aged between 17 and 21. The research was conducted among students in their first, second, third, and fourth years of study at Western Caspian University. On average, the test was administered to a sample size of 25 students per course. The research was carried out on a regular academic day prior to the examination period, with the objective of studying the impact of impending examinations on anxiety levels. All students participated in the testing process under identical conditions, ensuring the consistency of the data collected.

Upon conducting a statistical analysis of the research findings, it was discerned that the first-year students exhibited situational anxiety levels averaging at 34.75 points, with an individual anxiety index of 38.7 points. The students in the second year demonstrated levels of situational excitement averaging at 42.25 points, with an individual excitement index of 44.3 points. The third-year students displayed situational excitement levels averaging at 40.35 points, and an individual excitement index of 42.1 points. Lastly, the fourth-year students manifested a situational anxiety level of 41.82 points on average, and an individual anxiety index of 46.3 points. These findings provide a comprehensive overview of the varying levels of anxiety and excitement across different academic years. (Figure 2).

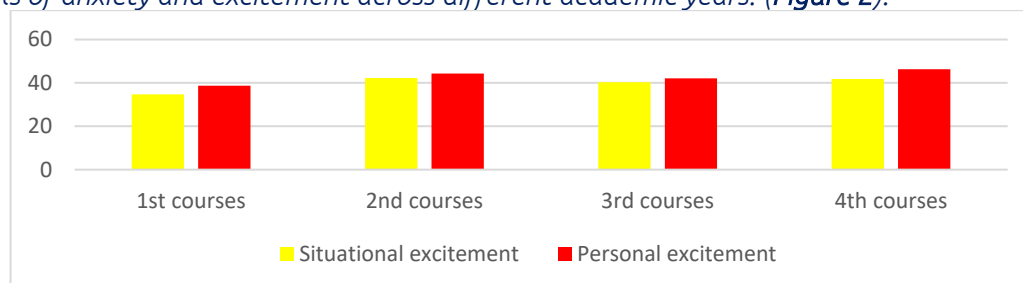


Figure 2. Individual and situational anxiety indicators of students studying in I, II, III and IV courses.

To investigate the influence of arousal on cognitive functions, we employed the “Memory by Number Test”, a tool designed to evaluate short-term memory. This test facilitates the assessment of short-term visual memory, its capacity, and precision. A table comprising 12 numerals intended for memorization is prepared. This table is displayed for a duration of 20 seconds, following which it is removed. The participant is then required to record all the numerals they can recall. The assessment of short-term visual memory is based on the count of accurately recalled digits. The standard range for adults is typically 7 ± 2 points. Consequently, the short-term memory scores were found to be 8.02 points for first-year students, 8.25 points for second-year students, 8.95 points for third-year students, and 8.07 points for fourth-year students. (Figure 3).

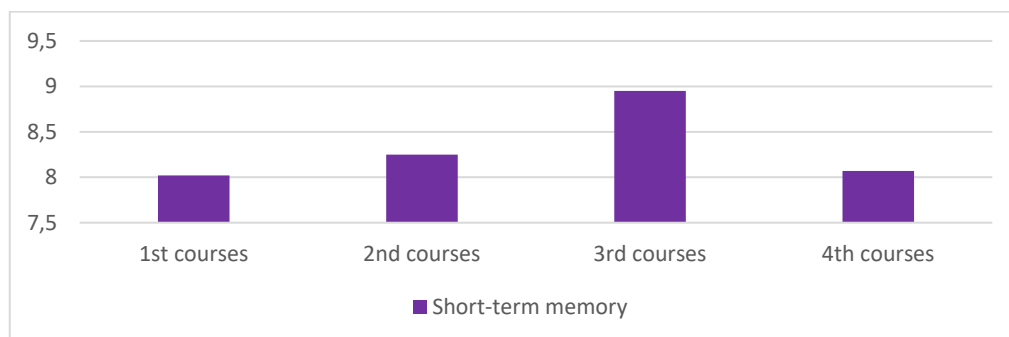


Figure 3. Indicators of short-term memory of students studying in I, II, III and IV courses.

CONCLUSION

The findings of the conducted research generally indicate a trend of escalating situational and individual anxiety with advancing age. Given that our study was undertaken on regular academic days preceding examinations, and students were in the throes of exam preparation, the observed level of arousal can be deemed as optimal. Somatic alterations transpiring within the body at this optimal level of arousal exert a positive influence on the efficiency of cognitive functions, including attention, memory, and the process of memorization. However, an arousal level exceeding the optimal threshold can precipitate a decline in productivity and cognitive function. This observation aligns with the Yerkes-Dodson law, which posits that arousal enhances the efficiency of cognitive processes up to a certain threshold of excitement, considered as the optimal level of arousal for each individual. When the level of arousal surpasses this optimal threshold, a converse phenomenon is observed, characterized by a deterioration in cognitive functions.

Consequently, our observations indicated that the optimal level of arousal stimulates cognitive processes in the students under study. The short-term memory index, which was found to be higher than the standard norm, coupled with an average level of arousal, substantiated the inference that the

students under study were essentially healthy, exhibited functional brain activity, and possessed the capability to activate cognitive processes as necessitated. Overall, it was discerned that cognitive processes are intrinsically linked to arousal processes.

References

1. Karamova, N.Y. (2013). *The problem of studying stress and its interactions with cognitive processes. Works of Young Scientists, (7), pp 221-228.*
2. Iskakova, U.B., Abisheva, Z.S., Zhurunova, M.S., Zhetpisbaeva, G.D., & Ismagulova, T.M. (2016). *Situational anxiety and psycho-emotional condition of students during border control. International Journal of Applied and Fundamental Studies, (11-5), pp 900-902.*
3. *Proceedings of the I International Scientific and Practical Conference 27-28 February 2024 Madrid.Spain 2024 p 117-118.*
4. Vivian, N.G., Koh, D., and Chia, S.E., *Examination Stress, Salivary Cortisol, and Academic Performance, Psychol. Rep., 2003, vol. 93, p. 1133.*
5. Yerkes RM, Dodson JD. *The relation of strength of stimulus to rapidity of habit-formation. J.Comp.Neurol.Psychol. 1908;18: pp 459–482.*
6. *Exam Experience and Some Reactions to Exam Stress* N. Šimic and I. Manenica University of Zadar Department of Psychology Krešimirova obala 2, Zadar, Croatia Received June 20, 2011
7. Carreras, P. and Fernandez Castro, J., *Adaptation to Examination Stress in First and Second Year University Students, Stud. Psychol., 1998, vol. 40, p. 181*

Technical sciences

RESEARCH ON THE EXTRACTION OF ORGANIC SUBSTANCES FROM THE GRAPES

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Abstract

The main and very popular product obtained from grapes is grape wine. However, its production leads to the collection of a large amount of waste - grape mash and pith. However, these products can be the starting raw materials for the production of semi-finished products containing a large amount of biologically active compounds. One of the most important properties of grape puree and pith is the ability to act as an antioxidant, that is, it inhibits lipid oxidation processes in fat-containing systems. In this regard, it is important to use useful substances in such waste.

Keywords: modern conditions, commercial activity, company, process, industry.

Introduction.

Since grape seed oil has a wide range of biological activity, it is in high demand in the world market in the food, cosmetic and pharmaceutical industries. Grape oil is characterized by a high amount of poly- and monounsaturated fatty acids; it contains tocopherols (vitamin E), carotenoids (vitamin A), chlorophylls and phenolic compounds, which have antioxidant, immunostimulating, anti-inflammatory, astringent and wound healing activities. These compounds cannot be synthesized by the human or animal body, they can only be obtained from food. Grape seed oil is obtained from grape seeds, which are waste from wine and juice production. 20-25% of the mass of processed grapes is waste, and the amount of grape seeds in the waste varies between 25-38% [1]. Grape seeds contain 10-20% fat, mainly consisting of triglycerides of fatty acids.

Main part

Carbon dioxide (CO₂) extraction of grape seeds is an alternative, modern and promising technology for extracting biologically active substances from plant raw materials. Carbon dioxide has low values of critical parameters: $T_{crit} = 30.9\text{ }^{\circ}\text{C}$, $P_{crit} = 72.8\text{ atm.}$, critical density 0.469 g/cm^3 ; CO₂ is non-flammable, non-toxic and allows selective and advanced processing of raw materials with different extraction parameters. Effects of pressure, temperature and time on grape oil yield during SCFE-CO₂. Thus, the following CO₂ conditions are suggested to obtain maximum oil from grape seeds: 250 bar, 80 °C, extraction time 60 min and CO₂ consumption 69 g/min, oil yield from 0.84-0.42 mm crushed seeds Merlot grape variety 14.66% [4]; 400 bar, 41 °C, extraction time 90 min and CO₂ consumption 32 g/min, and oil yield from Cabernerank seeds is 14.49%.

Extraction method with diethyl ether.

The mass fraction of total extractives in the raw material is determined by complete extraction with a low-boiling solvent in a glass Soxhlet apparatus (Figure 1). Diethyl ether with a boiling point of 34.5-36.0 °C is used as a solvent [2].

High performance thin layer chromatography determination of component composition of extracts was carried out by thin layer chromatography method. This technique is as follows. About 0.1 g (accurately weighed) of the extract is placed in a glass beaker, 10 cm³ of diethyl ether is added, and the sample is stirred with a glass rod until it is completely dissolved. After that, the resulting mixture is dried with anhydrous sodium sulfate until all traces of moisture disappear so that the solution is completely clear. In parallel, highly efficient "Sorbfil" plates are prepared: they are activated by heating in a drying cabinet at a temperature of 130 °C for 30 minutes; Mark the starting line 1 cm from the beginning of the plate. Then, the ether-dehydrated solution of the extract sample is applied by capillary to the starting line of the prepared plate, which is then placed in the chromatographic chamber. Chromatography is performed on the vapors of a mixture of

solvents: hexane: diethyl ether: acetic acid (80:20:1), using the developing reagent H_2SO_4 (2% solution). After that, the plate is placed in a drying cabinet for a few minutes to fully develop all the spots on the chromatogram. Quantification of individual groups of test substances is carried out by scanning densitometry using a computer program for evaluation and calculation of SorbfilTLC Videodensitometer chromatogram parameters. The chromatograms are then analyzed for group composition.

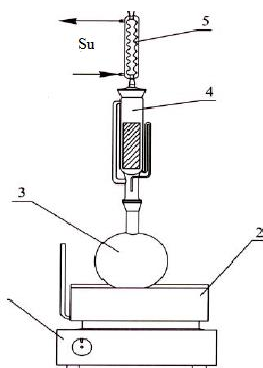


Figure 1. Low-boiling hydrocarbon solvent extraction setup.

