№101/2025

Znanstvena misel journal

The journal is registered and published in Slovenia.

ISSN 3124-1123

VOL.1

The frequency of publication – 12 times per year.

Journal is published in Slovenian, English, Polish, Russian, Ukrainian.

The format of the journal is A4, coated paper, matte laminated cover.

All articles are reviewed

Edition of journal does not carry responsibility for the materials published in a journal.

Sending the article to the editorial the author confirms it's uniqueness and takes full responsibility for possible consequences for breaking copyright laws

Free access to the electronic version of journal

Chief Editor – Christoph Machek

The executive secretary - Damian Gerbec

Dragan Tsallaev — PhD, senior researcher, professor

Dorothea Sabash — PhD, senior researcher

Vatsdav Blažek — candidate of philological sciences

Philip Matoušek — doctor of pedagogical sciences, professor

Alicja Antczak — Doctor of Physical and Mathematical Sciences, Professor

Katarzyna Brzozowski — PhD, associate professor

Roman Guryev — MD, Professor

Stepan Filippov — Doctor of Social Sciences, Associate Professor

Dmytro Teliga — Senior Lecturer, Department of Humanitarian and Economic Sciences

Anastasia Plahtiy — Doctor of Economics, professor

Znanstvena misel journal

Slovenska cesta 8, 1000 Ljubljana, Slovenia

Email: info@znanstvena-journal.com

Website: www.znanstvena-journal.com

CONTENT

AGRICULTURAL SCIENCES

BIOLOGICAL SCIENCES

CHEMISTRY

ECONOMICS

MEDICAL SCIENCES

PEDAGOGICAL SCIENCES

PHILOLOGY

PHYSICS AND MATHEMATICS

SOCIAL SCIENCES

TECHNICAL SCIENCES

AGRICULTURAL SCIENCES

PREPARATION OF LEMONADE FROM THE JUICE OF WILD AND CULTURED CHERRIES IN GEORGIA

Mamardashvili N.
Doctor of Technical Sciences, Assistant Professor, Department of Food Technology, Georgian Technical University, Georgia
Makhashvili K.
Doctor of Chemistry, Professor, Department of Food Technology, Georgian Technical University
Kiladze M.
Doctor of Engineering, Professor, Department of Food Technology, Georgian Technical University
DOI: 10.5281/zenodo.15294090

Abstract
The aim of the study is to obtain a non-alcoholic beverage (lemonade) from varieties of wild cherry (*Cerasus vulgaris*) and cultivated cherry (*Cerasus fructicola*) and to study its physicochemical properties. The experiment showed that both varieties of cherry contain substances important for health, such as carbohydrates, fats, vitamins, micro- and macroelements, anthocyanins, tannins, phenols, calcium, potassium, phosphorus, iron, magnesium and manganese, etc. The non-alcoholic beverage made from these juices, lemonade, maximally preserves biologically active substances, which allows for wider use of cherries as raw materials in the production of non-alcoholic beverages. Lemonade meets all the requirements set out in the standard.
Keywords: Non-alcoholic beverage, wild cherries, cultivated cherries.

The natural conditions of Georgia, the geographical position and the abundance of raw materials create sufficiently good conditions for the development of the food industry. Considering that Georgia is distinguished by an abundant harvest of vegetables and fruits, it has a significant potential for the production of various and high-quality beverages with good organoleptic properties. To do this, the country will register the property of local use, and also put forward high-quality drinks in a prominent place along with export production. It is known that beverages produced in Georgia are characterized by high physiological activity and on the basis of these properties they belong to "functional food products".

Fruit and vegetable juices occupy an important place in the diet of the population. People prefer products that are an important source of energy and also contain a complex of biologically active substances.

Cherry (*Prúnus subg. Cérasus*) accumulates different amounts of biologically active substances in different environmental conditions, therefore it is very important to study the basic chemical composition of the raw material and its rational use, in particular, for the preparation of a non-alcoholic drink from the raw material - lemonade. Cherry occupies a special place among berry cultures due to its chemical composition.

Syrups obtained from fruits and stone fruits can be used to prepare a high-quality non-alcoholic drink, which will have a pronounced natural taste and aroma of this particular fruit. Accordingly, the use of essences and other chemicals for the production of non-alcoholic beverages will be reduced.

The purpose of our research is the production of non-alcoholic beverages from wild and cultivated cherries and the study of their physical and chemical properties.

Wild cherry (*Cerasus vulgaris*) and cultured cherry (*Cerasus fructicola*) were selected for research. Both types of cherries contain substances important for health, such as carbohydrates, fats, vitamins, micro- and macroelements, anthocyanins, tannins, phenols, calcium, potassium, phosphorus, iron, magnesium and manganese and others.

Phenolic compounds, which the human body cannot produce, are particularly powerful antioxidant compounds, so it is extremely important to consume products containing a significant amount of these compounds.

For the experiment, 5 kg of cultivated cherry fruits and 5 kg of wild cherry fruits were collected in the stage of technical ripeness. They took the raw material for research, washed it and poured the sorted cherry into a glass container. The yield of juice from a wild cherry was 2,575 ml, and from a cultivated cherry - 2,725 ml.

They studied the quantitative changes of anthocyanins in both objects of research. The results are presented in diagram 1.

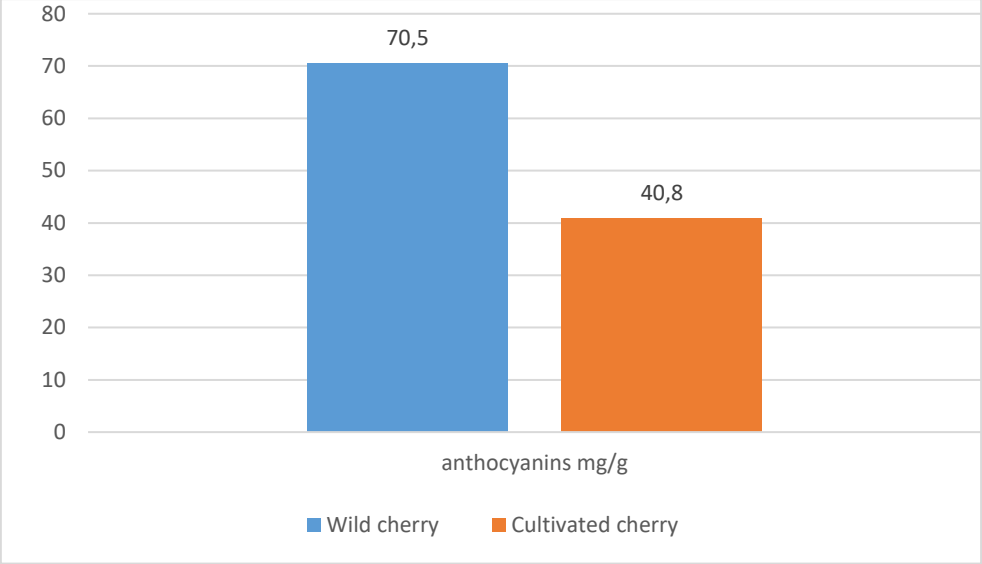


Diagram 1. Content of anthocyanins in cherry juice

Wild cherries contain more anthocyanins than cultivated cherries, which have strong antioxidant and anti-inflammatory properties.