1 - electric stove; 2 - water bath;
3 – receiving flask; 4 – Soxhlet apparatus; 5 – refrigerator.

Removal of the lipid complex was performed by pressing, extraction with a highly volatile organic solvent and liquid carbon dioxide. CO_2 extract of grape seeds is a yellowish-green oily transparent liquid with a pleasant smell and a bitter taste. The oil obtained by thorough extraction with diethyl ether is a greenish oily liquid with a pleasant odor and a bitter taste. The oil obtained by cold pressing in a laboratory hydraulic press with a compressive force of 100 kN/cm² and a holding time of 15 minutes is a yellowish oily liquid with a pleasant smell and a delicious taste.

Oils obtained by pressing, diethyl ether extraction and CO_2 extraction were analyzed by thin layer chromatography. The results of the study of the component composition of the extracts are shown in Figures 2, 3, 4. Figure 2 shows the lipid composition of grape seed CO_2 extract.

Results

The completed set of researches made it possible to develop technologies for the processing of secondary winemaking waste and the extraction of organic matter from grape seed.

Grape varieties have been studied and analyzed as a source of raw materials for obtaining grape oil. As a result, it became known that the most promising are the seeds of Bianco, Riesling, Sauvignon, Floral Muscat grape varieties with an oil content of 15-19%. Experimentally, it has been determined that grapeseed oil contains a favorable complex of fatty acids, for example: stearic from 4.7% to 11.2%, oleic from 27.3% to 32.9%, linoleic from 39.2% to 43.7%, linolenic from 0.4% to 0.9%;

The study of the lipid complex of grape oil obtained by mechanical extraction, hydrocarbon solvent extraction and carbon dioxide extraction showed that CO_2 extraction provides the maximum amount of biologically active substances and the maximum amount of oxidation products.

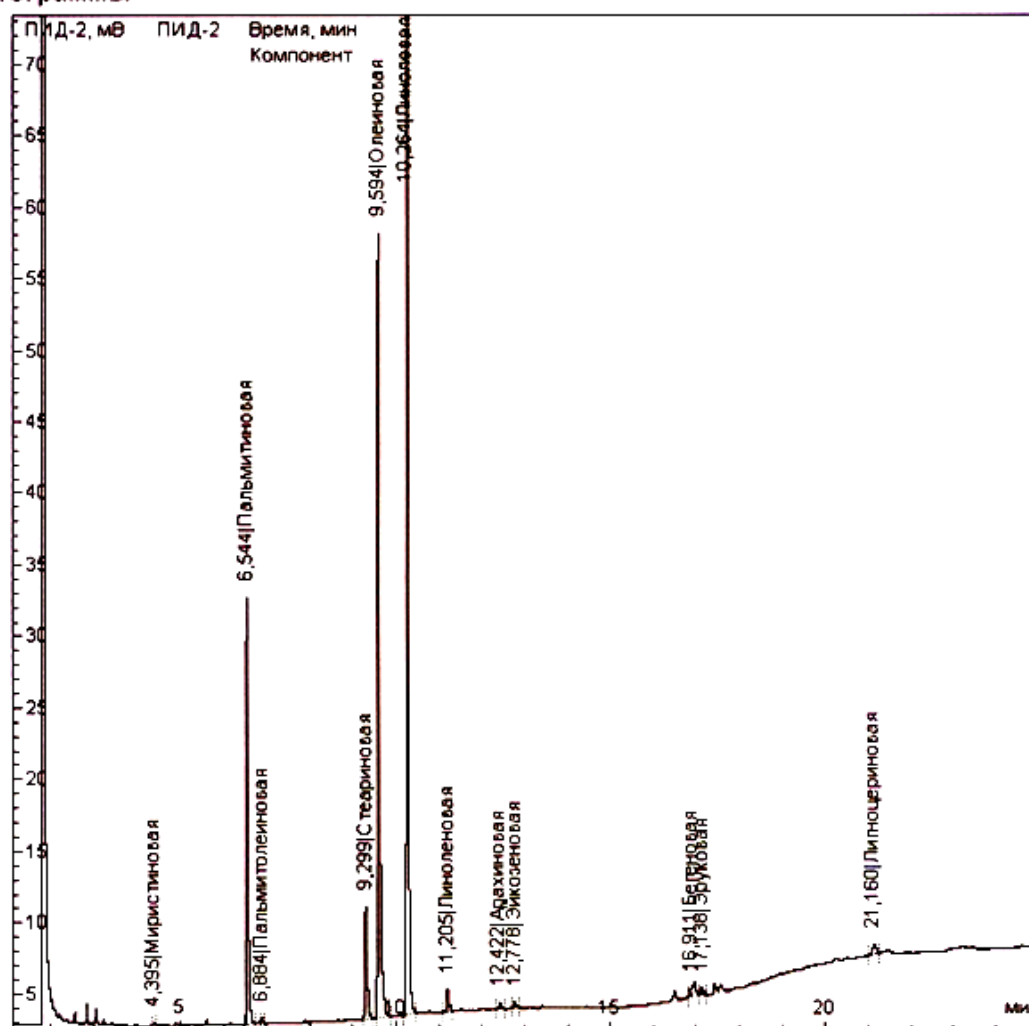
It has been shown that in order to maximize the yield of grapeseed oil and reduce the amount of accompanying lipids in its content, it is suggested to use electroactivated liquid hydrothermal treatment from NaCl aqueous solution. to use for 35 - 40 minutes at a concentration of 1% to 5%, a pH of 1 to 3 to 15% in an amount of 13.0%, a temperature of 105°C to 110°C needed.

Figure 2. Report on the determination of organic matter in the seed oil of Riesling grape variety.

Расчет по компонентам

№	Время, мин	Компонент	Площадь	Высота	Площадь, %
1	4.395	Миристиновая	0.513	0.261	0.10
2	6.544	Пальмитиновая	80.160	29.865	15.18
3	6.884	Пальмитолеиновая	0.952	0.387	0.18
4	9.299	Стеариновая	24.994	7.932	4.73
5	9.594	Олеиновая	173.743	54.866	32.90
6	10.264	Линолевая	230.805	75.113	43.71
7	11.205	Линоленовая	5.108	1.586	0.97
8	12.422	Арахидовая	1.624	0.442	0.31
9	12.778	Эйкозеновая	1.824	0.481	0.35
10	16.911	Бегеновая	1.435	0.553	0.27
11	17.138	Эруковая	2.041	0.484	0.39
12	21.160	Лигноцериновая	4.817	0.702	0.91

Хроматограммы



References

1. Zueva T.A., Ramazanov A.Sh., Andreeva I.N. Comparative analysis of quality indicators of the lipophilic complex of grape seeds obtained by different methods // Vestnik DGU. 2003. -S. 72-76.
2. Giashvili M.D., Tanashchuk T.N. Prospects of using grape juice as a source of biologically active additives. // Winemaking and viticulture. 2005. No. 6. -C. 37-38.

DESIGN AND DEVELOPMENT OF A SYSTEM FOR CONTROL OF AUTOMOBILE DRIVING**Marat Mukiyat**
Kazakhstan, Astana**Introduction**

The market sector for unmanned vehicle traffic control systems is new and rapidly growing in the world. For many years, research has been carried out on the development of driver assistance systems to improve road safety. These systems are referred to by the global engineering community as ADAS (Advanced Driver Assistance Systems). Large automakers are developing developments in the field of creating unmanned vehicle traffic control (UVTC) systems based on ADAS systems. IT companies and military equipment manufacturers, such as Google [1], Nvidia [2], Tesla [3] are also successfully developing DBMS; DARPA [4]; Armament Research; Development and Engineering Center; Oshkosh Defense; Lockheed Martin; Mira Autonomous Control Equipment; Ruag Defence; Torc Robotics; Kairos Autonomy; Selex ES; Oto Melara; G-Nius, etc.

Experience in developing unmanned vehicle traffic control systems

To assess the performance and increase the level of competition among developers of unmanned traffic control systems, with the support of the US government, competitions for unmanned vehicles (UVs) were organized - DARPA Grand Challenge [4]. The holding of these competitions revealed all the shortcomings of unmanned vehicles and significantly influenced the development of the unmanned industry. It should be noted that most of the participating teams were a combination of a large automaker that provided the vehicle and a university that was involved in the implementation of unmanned functions on this vehicle.

In 2014, the first national standard in the field of autonomous vehicles was approved in the United States - SAE J3016 "Automated traffic control systems for vehicles. Classification, terms and definitions" (SAE J3016 Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems) [5]. The standard was developed by the newly created On-Road Automated Vehicle Standards Committee and contains definitions, terminology, and classification of automation levels of road vehicles. The document in question is the basis for the subsequent development of standards and defines the future language of communication of the community dealing with issues of automated and autonomous telephone exchanges.

The SAE J3016 classification [5] gives the following definitions for automation levels:

- level 0 – without automation;
- level 1 – driver assistance;
- level 2 – partial automation;
- level 3 – conditional automation.
- level 4 – increased automation (for example, Tesla's Model S (Hardware version 2), which successfully passed autopilot tests in California [3];
- level 5 – full automation (a project to develop unmanned driving technology, started by Google [1].

The main difference between Google's developments and other UV developers is that during the movement, the data received from LIDAR is verified with high-resolution three-dimensional maps recorded earlier. Thanks to this, it is possible to detect obstacles along the route using a comparison method. Therefore, at this stage of development of autonomous driving technologies, Google cars do not drive on all public roads, but only on those where detailed 3D maps have already been recorded.

In the Republic of Kazakhstan at the moment there are no automobile manufacturing companies that would develop such vehicles. But in the neighboring Russian Federation there are a number of companies that are successfully developing this idea and plan to enter our market shortly: Yandex [6], Cognitive Technologies [7], FSUE NAMI [8], PJSC KamAZ [9], Aurora robotics [10] etc.

Among Russian developers of unmanned vehicles, one of the most successful companies is Yandex [6]. The goal of the development, like that of Uber [11], is to use unmanned vehicles in the field of transport services (passenger taxis, cargo transportation, etc.) in the future. To date, Yandex has developed two prototypes of unmanned vehicles based on the Toyota Prius and Kia Soul.

The hardware consists of the following types of sensors. Inside the car, there are front and rear cameras, from which images are used to recognize cars, pedestrians, road signs and markings, as well as

the boundaries of the roadway. Three LIDARs are installed on the car's roof: Velodyne HDL-32 and two Velodyne VLP-16. These devices scan the surrounding space using a laser emitter. Based on information about the reflections of rays, a three-dimensional map is compiled, with the help of which the exact distances to certain objects around the machine are calculated. The machine is also equipped with sensors that determine its location, speed, and direction of movement. These are GPS/GLONASS receivers, an inertial measurement unit, and sensors that measure the vehicle's odometric data, for example, the rotation speed of individual wheels.