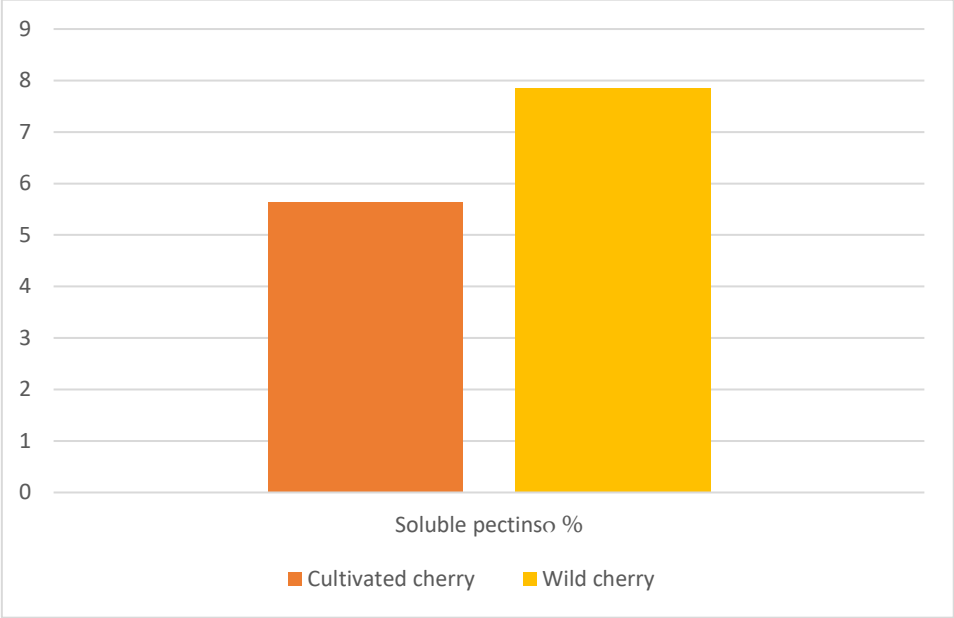


Diagram 2. Content of pectin in cherry juice

Determined content of pectin substances in cherry juice. The obtained results are shown in the diagram (diagram 2).

The experiment showed that both samples of cherry juice contain a rather large amount of this useful and important substance. This fact indicates the high commodity value of both research samples.

The general content of phenols was determined by the spectrophotometric method. A high quantitative content of phenols was found in both samples (diagram 3).

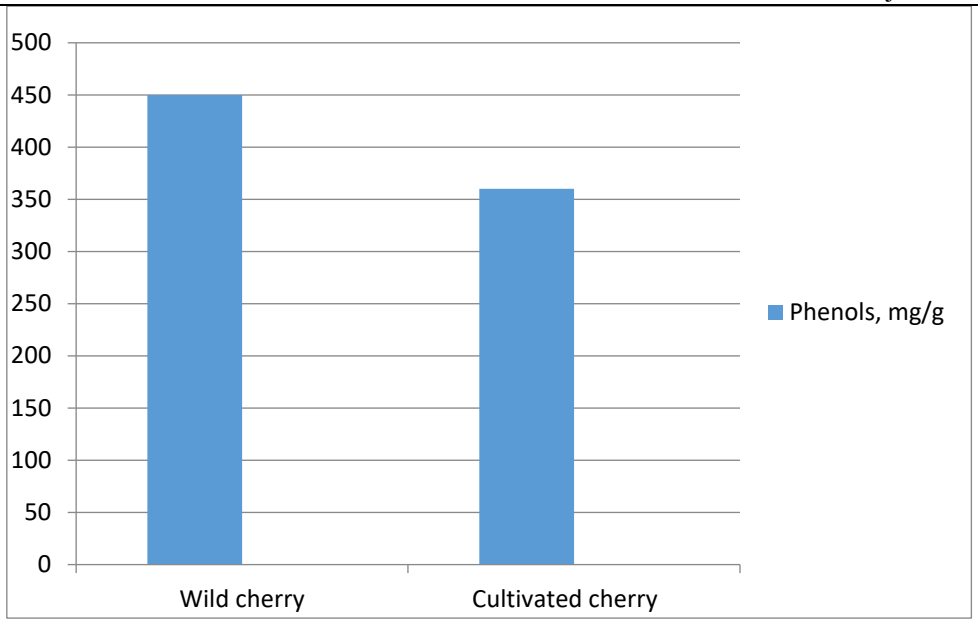


Diagram 3. Phenol content in wild and cultivated cherries

The active and titratable acidity of freshly squeezed juice was determined potentiometrically. The results are shown in diagram 4.

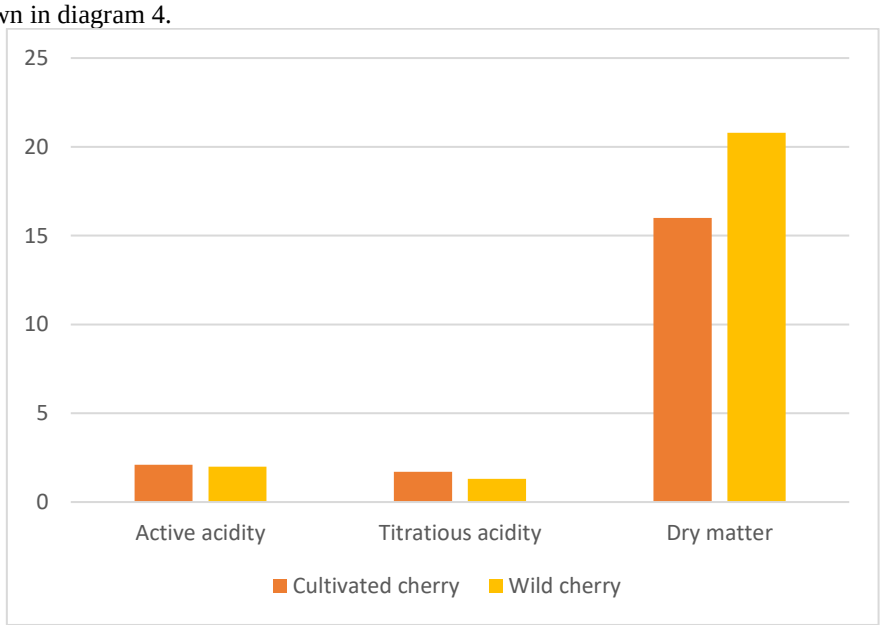


Diagram 4. Dry matter, titratable and active acidity in cherry juice

We determined the amount of sugars in the objects of study. The obtained data are shown in diagram 5.

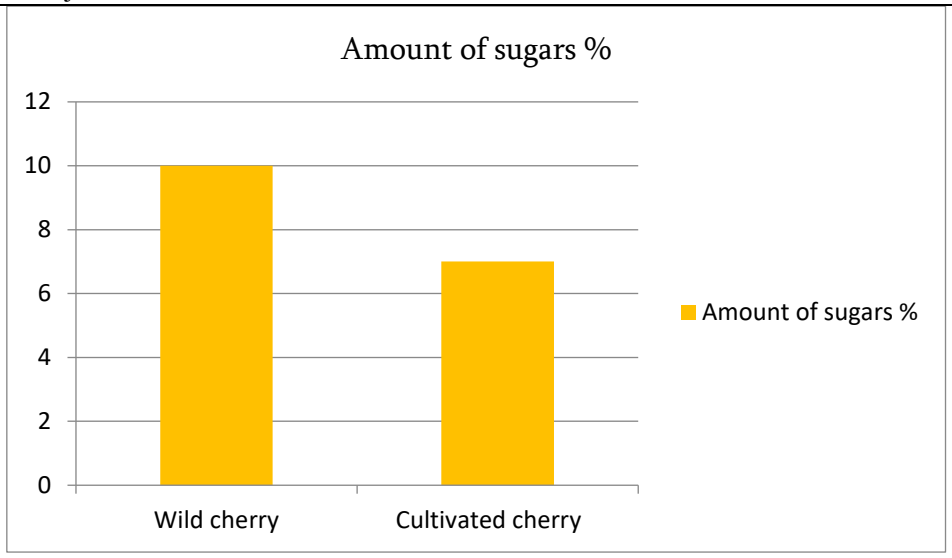


Diagram 5. Percentage of sugars in wild and cultivated cherries

We prepared invert sugar syrup. Place invert sugar syrup, diluted cherry juice, citric acid and softened water in a glass container. We mixed it all, filtered and carbonated. The soft drinks we prepared were subjected to standard analyses (Table 1,2)

Table 1.

Lemonade from wild cherry juice

Physicochemical parameters	Organoleptic parameters
Mass fraction of dry matter - 20,8%	Color - dark red
Acidity - 1,3	Taste - sweet and sour
Mass fraction of carbon dioxide - 0,4 %	Aroma - cherry

Table 2.