To reduce the gap in the technological development of unmanned vehicle traffic control systems and the development of UV automatic control technologies adapted for use in Russian climatic road conditions, UV competitions are held annually in Russia [12].

Electric platform of the unmanned vehicle being developed

An electric platform was chosen as the chassis for installing the unmanned vehicle traffic control system (Fig. 1).

Several advantages of electric transport over traditional types of vehicles justify this choice. The development of electric transport is a global trend. Almost all major automakers are developing in this area, and the leading countries of the world (USA, China, Japan, Germany, Great Britain) have long-term programs to support the development of electric vehicles and stimulate consumers. Currently, support is expected from the government of the Republic of Kazakhstan.

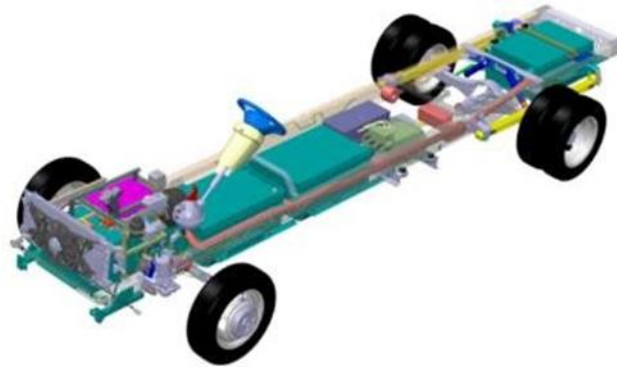


Figure 1. Appearance of the electrical platform

Control of chassis electrical units does not require the installation of actuators and drives in the case of mechanical, hydraulic and pneumatic units, which helps to increase the safety and reliability of vehicle systems, as well as increase the speed and reduce the cost of its various systems.

This electric platform is the basis of the electric bus (Fig. 2). The use of route transport as an object where unmanned solutions will be applied is explained by a number of reasons: the main route of the vehicle is predetermined, the ability to move along dedicated lanes for public transport, and the ability to charge batteries at the end points of the route. The indicated reasons for using an electric bus as an object of unmanned operation are relevant in the case when a regulatory and legislative framework for unmanned vehicles in the Republic of Kazakhstan is formed, according to which it will be possible to operate UV on public roads.

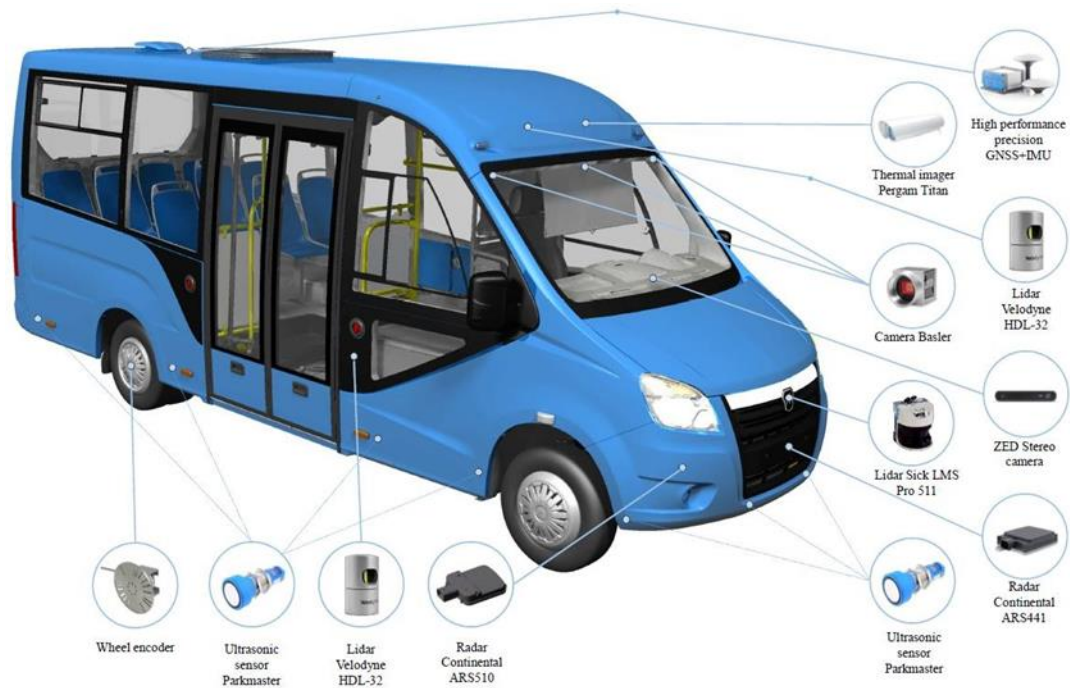


Figure 2. Appearance of the developed electric bus and the hardware of the system for determining the situation around the vehicle

The hardware of the system for determining the situation around the vehicle is shown in Fig. 2 and consists of several types of sensors.

To detect other traffic objects and obstacles along the route, as well as build a virtual map of the route, 4 Velodyne HDL-32 LIDARs located around the perimeter of the vehicle will be used. The system will also feature a Sick LMS Pro 511 planar LIDAR installed at bumper level. This LIDAR has a higher frequency and environmental protection and will be used to detect obstacles ahead of the vehicle at longer distances.

An important aspect when designing a control system is the reliability of the entire control system as a whole. This issue is especially relevant in extreme road and climatic conditions.

To increase the reliability of the obstacle detection system on the UV, in addition to the lidar system, it is planned to use a system of short- and long-range radars. The Continental ARS441 and SRR510 radars have suitable characteristics. The use of this system of several radars will make it possible to assess the situation ahead of the car and measure the distance to obstacles at long ranges (up to 250 m). The operation of radars is less affected by weather conditions, the color of objects, and illumination. Radars also have good range and speed resolution and instant data processing, which is especially important for high speeds. It is worth noting that systems with various types of radars are already commercially used by large automakers in the development of ADAS systems.

In the near zone (up to 3 m), the situation around the UV will be monitored using a system consisting of 16 ultrasonic sensors.

Compliance with traffic rules is a mandatory condition for operating UV on public roads. Recognition of participants in the road scene, in particular, other cars, pedestrians, road signs, markings, etc. carried out using a technical vision system, the hardware of which is Basler video cameras [13]. The unmanned vehicle traffic control system uses three video cameras that completely cover the forward view.

To increase the efficiency, reliability, and safety of the systems for detecting obstacles and other road users, a thermal imager will be used. The thermal image obtained from it, after processing by the computer complex, will improve the recognition of the boundaries of the roadway, and pre-assess upcoming turns and curvatures on the route. A thermal imager, unlike video cameras, operates when illuminated by the headlights of oncoming cars, through smoke, dust, fog, and rain.

For accurate positioning of the UV on the ground, it is planned to use a complex loosely coupled navigation system, consisting of high-precision GNSS navigation and an inertial unit with an odometer.

Experimental studies of SBUD components planned for installation on an electric bus

Before installing the hardware on the electric bus, the functionality of the driver assistance system was realized and implemented, aimed at recognizing the road scene, and traffic objects and warning about a possible critical situation.

To operate the system for recognizing road scene parameters and traffic objects, it was proposed to use a ZED stereo camera [14] with an Nvidia Jetson TX2 computing module. This combination of equipment should ensure continuous data collection while driving and the construction of a 3D model of the road scene, with further saving and loading into a common database. The system allows you to constantly collect data about the environment and draw a movement trajectory, which will help you plot the most favorable route of movement (Fig. 3).

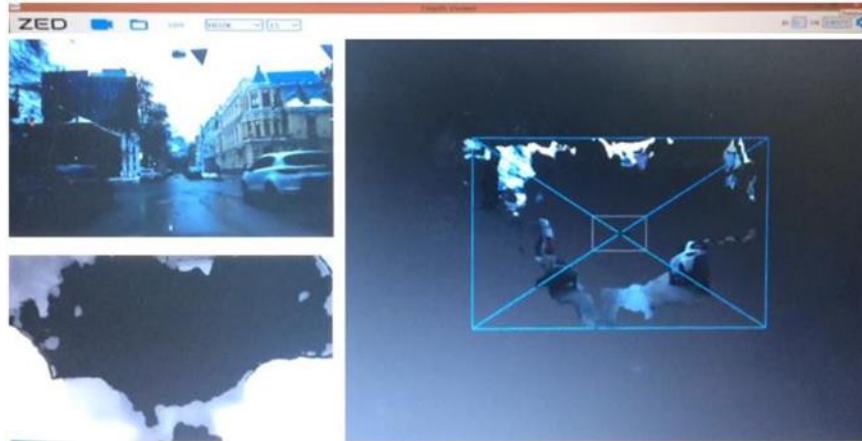


Figure 3. Construction of a depth map with a ZED stereo camera

The camera requires a USB 3.0 interface, a high-performance Nvidia video card or an Nvidia Jetson TX 1st or 2nd series development platform, and the Cuda 7.5 library installed (this driver is publicly available).

Based on the results of studies of the stereo camera, the range of the system was assessed. The average range is 11.65 m, which satisfies the requirements and allows the construction of depth maps based on the stereo camera, which can later be used in work.

In parallel with the experimental studies of stereo cameras, work was carried out with LIDARs. The goal is to assess the possibility of generating a point cloud of a road scene and the feasibility of further localization of the UV inside the point cloud. The tests used a Velodyne VLP 16 LIDAR, the scanning mechanism of which uses a rotating mirror. If the mirror's rotation axis is almost perpendicular to the mirror surface, the scan of the reflected laser beam will be an elliptic curve. The undeniable advantage of this approach is that every point in the surrounding space is scanned twice. But at the same time, such a scan makes processing the scanning results in themselves several times more difficult, since, in addition to increasing the volume of output data, points of the same area were obtained not from one, but from different positions (if we consider a moving system), the resulting point cloud contains "noise".

Fig. Figure 4 shows an example of a point cloud obtained using Velodyne VLP 16 LIDAR [15] in the city of Astana. A blue dot is visible near the center of the image. It indicates the position of the LIDAR in space. The representation of data in space is carried out by combining two-dimensional point clouds. When the module rotates, an array of points from each emitter-detector pair forms a continuous circle on a flat surface.

In the example above, the LIDAR was installed on the roof of a car, so in the image below the blue dot, there is a dark area - the body of the car. The image shows a road fence, ground, and trees.

If there are obstacles on the optical path that prevent you from obtaining data about what is behind them, such areas remain empty in the figure. It is also possible to mount the LIDAR at an angle of 90° to the vertical axis to change the field of view.

The Velodyne VLP 16 LIDAR reviewed belongs to class 1, that is, it is considered safe for the eyes. The sensor is housed in a waterproof housing that remains operational at temperatures from -10 to +60 C°, and is optimal for use in cars.

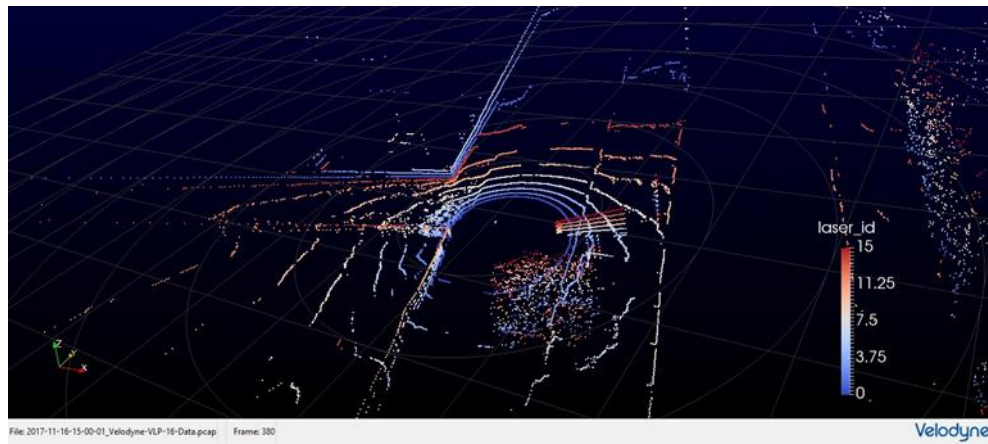


Figure 4. Point cloud

Based on the results of LIDAR studies, the feasibility of using this method of localizing vehicles in space along the boundaries of the roadway has been confirmed. The quality of the algorithm is 78%. It should be noted that checking the lane detection method is part of localizing the vehicle in space. In the future, when the unmanned electric platform moves, the pre-compiled map will be compared with the map obtained in real-time, also generated using LIDARs. Based on the comparison results, the UV will be localized in a relative coordinate system, where the center is LIDAR.

Experimental studies of the route positioning system were also carried out, consisting of:

- dual-antenna GNSS receiver OS-203-GSM [16];
- two GNSS antennas AT330;
- inertial block Girolab GL-VG109.

The system is made according to a separate scheme for integrating data from the GNSS receiver and IMU, i.e. they work independently of each other. The IMU is periodically adjusted based on GNSS data.

In total, after installing the equipment on the vehicle, 10 races were carried out along the route. The chosen route simulated an urban environment consisting of buildings close to each other, trees, metal structures, trusses, and pipes located along the road. An analysis of the operation of the navigation system was carried out after the races and consisted of comparing coordinates from the GNSS receiver and the IMU unit.

During the races, the integrity and smoothness of the trajectory, the quality of GSM communication along the entire length of the route, the possibility of integrating the positioning system with the onboard computer, and the need and quality of operation of the inertial unit were determined. A fragment of the testing is shown in Fig. 5.

The quality of tracking of navigation satellites throughout the entire trajectory was normal. The only exceptions were the intersections with iron trusses and pipes, which caused a trajectory shift of 1-3s.

The quality of the GSM network signal was satisfactory, however, at the beginning of the route, communication disruptions (irregular) were noticed. It is recommended to use Wi-Fi to transmit corrective information from the base station to the vehicle.

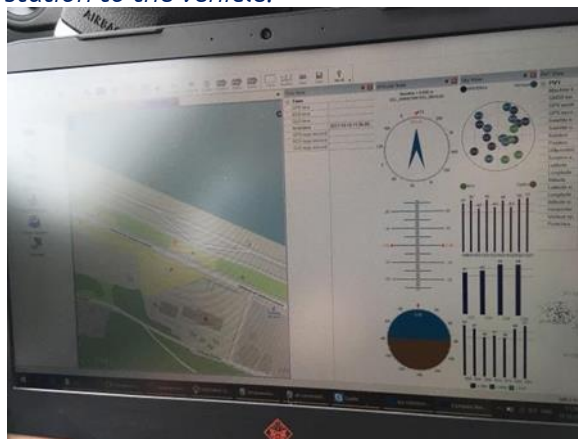


Figure 5. Operation of navigation equipment during testing

The use of an inertial block caused a deterioration in the smoothness of the trajectory, but the use of an inertial system is desirable to prevent sharp jumps in the trajectory when tracking of navigation satellites deteriorates. The distance between points during optimal operation was about 2 m along the entire route. It should be noted that the navigation trajectory cannot be considered a reliable source of positioning information.

Thus, this navigation system can be used in urban environments, but without the presence of tunnels and other long-term interruptions in communication with GNSS satellites. To improve the accuracy of vehicle positioning in space, in the future, it is necessary to ensure joint work with diversification systems to increase the reliability of the system (technical vision, work with laser scanners, etc.). Work will also be done to improve the quality of the output trajectory of the inertial system, and repeated testing is planned.

According to the results of studies of the navigation system, the deviation of the artificial neural network movement trajectory from the GNSS movement trajectory did not exceed 3 m. The minimum deviation value is 1.334 m, the maximum is 2.647 m. The wide interval between the minimum and maximum value arose because communication with the GNSS satellites was lost for a long time (more than 10 s) due to interference in the traffic area (metal trusses and pipes) and low vehicle speed. In the future, it is necessary to improve the quality of the ANN output trajectory, as well as to ensure joint work with diversification systems to increase the reliability of the system.

Technical implementation of an unmanned vehicle

Preparation for the installation of unmanned control systems for both the electrical platform as a whole and its components and assemblies is one of the most important tasks. Some components borrowed from commercially produced vehicles are not suitable for integrating a self-driving control system. Thus, a hydraulic power steering with an electric hydraulic pump is currently installed on the electric platform. This solution complicates the implementation of steering control in unmanned mode and leads to an increase in the cost of the design, an increase in its complexity, and a decrease in reliability in the case of using additional actuators and drives. In the future, this design solution cannot be applied to a production model.

To avoid these problems, it was decided to implement a steering mechanism with an electromechanical power amplifier. Developing your mechanical rack unit is impractical due to the large financial and time costs. To speed up the development of electromechanical power steering, an analog was chosen that is freely distributed on the CIS market and fully meets the requirements set in the technical specifications. According to the technical specifications of the Joint Engineering Center of the GAZ Group, a steering mechanism with an electromechanical amplifier was selected and implemented. This rack-and-pinion steering with a torque sensor on the input shaft, an electric motor located parallel to the rack axis (drive from the electric motor to the rack through a belt drive and a ball screw drive) and an electromechanical power steering control unit meets the parameters.

The planned transition to a steering system with the possibility of external influence and connection to ADAS systems with an autopilot function in the future consists of using an electromechanical steering mechanism of the selected type to control the vehicle's turn. This type of steering mechanism meets the requirements for load capacity, and durability and does not violate wheel alignment angles. Fig. 6 shows photographs of the installation field of the electromechanical rail on the standard places of the subframe of the unmanned electric bus being developed with minimal modifications.



Figure 6. Electromechanical rack installed in a regular place in an electric bus

Steering control will be carried out by changing the rotation parameters of a three-phase synchronous electric motor mounted on the steering rack. Control signals will be transmitted via the CAN bus.

This solution ensures the integration of steering control into the overall vehicle CAN bus architecture, rapid response to control input, and reliable operation of the steering control as a whole.

To implement the steering mechanism on a prototype UV, it was necessary to solve several main problems:

- *selection and configuration of the steering motor controller, and transmission of control commands via the CAN bus;*
- *development of software for electric motor control;*
- *layout of the steering mechanism with an electromechanical amplifier in the standard places of the car.*

When choosing a controller for an electric motor, difficulties arose due to the lack of a product, or the characteristics of the existing ones did not meet the requirements. In addition, all technical solutions on the market are aimed at companies operating on a large industrial scale.

The selected module [17] allows you to adjust the position, speed, and torque of the electric motor. In addition, this module is also a controller, with the help of which it is possible to receive and transmit messages to the CAN bus.

Conclusion

The structure of the unmanned vehicle traffic control system has been developed, the hardware has been selected, and barriers in the field of technical implementation of a steering control system with the possibility of external influence have been overcome. Design documentation is being developed for various SBUD systems, software, and data transmission networks that unite all subsystems into a single network on the onboard computer system, and an electrical platform is being prepared for the installation of unmanned traffic control systems. Experimental studies of the components planned for installation on the electric bus were also carried out. The research results confirmed the feasibility of using the selected components on the UV.

At the moment, the prototype electric bus is equipped with an electromechanical steering rack with the possibility of external control. The system was tested. After installation and debugging of the technological equipment, a prototype of the UV will be tested at a specialized testing site to check and debug all systems.

References

1. Self-driving cars - autonomous vehicles - ride-hail. Waymo. <https://waymo.com/>
2. Nvidia blog. NVIDIA Blog. <https://blogs.nvidia.com/>
3. Electric cars, Solar & Clean Energy. Tesla. <https://www.tesla.com/>
4. Defense Advanced Research Projects Agency. DARPA RSS. <https://www.darpa.mil/>
5. Mfenjou, M. L., Abba Ari, A. A., Abdou, W., Spies, F., & Kolyang. (2018). Methodology and trends for an intelligent transport system in developing countries. *Sustainable Computing: Informatics and Systems*, 19, 96–111. <https://doi.org/10.1016/j.suscom.2018.08.002>
6. Company blog - yandex.taxi unveils self-driving car project. Yandex. (n.d.). <https://yandex.com/company/blog/yandex-taxi-unveils-self-driving-car-project/>
7. Hqt. (2022a, October 13). The future of farming: Tractor Autopilot Systems. smajayu. <https://www.smajayu.com/tractor-autopilot-systems/>
8. State Scientific Center of the Russian Federation FSUE NAMI. NAMI logo. <http://nami.ru/>
9. PJSC official website. Official website of KAMAZ PJSC. <https://kamaz.ru/>
10. ROBOTICS AND AUTONOMOUS CONTROL OF GROUND VEHICLES. Aurora Robotics. <http://avroa-robotics.ru/>
11. Our road to self-driving vehicles | uber blog. (n.d.). <https://www.uber.com/blog/our-road-to-self-driving-vehicles/>
12. Creation of an intelligent assistance system. Russianrobotics.ru. (n.d.). <http://russianrobotics.ru/>
13. Expert in computer and machine vision. Basler. (2024, April 23). <https://www.baslerweb.com/ru>
14. AI perception for Automation. Stereolabs. (n.d.). <https://www.stereolabs.com/>
15. Envision the future. Velodyne Lidar. (2023, April 4). <http://velodynelidar.com/>
16. GNSS receivers guide 2023: All types and manufacturers + read expert buying tips. Geo. (n.d.). <https://geo-matching.com/categories/gnss-receivers> ODrive. <https://odriverobotics.com/>

TRAINING CNNs TO RECOGNIZE MANUSCRIPTS TRAINING CONVOLUTIONAL NEURAL NETWORKS TO RECOGNIZE MANUSCRIPTS

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Abstract

Convolutional neural networks (CNNs) are commonly used for image classification tasks, including recognizing manuscripts. The process of training a CNN to recognize manuscripts typically involves several steps:

First, the dataset of manuscript images needs to be preprocessed to ensure that the images are of a consistent size and format. This may involve resizing, normalization, and data augmentation techniques, such as random rotations or flips, to improve the quality of the images and to increase the size of the training set. Next, the dataset is typically split into training, validation, and testing sets. The training set is used to train the CNN model, while the validation set is used to evaluate the performance of the model during training and to adjust the hyperparameters of the model. The testing set is used to evaluate the final performance of the trained model on unseen data.