Lemonade from cultivated cherry juice

Physicochemical parameters	Organoleptic parameters
Mass fraction of dry matter - 16%	Color - dark red
Acidity - 1,7	Taste - sweet and sour
Mass fraction of carbon dioxide - 0,4 %	Aroma - cherry

Conclusion

As a result of the experiments, it was established that the juice of wild and cultivated cherries contains a fairly large number of biologically active substances: such as micro- and macroelements, vitamins, carbohydrates, anthocyanins, tannins, phenols and others. The non-alcoholic drink we make from these juices - lemonade - maximally preserves biologically active substances, which allows us to use cherries more widely as raw materials in the production of non-alcoholic beverages. Lemonade meets all the requirements set out in the standard.

References

1. W. Loescher, Cherries (Prunus spp.): The Fruit and Its importance. Encyclopedia of Food and Health, 2016.

2. Tart Cherry Fruits. A, Kirakosyan, S.F. Bolling, in Bioactive food as Dietary Interventions for Arthritis and Related Inflammatory Diseases, 2013.

3. Tania G. Albuquerqe, Analysis, Identification, and Quantification of anthocyanins in Fruit Juices, Helena S. Costa, in Fruit Juices, 2018.

4. Bell PG, Stevenson E, Davision GW, Howatson G. The effects of Montmorency tart cherry concentrate supplementation on recovery following prolonged, intermittent exercise. Nutrients. 2016; 8.

5. Ballisteri, G., Continella. A. Gentile, A. Amenta, M. Fabroni, S. & Rapisarda, P. (2013). Fruit quality and bioactive compounds relevant to human health of sweet cherry (Prunus Avium L.) cultivars grown in Italy. Food Chemistry, 1401 630-638.

6. Bykova, T. O., Aleksahina, S. A., Demidova, A.V., Makarova, N.V., Demenina L. G. (2017). Comparative analysis of the chemical composition of cherry and cherry fruits of different varieties grow in the samara region. News of universities. Food technology, 1, 32-35.

7. Serradilla M.J., Aksic M.F., Manganaris G.A Fruit Chemistry, Nutritional Benefits and Social Aspects of Cherries // Cherri: botany, production and uses. Boston: CABI, 2017. P. 420-441.

BIOLOGICAL SCIENCES

NOSİSEPTİV MƏRKƏZİN FOTOSTİMULYASİYA MEXANİZMİ

Hüseynova U.B.
Bakı Dövlət Universiteti, Bakı, Azərbaycan, magistrant

MECHANISM OF PHOTOSTIMULATION OF THE NOCICEPTIVE CENTER

Huseynova U.
Baku State University, Baku, Azerbaijan, master's student
DOI: 10.5281/zenodo.15294096

Xülasə

Ağrı emalı mürəkkəb sinir mexanizmlərinə sahibdir. Ağrı hər zaman təmas və ya zədələnmə nəticəsində yaranmır, bəzən neytral mühit amilləri də ağrının modulyasiyasına səbəb ola bilir. Hal hazırda xroniki ağrı, fotofobi nəticəsində formalaşan baş ağrıları, migren və s diqqət mərkəzindədir. Optogenetika və işıqla terapiya istiqamətində aparılan işlər ağrının retina-talamik-kortikal mexanizmlərini təhlil edir. Biz tədqiqat obyektimiz olan 6 aylıq, şinşilla cinsindən olan erkək ada dovşanında ağrı hissinin işıq stimulu ilə induksiyasının zamandan aslı təlim modelində mərkəzlərarası assosiasiya yaradaraq elektofizioloji metod ilə mərkəzlərin bioloji cərəyanlarının aktivliyinin qeydini və elektroensefaloqramın təhlilini apardıq.

Abstract

Pain processing involves complex neural mechanisms. Pain is not always caused by contact or injury, and sometimes neutral environmental factors can also modulate pain. Currently, chronic pain, headaches caused by photophobia, migraines, etc. Are in the spotlight. Studies in optogenetics and light therapy are analyzing the retinal-thalamic-cortical mechanisms of pain. We created an inter-center association in a time-dependent learning model of pain sensation induction by light stimulus in a 6-month-old male chinchilla rabbit, which is our research object, and recorded the activity of biological currents of the centers and analyzed the electroencephalogram using the electrophysiological method.

Açar sözlər: fotostimulyasiya, fototransduksiya, ağrı matrisi, EEQ, ağrı.
Keywords: photostımulatıon, phototransduction, pain matrix, EEG, pain.