The CNN model is defined and compiled using appropriate activation functions, loss functions, and optimization algorithms. The model architecture may consist of multiple convolutional layers, pooling layers, and dense layers, with the number and size of the layers depending on the complexity of the task and the size of the dataset. The model is then trained on the training set using backpropagation and gradient descent techniques to minimize the loss function. During training, the performance of the model is evaluated on the validation set to determine whether the model is overfitting or underfitting the training data. If necessary, the model is fine-tuned by adjusting the hyperparameters, such as the learning rate or the number of layers, to improve its performance on the validation set. Finally, the trained model is tested on the testing set to evaluate its performance on unseen data. The accuracy of the model can be further improved by using transfer learning techniques or more advanced architectures such as recurrent neural networks (RNNs) or attention-based models.

Overall, the process of training a CNN to recognize manuscripts requires careful preprocessing of the dataset, selection of appropriate hyperparameters and optimization algorithms, and monitoring of the model's performance during training and evaluation. With proper implementation, CNNs can achieve high accuracy in recognizing manuscripts, making them a valuable tool for applications such as document analysis and digitization.

Keywords: CNN – Convolutional neural networks, The Mnist – Modified National Institute of Standards and Technology database, Cross-entropy loss – is used when adjusting model weights during training, GPU – graphics processing unit, Probability – simply how likely something is to happen, Prediction – prediction, or forecast, is a statement about a future event or data.

Introduction

Handwritten digit recognition is a classic problem in computer vision and has numerous practical applications such as automated mail sorting, check processing, and signature verification.

Manuscripted digits are a challenging subset of handwritten digits that are written in a more free-form style and have greater variation in size, shape, and style. Convolutional neural networks (CNNs) have been shown to achieve state-of-the-art performance in digit recognition tasks, surpassing human-level accuracy. In this paper, we explore the use of a CNN based on the Lenet5 architecture to distinguish between manuscripted digits. We start by preprocessing a dataset of manuscripted digit images to ensure that they are of a consistent size and format. We then split the dataset into training, validation, and testing sets and train the CNN using backpropagation and gradient descent techniques. During training, we monitor the performance of the model on the validation set and fine-tune the hyperparameters of the model to improve its accuracy. Finally, we evaluate the performance of the trained model on the testing set to determine its accuracy in distinguishing between manuscripted digits.

Our results demonstrate that the Lenet5 CNN architecture can achieve high accuracy in distinguishing between manuscripted digits, with potential applications in automated data entry and image recognition tasks that involve manuscripted digit data.

Literature review

Handwritten digit identification has long been a fundamental issue in the field of computer vision and it has been extensively studied in the literature. Traditional approaches to digit recognition involved manually designing features and using classifiers such as support vector machines (SVMs) or decision trees. However, these approaches often require domain expertise and suffer from limited accuracy on complex datasets.

Convolutional neural networks (CNNs) have revolutionized the field of computer vision, achieving state-of-the-art performance on various tasks, including digit recognition. LeCun et al. proposed the LeNet5 architecture in 1998, which was the first successful CNN for digit recognition, achieving near-human level accuracy on the MNIST dataset. Since then, numerous variations of CNN architectures have been proposed for digit recognition, such as AlexNet, VGG, and ResNet. These architectures have achieved even higher accuracy on the MNIST dataset and other more complex digit recognition datasets such as SVHN and MNIST-M.

However, recognizing manuscripted digits is still a challenging problem, as they exhibit greater variation in size, shape, and style compared to standard handwritten digits. Several approaches have been proposed in the literature to address this challenge. For example, some methods involve segmenting the digit into smaller sub-regions and applying different recognition algorithms to each sub-region. Other methods involve using generative models, such as generative adversarial networks (GANs), to synthesize new examples of manuscripted digits and augment the training dataset.

Despite these efforts, there is still room for improvement in recognizing manuscripted digits. In this paper, we explore the use of a CNN based on the Lenet5 architecture to distinguish between manuscripted digits. We also experiment with different preprocessing techniques and hyperparameter settings to improve the accuracy of the model. Our results demonstrate that the Lenet5 CNN architecture can achieve high accuracy in recognizing manuscripted digits, which has potential applications in automated data entry and image recognition tasks that involve manuscripted digit data.

Main part (methodology, results)

To get started, we'll need to import some libraries from PyTorch. In addition, we will also use matplotlib.pyplot to see our image data and test data. We will import requests to get an image from the internet to test our model. We also need the Image module from the PIL library because that is what our testing image will be, an image. We also need to import the copy library in order to copy our model later on:

Import libraries

```
import copy
import torch, torchvision
from torch import nn
from torch import optim
from torchvision.transforms import ToTensor
import torch.nn.functional as F
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
from sklearn.metrics import confusion_matrix

import requests
from PIL import Image
from io import BytesIO
```

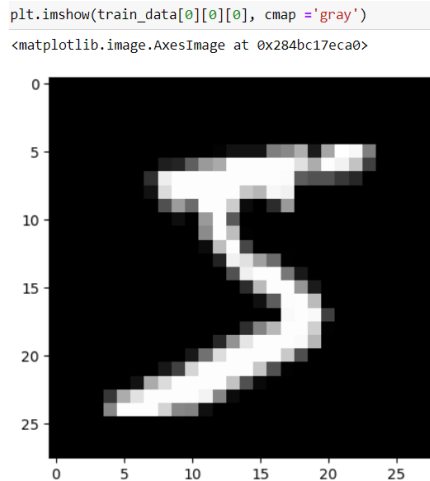
Set the batch size to 64:

```
numb_batch = 64
```

We need to transform the image into a tensor that can be used, so we do `torch vision.transforms.ToTensor()`. We get the training data from the Mnist library and set download to True. Then we need to transform the images. The same can be done for the validation data except that that train is False. We also need the data loaders for each dataset and set the batch size to the wanted number, 64:

```
T = torchvision.transforms.Compose([
    torchvision.transforms.ToTensor()
])
train_data = torchvision.datasets.MNIST('mnist_data', train=True, download=True, transform=T)
val_data = torchvision.datasets.MNIST('mnist_data', train=False, download=True, transform=T)

train_dl = torch.utils.data.DataLoader(train_data, batch_size = numb_batch)
val_dl = torch.utils.data.DataLoader(val_data, batch_size = numb_batch)
```

Creating and Validate the Model: This validation will use the validation set of handwritten digits and compute how many images are predicted right out of the total number of images. This is just a simple loop through every image in the validation data loader:

```
def create_lenet():
    model = nn.Sequential(
        nn.Conv2d(1, 6, 5, padding=2),
        nn.ReLU(),
        nn.AvgPool2d(2, stride=2),
        nn.Conv2d(6, 16, 5, padding=0),
        nn.ReLU(),
        nn.AvgPool2d(2, stride=2),
        nn.Flatten(),
        nn.Linear(400, 120),
        nn.ReLU(),
        nn.Linear(120, 84),
        nn.ReLU(),
        nn.Linear(84, 10)
    )
    return model
```

```
def validate(model, data):
    total = 0
    correct = 0
    for i, (images, labels) in enumerate(data):
        images = images.cuda()
        x = model(images)
        value, pred = torch.max(x, 1)
        pred = pred.data.cpu()
        total += x.size(0)
        correct += torch.sum(pred == labels)
    return correct*100./total
```

For training, we will set the default value to 3 epochs, the learning rate to 0.001, and the device to the cpu of the machine. These can be changed by using parameters when calling the train function. We will use Cross Entropy Loss as our loss function of choice and the Adam optimizer. An array of accuracies of the validation set is also being kept to plot the graph after the training process is finished for us to see how the model did on the validation. We only want the best model, so we have to keep a max_accuracy variable and keep updating it if a new accuracy is higher than maximum. Then we just copy the best model into best_model and then return best_model at the end of the function:

```
def train(num_epochs=3, lr=1e-3, device="cpu"):
    accuracies = []
    cnn = create_lenet().to(device)
    cec = nn.CrossEntropyLoss()
    optimizer = optim.Adam(cnn.parameters(), lr=lr)
    max_accuracy = 0
    for epoch in range(num_epochs):
        for i, (images, labels) in enumerate(train_dl):
            images = images.to(device)
            labels = labels.to(device)
            optimizer.zero_grad()
            pred = cnn(images)
            loss = cec(pred, labels)
            loss.backward()
            optimizer.step()
        accuracy = float(validate(cnn, val_dl))
        accuracies.append(accuracy)
        if accuracy > max_accuracy:
            best_model = copy.deepcopy(cnn)
            max_accuracy = accuracy
            print("Saving Best Model with Accuracy: ", accuracy)
        print('Epoch:', epoch+1, "Accuracy :", accuracy, '%')
    plt.plot(accuracies)
    return best_model
```

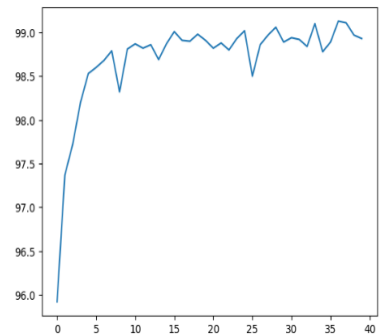
Now we check if a GPU is available. If so, then we can use it. If not, then we must resort to using the CPU:

```
if torch.cuda.is_available():
    device = torch.device("cuda:0")
else:
    device = torch.device("cpu")
    print("No Cuda Available")
device
device(type='cuda', index=0)
```

Now we will call the training function to actually train the model. Since the function will return the best model, we store it in the name `lenet`. I chose to call the function with 40 epochs but you can try different values and see what works best:

```
lenet = train(40, device=device)

Epoch: 1 Accuracy : 95.91999816894531 %
Saving Best Model with Accuracy: 95.91999816894531
Epoch: 2 Accuracy : 97.37000274658203 %
Saving Best Model with Accuracy: 97.37000274658203
Epoch: 3 Accuracy : 97.72000122070312 %
Saving Best Model with Accuracy: 97.72000122070312
Epoch: 4 Accuracy : 98.19999694824219 %
Saving Best Model with Accuracy: 98.19999694824219
Epoch: 5 Accuracy : 98.52999877929688 %
Saving Best Model with Accuracy: 98.52999877929688
Epoch: 6 Accuracy : 98.5999984741211 %
Saving Best Model with Accuracy: 98.5999984741211
Epoch: 7 Accuracy : 98.6800030517578 %
Saving Best Model with Accuracy: 98.6800030517578
Epoch: 8 Accuracy : 98.79000091552734 %
Saving Best Model with Accuracy: 98.79000091552734
Epoch: 9 Accuracy : 98.3199969482422 %
Saving Best Model with Accuracy: 98.3199969482422
Epoch: 10 Accuracy : 98.80999755859375 %
Saving Best Model with Accuracy: 98.80999755859375
Epoch: 11 Accuracy : 98.87000274658203 %
Saving Best Model with Accuracy: 98.87000274658203
Epoch: 12 Accuracy : 98.8199969482422 %
Epoch: 13 Accuracy : 98.86000061035156 %
Epoch: 14 Accuracy : 98.69000244140625 %
Epoch: 15 Accuracy : 98.87000274658203 %
Saving Best Model with Accuracy: 99.01000213623047
Epoch: 16 Accuracy : 99.01000213623047 %
Epoch: 17 Accuracy : 98.91000366210938 %
Epoch: 18 Accuracy : 98.9000015258789 %
Epoch: 19 Accuracy : 98.9800033569336 %
Epoch: 20 Accuracy : 98.91000366210938 %
Epoch: 21 Accuracy : 98.8199969482422 %
Epoch: 22 Accuracy : 98.87999725341797 %
Epoch: 23 Accuracy : 98.80000305175781 %
Epoch: 24 Accuracy : 98.93000030517578 %
Saving Best Model with Accuracy: 99.0199966430664
Epoch: 25 Accuracy : 99.0199966430664 %
Epoch: 26 Accuracy : 98.5 %
Epoch: 27 Accuracy : 98.86000061035156 %
Epoch: 28 Accuracy : 98.97000122070312 %
Saving Best Model with Accuracy: 99.05999755859375
Epoch: 29 Accuracy : 99.05999755859375 %
Epoch: 30 Accuracy : 98.88999938964844 %
Epoch: 31 Accuracy : 98.94000244140625 %
Epoch: 32 Accuracy : 98.91999816894531 %
Epoch: 33 Accuracy : 98.83999633789062 %
Saving Best Model with Accuracy: 99.0999984741211
Epoch: 34 Accuracy : 99.0999984741211 %
Epoch: 35 Accuracy : 98.77999877929688 %
Epoch: 36 Accuracy : 98.88999938964844 %
Saving Best Model with Accuracy: 99.12999725341797
Epoch: 37 Accuracy : 99.12999725341797 %
Epoch: 38 Accuracy : 99.11000061035156 %
Epoch: 39 Accuracy : 98.97000122070312 %
Epoch: 40 Accuracy : 98.93000030517578 %
```



Although we were already using the validation data to find the accuracy of our model, we also want to see where the model got confused. In order to do this, we will have a list of predictions and ground truth for every image in the validation set. Call the function and store it in two numpy arrays that are returned from the `predict_dl` function:

```
def predict_dl(model, data):
    y_pred = []
    y_true = []
    for i, (images, labels) in enumerate(data):
        images = images.cuda()
        x = model(images)
        value, pred = torch.max(x, 1)
        pred = pred.data.cpu()
        y_pred.extend(list(pred.numpy()))
        y_true.extend(list(labels.numpy()))
    return np.array(y_pred), np.array(y_true)

y_pred, y_true = predict_dl(lenet, val_dl)
```

Now that we have two numpy arrays of the predictions and the ground truth, we can use the confusion matrix feature from `sklearn`. We are showing this confusion matrix through a pandas dataframe. Hopefully, since our model was somewhere in the neighborhood of 99% accurate with the validation dataset, there should be little confusion between digits:

```
pd.DataFrame(confusion_matrix(y_true, y_pred, labels=np.arange(0,10)))
```

	0	1	2	3	4	5	6	7	8	9
0	975	0	0	0	0	0	0	0	4	1
1	0	1132	0	0	0	0	1	0	1	1
2	1	1	1028	0	0	0	0	1	1	0
3	0	0	1	1003	0	2	0	0	2	2
4	0	1	1	0	974	0	0	0	1	5
5	1	0	0	5	0	884	1	0	1	0
6	5	4	0	0	1	3	943	0	1	1
7	0	3	4	0	0	0	0	1019	1	1
8	2	1	2	1	0	0	2	0	963	3
9	0	2	0	0	9	2	0	3	1	992

Now that we are confident that our model is pretty good at classifying digits, we can get any image from the internet with a single digit in it and see what the model predicts! We use the `requests` library to get the path and then we can access the contents of the path. This is where we use the `Image` module from `PIL` to open the image from the path. Then we need to resize it to (28, 28) in order to be accessible by the model. Finally, we call the model with the transformed image (from `PIL` image to tensor). We must send in an image as a float and set to the device we want to use. After the model predicts and returns an output, we need to do a softmax in order to normalize the output into probability (0.0 to 1.0):

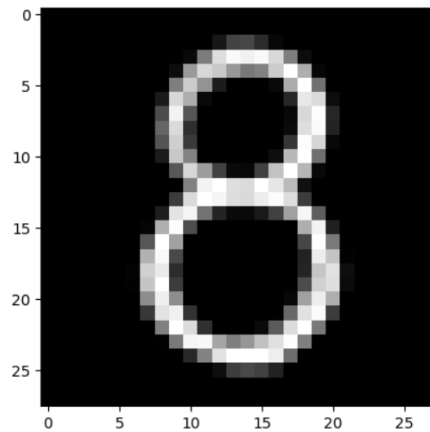
```
def inference(path, model, device):
    r = requests.get(path)
    with BytesIO(r.content) as f:
        img = Image.open(f).convert(mode="L")
        img = img.resize((28, 28))
        x = (255 - np.expand_dims(np.array(img), -1))/255.
    with torch.no_grad():
        pred = model(torch.unsqueeze(T(x), axis=0).float().to(device))
    return F.softmax(pred, dim=-1).cpu().numpy()
```

We can simply just copy the image's address from the internet and paste it in the string path. Then, we can access the contents of the image and resize it, similar to what we did in the inference function:

```
path = "https://thumb.ac-illustr.com/c3/c3f1db3e849f676df427981547fb8dcc_t.jpeg"
r = requests.get(path)
with BytesIO(r.content) as f:
    img = Image.open(f).convert(mode="L")
    img = img.resize((28, 28))
x = (255 - np.expand_dims(np.array(img), -1))/255.
```

Now that we have successfully transformed the image and resized it, we can see what the image looks like. If the image looks very different (meaning that the image has been stretched or shrunk significantly) than what it originally was from the internet, chances are that the model might predict incorrectly:

```
plt.imshow(x.squeeze(-1), cmap="gray")
<matplotlib.image.AxesImage at 0x284bd655c10>
```



Now it's time to get the prediction for the image. We can just call the inference function, which will then call the model itself. Once we receive the predictions, a numpy array of size 10 — for 0 to 9 digits, we have to find index of the array that has the largest value, which means that the model is most confident in that answer. To do this, we use the built-in argmax function of numpy. Finally, we can just print the index, which is the digit predicted, as well as the probability (as a percent done by multiplying by 100), which is nothing but the value of the pred array at the index:

```
pred = inference(path, lenet, device=device)
pred_idx = np.argmax(pred)
print(f"Predicted: {pred_idx}, Probability: {pred[0][pred_idx]*100} %")

Predicted: 8, Probability: 100.0 %
```

Here we can just show every the whole numpy array to see the model's prediction of the probability of each digit (0–9) being the digit in the image. A really good model should be able to distinguish greatly between the correct digit and the other 9 incorrect digits. In this case, only 8 is even close to or at 1 (100 % probability), whereas the other digits are very close to 0 (0 % probability):

```
pred
array([[7.2250548e-14, 8.4960937e-15, 1.1781145e-12, 1.6298326e-12,
        1.5884027e-18, 6.5970306e-11, 3.0543030e-13, 4.0287147e-16,
        1.0000000e+00, 5.3478467e-13]], dtype=float32)
```

Conclusion

In conclusion, training a CNN (Lenet5) to distinguish between manuscript digits is a challenging problem that has been extensively studied in the literature. CNNs have demonstrated remarkable success in digit recognition, including the Lenet5 architecture, which was the first successful CNN for digit recognition. While recognizing manuscript digits remains a challenge, there have been many approaches proposed in the literature to improve performance. This paper explores the use of the Lenet5 CNN architecture to recognize manuscript digits and highlights potential applications in automated data entry and

image recognition tasks. Overall, this research can contribute to the development of more accurate and efficient methods for manuscript digit recognition.

List of literature

1. Simard, P. Y., Steinkraus, D., and Platt, J. C. (2003). Best practices for convolutional neural networks applied to visual document analysis. *International Conference on Document Analysis and Recognition*, 958-963. cognitivemedium.com/assets/rmnist/Simard.pdf
2. Ciresan, D., Meier, U., & Schmidhuber, J. (2012). Multi-column deep neural networks for image classification. *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 3642-3649. people.idsia.ch/~juergen/cvpr2012.pdf
3. Tavanaei, A., & Ghodrati, M. (2017). Hierarchical multiscale convolutional neural networks for handwritten digit recognition. *Neural Networks*, 94, 76-86. https://www.researchgate.net/publication/341905569_Hierarchical_Convolutional_Neural_Network_for_Handwritten_Digits_Recognition
4. Zhang, X., Lu, Y., & Feng, J. (2021). An enhanced multi-task learning model for handwritten digit recognition. *Knowledge-Based Systems*, 221. <https://ieeexplore.ieee.org/abstract/document/8266464>

HISTORY OF THE PHILOSOPHY OF WINE

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ІСТОРІЯ ФІЛОСОФІЇ ВИНА

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Abstract

The article contains philosophical reflections on the existence of wine since time immemorial. The concepts of "philosophy", "wine" and "being" are explained. Reflections of the Greek philosophers Socrates, Plato and Aristotle on the existence and consumption of wine are given; about the most direct connection between wine and philosophy, which was in the symposia that took place in ancient Greece, about meetings that were accompanied by wine and that contributed to deep philosophical dialogues at many symposia of that time. Wine is considered as an aesthetic category and a subject of philosophical research from the time of the Neolithic to the present day. The place of wine in the culture of different nations is shown, as well as the connection between wine, art and philosophy. About a drink that has a centuries-old history of its appearance and its production.