We created a time-dependent learning model in which an adult male Chinchilla rabbit, our research subject, could gain individual experience. During training, we successfully implemented the inter-center connection, which is the main goal of training, using 2 discrete stimuli. Photostimulation with a pulse lamp was applied to the retina of the eye, and electrical stimulation was applied to the hind leg muscle. Electroencephalography was used to visually study the formation of temporary connections between the visual and sensorimotor centers of the cerebral cortex. Electrodes were placed on these structures under general anesthesia according to the coordinates of the stereotaxic atlas, and EEG recordings were recorded with a Neuron Spectrum pectrum 5 encephalograph.

The light impulses we apply to the rabbit's eye pass through the cornea and are received by the photoreceptor in the retina, and this process occurs within a very short time frame based on the sequential induction of various biochemical, molecular changes and signals. During the phototransduction process, light energy is received and converted into an electrical impulse by the photopigments within the rods and cones in the retina, which leads to the formation of a visual image in the center. Opsin proteins, which are the main structure of the photopigment, are sensitive to light and are sensitive to different wavelengths of light. Rhodopsin in the rods is involved in the reception of weak light, while cones have different types of opsin proteins that participate in the differentiation of colors and the reception of bright light. Retinal and opsin pigment induce the phototransduction cascade. With the reception of light, the configuration of the retinal changes, which activates the G-protein (transducin) associated with the pigment. Following this, the phosphodiesterase enzyme is activated. Phosphodiesterase is an enzyme that regulates the level of secondary signaling pathways within the cell, hydrolyzing cyclic nucleotides, causing the termination or attenuation of signal transduction. The action of this enzyme reduces the concentration of cGMP and causes the closure of cGMP-gated ion channels, resulting in hyperpolarization of the cell membrane. [6]

The dorsal horn of the spinal cord is the main center for the transmission and integration of nociceptive signals. Nociceptive information is transmitted from the spinal cord via the spinothalamic tracts to the thalamus and sensory cortex, and also via the brainstem and amygdala to the cingulate cortex and insular cortex. There is no single center for the processing of pain sensation, so the term pain matrix is more accurate. The lateral part of the parabrachial nucleus in the brainstem is involved in the generation of states such as fear, stress, and emotional responses by transmitting information about pain and other unpleasant stimuli to the amygdala and other limbic structures. The PBN not only transmits pain signals, but also modulates their intensity and emotional component, thereby regulating the subjective feeling of pain experience. Nociceptive neurons in the PBN receive input from the dorsal horn of the spinal cord and trigeminal sensory nuclei, and directly from trigeminal ganglion neurons. [5]

Thalamic nuclei are classically considered relay centers for sensory information from the dorsal horn of the spinal cord and brainstem to the cortex. Studies

have revealed that there is multisensory integration between the lateral geniculate nucleus and the ventral posterior nucleus of the thalamus. [4]

The light stimulus is converted into nociceptive signals by the trigeminovascular pathway, which indirectly induces the pain center. The trigeminovascular pathway includes the parts of the trigeminal nerve that innervate the meninges and cerebral vessels. Light directly activates intraocular trigeminal nociceptors, which in turn activate second-order nociceptive neurons in the trigeminal nucleus of the spinal cord, causing pain. Light amplifies pain through the convergence of light signals from the retina and nociceptive signals from the meninges in the same thalamic neurons that project to the somatosensory cortex. The neuronal activity of the nociceptive pathway underlying pain is modulated at the level of the posterior thalamus by direct input from the retina. Light enhances the activity of thalamic trigeminovascular neurons in a manner similar to the activation of melanopsin-expressing RGCs by light, and a portion of the dura mater (the outermost and thickest layer that protects the brain and spinal cord from mechanical shock) thalamic neurons are located in the posterior thalamus. The axons of the light-enhanced dura-sensitive thalamic neurons project to multiple cortical areas, including the primary and secondary somatosensory, motor, retrosplenial, and parietal association cortices.[1, 7]