Анотація

В статті наведені філософські роздуми про існування вина з незапам'ятних часів. Розтлумачені поняття що таке «філософія», «вино» та «буття». Наведені роздуми грецьких філософів Сократа, Платона і Аристотеля щодо існування та вживання вина; про найбезпосередніший зв'язок вина з філософією, що полягав в симпозиумах, які відбувалися в античній Греції, про зустрічі які супроводжувалися вином і які сприяли глибоким філософським діалогам на багатьох тодішніх симпозиумах. Розглянуто вино як естетичну категорію та предмет філософських досліджень починаючи з часів неоліта до наших днів. Показано місце вина в культурі різних народів, а також зв'язок вина, мистецтва і філософії. Про напій який має багатовікову історію появи та про його виробництво.

Keywords: Wine, philosophy, neo-nelite, symposia, civilization, taste, symbiotic relationship, archaeological evidence, meaning of life, alcoholic drink.

Ключові слова: Вино, філософія, неонеліт, симпозиуми, цивілізація, смак, симбіотичні відносини, архіологічні свідчення, сенс життя, алкогольний напій.

Історія вина і філософії

Яке цікаве словосполучення – вино і філософія. Дехто вважає, що вино, це напій; а філософія це роздуми про буття. А якже буття без вина. Давайте спочатку з'ясуємо, що таке філософія. Отже, філософія - це «любов до мудрості»! Так, «любов до мудрості», це перше, істинне значення слова «філософія». Тому філософія вина це роздуми: роздуми про те, що існує велика відмінність між вином як засобом, що сприяє товариському спілкуванню і вином як самим по собі як предметом гідним філософських досліджень.

Буття людини це специфічний спосіб її унікального, неповторного існування. У світовій філософії це поняття трактується по-різному. Однак при всіх відмінностях воно оцінюється як особлива реальність, збагнення якої дозволяє людині краще зрозуміти саму себе. Аристотель трактував «буття як бути», а також висловлювався про «буття. як таке». З тих пір термін «буття» використовують також не у розумінні існування взагалі, а позначають ним «все, що існує» – вживають у значенні «світ», «всесвіт», «космос». Буття є найфундаментальнішим зі всіх філософських категорій.

Термін «філософія», запозичено з грецької мови; грец. філософія «любов до знання; філософія» пов'язане з грец. філософос «освічений, учений», утвореним з основ іменників філоз «друг» і софія «наука, мудрість». Осмислення тонкощів вина – справа життя цілих поколінь, а

тому описам тонкощів цих таємних процедур присвячено не одну книгу, не одну працю. Вино та філософія протягом усієї історії більш пов'язані, ніж собою ніж може здатися. Багато унікальних філософських думок виникли завдяки вину, а може й у супереч. Не дивно, що вино з'явилося у висновках великих мислителів. Основу майбутньої культури щодо існування та вживання вина були закладені грецькими філософами Сократом, Платоном і Аристотелем.

Стародавні філософи про вино

Сократ, засновник західної філософії. (469 рік до н.е. – 399 рік до н.е.) – писав, що: «Вино зволожує і утихомирює дух і заколисує турботи розуму, воно оживляє наші радості, воно - масло, що підливається в погасаючий вогонь життя. Якщо ми п'ємо помірно і маленькими ковтками, вино просочується в нас як найсолодша ранкова роса».

Відповідно філософії Платона (428-348 гг. до н.е.), вино має таку ж природу, що і вогонь. Вино зігріває душу, звільняє її як від черствості, так і від турбот. Втім, вплив вина не зводиться тільки до звільнення від чогось: воно справляє і позитивний ефект, бо приносить чоловікові середнього віку віру в свою мужність, старшому поколінню радість спілкування, повертає до життя, його п'ють за бажанням. Платон вважає вино не втіленням безладу і вільності, а, навпаки, відображенням порядку та гармонії: необхідно лише суворо дотримуватися норми щодо його споживання. Він навіть вважає зловживання, наприклад, сном, згубнішим, ніж зловживання вином.

Аристотель (384 р. до н.е. — 322 р. до н.е.) був студентом Платона, який сам був учнем Сократа, провів близько двадцяти років в Академії Платона в Афінах, спочатку як студент, а потім як асоційований. Пізніше він навчав Олександра Македонського. Вино у розумінні Аристотеля є привілейованим інструментом антропологічного пізнання: з його допомогою можна виділити приховані особливості людини.

Філософію вина і винопиття, більш-менш повною мірою відтворено насамперед у думках відомих історичних особистостей - послідовників древніх філософів. Так, Квінт Гораций Флакк (Гораций, 65-8 рр. е.) не сприймав вино як загрозу, бо «хорообрість стародавнього Катона вином гартувалася». У його поезії вино є напоєм вірної та приємної дружби, уважної мудрості. А грецький аристократ Плутарх (близько 50-125 рр.) вважав, що гарячий темперамент у поєднанні «з вогненною рідиною» швидше виснажують організм, і є, зокрема, причиною передчасної смерті Олександра Македонського. Він вважав, що справжня користь від вина не в сп'янінні, а в вишуканій комунікабельності, якій воно сприяє, і хорошому самопочутті, яке воно приносить.

У Старому завіті написано: «Вино корисне для життя людини, якщо питимеш його помірно. Що за життя без вина? Воно створено для веселощів людям. Вино – це відрада серцю і втіха для душі. І все це – вино».

На думку великого романіста Олександра Дюма (1802-1870), вино є зразком виміру ступеня цивілізованості народів. У його творах вино передає пишну розкіш традицій великосвітського салону епохи Людовіка XIV, найромантичнішої епохи французької історії. Воно є квінтесенцією застілля, як і салонна розмова є найвищим проявом мовної тонкощі.

Але найбезпосередніший зв'язок вина з філософією полягав в симпозіумах, які відбувалися в античній Греції, то були зустрічі які супроводжувалися вином і які сприяли глибоким філософським діалогам. Філософія становила головну тему розмов на багатьох тодішніх симпозіумах. Цей факт показує лише одну сторону поєднання вина і філософії. В ті часи вважали, що саме Сократ спустив філософію з небес і ввів її в людське життя, його вважали першим грецьким моральним мислителем. Разом з тим, греки мали давно утверджений звичай обговорювати питання, що слушне, а що хибне, а погляди на мораль висловлювали в усіх літературних творах. Сократ для обговорення на симпозіумах ставив серйозні питання про роль самого вина, про визнані чесноти такі як справедливість, побожність, здоровий глузд, сміливість і мудрість. Так, вино спонукало до написання філософських трактатів, до роздумів, до спілкування в колі однодумців, але його соціальні і історичні контексти самого вина як предмета гідним філософських досліджень як самим пособі, крізь призму філософії, на той час було ще не достатньо обґрунтовано.

Вино і філософія віддавна мали симбіотичні відносини, які зародилися ще за часів появи і вина, і філософії. Археологічні свідчення про існування вина походять з неолітичного періоду, так в Єгипті виноградарство було відоме за X тисяч років до нашої ери.

Осмилення тонкощів вина – справа життя цілих поколінь, а тому описам тонкощів цих таємних процедур присвячено не одну книгу, не одну працю. Феномен вина в давні часи описано всесвітньо відомими філософами, в більш пізні часи про вино писали шумери, епікурейці, стоїки,

про нього згадується в кодексі Хаммурапі, спогади про вино як символу крові Ісуса Христа піднімалася у ранньохристиянській філософії; в наші часи про вино писали вчені, історики, винороби, дослідники, археологи, це закордонні дослідники такі як Джон Ділворт, Джеймі Гуд, Дуглас Бернейм, Кевін Свіні, Рендел Грем, вітчизняні дослідники Валерій Тінтулов, Павло Магеляс, Едуард Городецький, Сергій Клімов, Олександр Шаповалов, Микола Жевержеєв, Іван Плачков, Костянтин Франк, Володимир Голов, Микола Бойко, Олександр Мироненко, Павло Голодрига, Марія Костик, Євгенія Ніколайчук та багато інших.

Трошки історії виноробства

Вважається, що виноробство почало розвиватися близько 8000 років тому в районі Закавказзя, Східної Анатолії та півночі гір Загрос (сучасний Іран). На території Ірану в районі Хаджі-Фіруз, заселеному 7 000 років тому, знайшли глечики із залишками речовин, які однозначно вказували на виноградне вино. Археологи дійшли висновку, що вже тоді був вирощений вид винограду, аналогічний сучасному *Vitis vinifera*, з якого виготовляють і більшість сучасних вин. З цих регіонів виноробство перейшло до Месопотамії, Греції та Єгипту. До другого тисячоліття до н.е. вживання вина в Греції стало частиною культури.

З історії відомо, що вино зародилось у Стародавньому Близькому Сході. Можливо, воно було у Месопотамії. Стародавній Близький Світ вважається колыскою цивілізації. Тому і не дивно, що вино зародилося там, де по факту зароджувалась цивілізація. Неабияку роль у історії створення вина зіграли фінікійці. Вони розповсюдили вино буквально по всьому басейну Середземного моря. Є дані, що у другому тисячолітті до нашої ери вони вже мали торгові зв'язки з Єгиптом. Можливо, у ще давніші часи вони і завезли вино в Єгипет. Відомо, що у 3150 році до нашої ери у древньому Єгипті вже споживали вино. Багато глечиків із залишками вина знаходили у гробницях другої династії раннього царства. А це 2600 роки до нашої ери. Печатки на тих глечиках свідчать, що в ті часи виноград вирощували у Близькому Єгипті. Найвідомішим виноробом був фараон Джосер (правив у 2665-2645 роках до н.е.), з якого почалась третя династія Єгипту. Вино у Стародавній Греції - колысці західної цивілізації - з'явилося у 2000 році до нашої ери. Родоначальником виноробства у Стародавній Греції вважали бога Діоніса. Фулідід (460-400 роки до н.е.) як засновник історії як науки говорив, що греки попрощались з варварством, коли почали вирощувати виноград – настільки вино було важливим для них та їх культури.

Пили його теплим і холодним, з прянощами і без, чистим і розбавленому водою. Греки розбавляли вино одну його частину – чотирма частинами води. Греки витримували свої вина і вживали його у помірній кількості. Витримка відбувалась в піфосах (глиняних амфорах). Перед заливом вина амфори обкурювали бджолиним воском або трав'яним ладаном. Одисей із Гомера згадує про вина 11-річної витримки.

Римська імперія перейняла у Греків культуру, богів, архітектуру і, звичайно, любов до вина. Богом виноробства у греків був Бафос. Римляни вірили, що вино було повсякденною необхідністю. Напій став масовим, демократичним і був доступним для всіх, навіть для рабів. І тому, щоб забезпечити постійні поставки вина, на всіх територіях, які підходили для виноробства, вони вирощували виноград.

Римська імперія була дуже великою і впливовою, контролювала весь середземноморський басейн. Тому культ вина розповсюдився на дуже великі території: від Іспанії до Ізраїлю, від Британії до Єгипту. В тому числі, Римська імперія вплинула на історію теперішніх виноробних регіонів Франції, Німеччини, Італії, Іспанії, Португалії. В той час були популярними сорти винограду: Альбанське, Массікське, Соррентійське, Цекубське, Фалернське. Середній час для витримки римських вин складав 15 років. Вина для народних мас -3 роки. Мистецтво виноробства надзвичайно розвинулося в середньовіччі. Монастирі стали важливими гравцями у виробництві, експорті та збереженні вина, що призвело до торгівлі вином, яка з'єднала регіони по всій Європі.

Виноградне вино – це стародавній напій створений багатовіковою працею і кмітливостю народів, що населяють широкі території з помірним спекотним кліматом. Вино увійшло в повсякденний побут, але не кожна людина знайома з його властивостями, сортовими особливостями і місцем яке займає вино серед різноманіття напоїв.

Для багатьох людей вино – це просто алкогольний напій, але вони помиляються. Вино – це продукт багатовікової історії, культури та людської праці. Його вживання оточене ритуалами, традиціями та етикетом. Вино може бути джерелом естетичного задоволення, соціального єднання та глибоких філософських роздумів. Вино здатне передати те, що на душі так само, як музиканти у вигляді музичного твору чи художники у пейзажі. Хоча музика чи пейзаж можуть

викликати у нас емоції спонтанно. А виразна сила вина залежить від асоціацій у свідомості кожного хто його дегустує. Якщо вина мають силу висловлювання, то вони розкажуть про свою історію народження та життєвий шлях, про культуру та традиції краю, звідки вони родом.

Створювати вино – це мистецтво, це філософія, це сенс життя, який затягує. Філософія і вино – два супутники, що супроводжують один одного усе своє буття. Витончене вино є невід’ємною складовою розкішного способу життя. Вино – чарівник, який має владу змінити свідомість на той необхідний градус, який дозволяє подивитися на речі незвично, інакше, не так, як завжди.

Мистецтво пити - це не те, чого можна навчитися за один вечір або прочитавши одну книгу. Це те, до чого варто прагнути постійно, безперервно, келих за келихом. Елементи краси у вині залежать цілком від нашого сприйняття, тож пізнавати вино варто одночасно читати про нього і насолоджуватися ним.

Вино у поєднанні із філософією це такий коктейль який однозначно варто спробувати. Симпозіум думки і келиха це про те, що всі ми – різні, але всіх нас об’єднує одне - пристрасть до якісного витонченого вина. Вино є не менш важливим складником людського буття. Культура вживання вина має набагато складнішу органіку, ніж уживання, наприклад, пива. Можливо, у цьому можна відшукати причину певної елітарності вина щодо пива, яке вважається буденнішим і простішим напоєм. Осмислення тонкощів вина – справа життя цілих поколінь, а тому описам тонкощів цих таємних процедур присвячено не одну книгу, не одну працю.

Немає сенсу говорити про жодну критику, коли йдеться про вибір вина: врешті, все залежить від особистого смаку. Основа особистості, тобто знання і досвід, притаманні людині під час ознайомлення з конкретним вином, теж має особистісну природу. Процес смакування вина порівнюється із процесом правильного мислення, що дарує радість і насолоду від життя. Філософія дає можливість зрозуміти, знайти особливий зв’язок між речами, світом і людиною, а вино в цьому разі є радше нераціональним та креативним способом пізнання. Тобто, смакування гарного вина дає нам задоволення, але це також дає можливість мислити. Смак запрошує розмірковувати про те, що ми п’ємо, і відкриває безліч думок від філософів до звичайних дегустаторів.

Якщо на смак вино відрізняється у різних націй, то чи взагалі може існувати таке поняття, як смак вина. Якщо відповідь негативна, смак суб’єктивний і залежить лише від індивідуальних переживань. Тож, чи можемо ми по-справжньому розділити насолоду від цього келиха. Незалежно від того, є бажання чи ні, - існує надія на те, що ми можемо пояснити наше бажання розділити келих найкращого вина з нашими супутниками життя. Критики вина дозволяють собі в одну мить говорити, що смак суб’єктивний, а вже наступної миті — рекомендувати одні вина більше за інші, пояснюючи, що ці вина неперевершені.

Філософський дискурс про вино

Філософія існує щонайменше 2500 років на території, яку називаємо ми Заходом, і має ще більш давнє коріння в Азії. Але до середини 2000-х років терміну «філософія вина» навіть не існувало. За останні 15 років з’явилося кілька монографій і кілька антологій, присвячених цій темі, хоча її навряд чи можна назвати центральною у філософії. У зв’язку з таким дискурсом виникає питання, чому філософи взагалі повинні обговорювати вино, і чому будь-хто, хто цікавиться вином, повинен прислухатися до того, що говорять філософи.

Філософський дискурс про вино виник не у вакуумі. До середини 20-го століття ми б ніколи не зустріли «філософію економіки», «філософію права», «філософію науки», «філософію соціальних наук» чи «філософію мистецтва», кожна з яких стала стандартною частиною філософського канону. Філософам завжди було що сказати про ці практики, але вони не були організовані в окремі субдисципліни зі своїми власними предметами.

Припущенням, що стоїть за появою цих субдисциплін, є те, що вивчення філософії приносить у них певні навички чи більш повне розуміння щодо занурення у самі дисципліни. Таким чином, намагаючись з’ясувати, який внесок може зробити філософія вина у спільноту любителів вина, можна натрапити на питання про те, які саме навички чи знання характеризують філософію.

Перше, що очевидно: філософія корисна, коли людська практика піднімає складні концептуальні питання. В цьому випадку філософи розтлумачуючи концептуальні питання, використовують логіку, фокусуючи і відточуючи питання, які потрібно поставити, щоб внести ясність, і пояснюючи припущення і передумови, які не є очевидними і про які практикуючі певні види діяльності можуть не знати. Можливо, важливіше те, що філософи використовують свою

здатність робити висновки і формулювати концепції для синтезу сфер дослідження, які на перший погляд можуть здаватися не пов'язаними між собою. Звичайно, це загальні інтелектуальні навички, але філософська підготовка має зробити їх особливо вправними.

Філософи також спеціалізуються на раціональному обґрунтуванні. Не задовольняючись просто встановленням походження наших систем переконань, філософи зосереджуються на доказах, які підтримують наші системи переконань, і на тому, чи маємо ми вагомі підстави вірити в те, у що віримо, що вимагає дослідження того, що саме вважається вагомими підставами. Іншими словами, філософи думають про мислення і намагаються розробити концепції, які допоможуть нам мислити чіткіше.

У будь-якому разі, якщо практика не порушує жодних концептуальних питань, вона не є добрим кандидатом для філософського осмислення. Є сумніви, що хоч колись ми побачимо філософію авторемонту, філософію роботи колл-центру або філософію таксі, тому що очевидно, що вони не піднімають концептуальні або логічні проблеми, які потребують вирішення. З цього випливає, що для того щоб філософський дискурс розвинувся навколо практики виноробів, то повинні існувати концептуальні питання, які, принаймні, потребують уваги. Отже, з якими концептуальними питаннями стикається виноробна індустрія, на яке філософське дослідження могло б пролити своє світло відповідно виробництву вина.

Вино - це не просто порція алкоголю, і його ніколи не можна плутати за ефектом зі спиртними напоями або з коктейлями. Вино - це не змішаний напій, а трансформація винограду. Перетворення душі під його впливом є лише продовженням іншого перетворення, яке почалося, можливо, п'ятдесят років тому, коли виноград вперше зірвали з лози.

Культура споживання вина - це не просто сукупність правил етикету.

Це ціле самостійне направлення в розділі філософії вина, яке ґрунтується на повазі до вина, до природи, до себе та до інших людей. Чим більше людина занурюється у історію вина, у його походження, у його виробництво, у метафізику, у його політику та економіку, тим більше розумієш чому вчить філософія вина. А вчить вона нас:

- насолоджуватися вином вдумливо, досліджуючи його смак, аромат, історію;
- цінувати різноманіття вин та поважати *terroir*, з якого воно родом;
- ділитися вином з близькими, щоб створити атмосферу єднання і спілкування;
- вживати вино помірно, щоб воно збагачувало життя, а не шкодило йому.

Висновки

Отже, коли ми підносимо келих вина до вуст, ми насолоджуємося процесом, що триває: вино - це жива істота, останній результат інших живих істот і праць життя в нас самих. Це ціла філософія, яка ґрунтується на повазі до вина, до природи, до себе та до інших людей. Крім того, вино спонукає до творчості та вдумливих роздумів. Відчуття насолоди та вишуканості, які супроводжують споживання вина, можуть вдати до творчого натхнення та стимулювати творчий процес. Багато художників, письменників та митців знаходять у вині джерело натхнення та емоційного збагачення для своїх творів. Вино збагачує життя людини, адже це: ключ до нових знань, емоцій та вражень; можливість подорожувати світом, не виходячи з дому, знайомитися з різними культурами та традиціями; чудове доповнення до романтичної вечері, дружньої зустрічі або сімейного свята. Вино – це мистецтво життя!

З вище наведеного можна сказати, що розвиток науки нового часу як і соціальні перетворення викликали до життя нову орієнтацію в філософії. Якщо в середні віки вона виступала в союзі з богослов'ям, в епоху відродження - з мистецтвом та гуманітарним знанням, то тепер вона спирається головним чином на науку. І оскільки наука займає провідне місце в світогляді цієї епохи, то і в філософії на перший план виходять теорії пізнання гносеології.

Узагальнюючи, вино впливає на культуру та мистецтво у багатогранний спосіб, відображаючи значення та символізм у різних аспектах життя суспільства. Його присутність в релігійних обрядах, літературі, музиці та мистецтві свідчить про його глибокий культурний вплив і значення для людства через віки. Вино – це не просто напій, воно є невід'ємною частиною нашої культурної спадщини та мистецької традиції.

References

1. Fritz Olhof. *Planting vineyards. Introduction / Wine and philosophy. Thought and glass symposium.* - K.: Tempora, 2010.
2. Harold Tarrent. *Wine in ancient Greece. Some Platonic reflections / Wine and philosophy. Thought and glass symposium.* - K.: Tempora, 2012.



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