In the first stage of training, we recorded the bioelectric activity of both centers separately. The bioelectric activity in the visual center was recorded by applying a light stimulus to the retina of the eye, and the bioelectric activity of the centers was recorded by applying a weak electrical stimulus to the leg muscle at 20-second intervals. Time intervals are a very important aspect in training. During the continuity of the 20-second interval electrical stimulus that we applied to the leg muscle, its manifestation in the center will gradually increase, and the animal will learn this time interval after a while. If we can maintain this continuity, then we will see that the center responds at the appropriate time even if the stimulus is not applied. At the beginning of the training, the light applied to the retina of the eye was a neutral stimulus. In the second stage of training, 4 seconds after applying the light stimulus to the retina of the eye, an electrical stimulus was applied to the leg muscle. We continued the training by repeating this process regularly. Our goal here is to both teach the animal the duration of the interval and to create a connection between two different stimuli. From the 5th minute of the training model, after applying a light stimulus to the retina, bioelectric activity was observed in the sensorimotor center, even though we did not apply an electrical stimulus to the leg muscle. Thus, we achieved our goal at the beginning of the training. The intervals between events are no longer an aspect that determines the formation of experience, but rather, the duration of these intervals and the ratios between them are the content and essence of learning itself. A strong version of this view is that temporal relationships between events are constantly and automatically encoded. These temporal relationships can even be inferred from single experiences. [2,3]

The research was conducted on adult male Chinchilla rabbits kept in standard vivarium conditions. In the study, the bioelectric activity of the corresponding centers of the brain was recorded using the electrophysiological method, using the electroencephalography method. The stereotactic method determines the precise localization of the studied brain structures [GQ, SQ]. The stereotactic method is a medical technique that allows for high-precision intervention on a target located in the brain using a three-dimensional coordinate system. Using the stereotactic method, electrodes were implanted into the cranial bone above the frontal sinus of the rabbit. In this method, a special frame was used to keep the head of the research subject stable. First, the head and brain were cleaned of soft tissues, then the implantation of recording and stimulating electrodes was performed under nembutal anesthesia [35-40 mg/kg] in the following structures: GQ [AP=9, L=9, H=2]; SQ [AP=1, L=1, H=1]. Nembutal anesthesia was used first during the electrode implantation surgery. Nembutal slows down the transmission of nerve impulses in the brain by enhancing GABA receptors. This has a calming effect on the central nervous system, causing depression. The indifferent electrode was placed in the bone above the frontal sinus. After performing the indicated manipulations and completing the electrode implantation procedure, a composite-plastic mixture was poured into the complex consisting of electrodes and a rigid frame. After the operation, sulfalene 0.2 ml solution [1%] was injected intramuscularly into the animals to prevent septic complications. In the experiments, the animals were placed freely in the chambers a few days before the experiments in order to adapt to the chamber before electrophysiological studies. Daily EEG recordings were made with the “Neuro Spectrum 5” apparatus. Photostimulation was performed using a pulse lamp. The conditioned stimulus was applied in the form of electrical stimulation to the leg muscle.

References

1. Arnold J Wilkins, Sarah M Haigh, Omar A Mahroo, GordonT Plant. Photophobia in migraine: A symptom cluster? 2021 May 14

2. Balsam P, Drew M, Gallistel C. Time and associative learning. Comp Cogn Behav Rev. 2011 Feb 25.

3. David B. Fischer, BS, Robert D. Truog, MD. What is a reflex? Neurology. 2015 Aug 11.

4. Fang Guo, Yu Du, Feng-Hui Qu, Shi-Da Lin, Zhong Chen, Shi-Hong Zhang. Dissecting the Neural Circuitry for Pain Modulation and Chronic Pain: Insights from Optogenetics. 2022 Mar 5

5. Kevin Cheng, Laurent F Martin, Marvin J Slepian, Amol M Patwardhan, Mohab M İbrahim. Mechanisms and Pathways of Pain Photobiomodulation: A Narrative Review. 2022 Jul 1.

6. Rami Burstein, Rodrigo Noseda, Anne B Fulton. The neurobıology of photophobia . 2020 Mar 1.

7. Rodrigo Noseda, Rami Burstein. Advances ın understandıng the mechanısms of mıgraıne-type photophobia. 2015 Jul 15.

CHEMISTRY

CHARACTERISTICS OF METHANOL CONVERSION TO DIMETHYL ETHER OVER ZEOLITE CATALYSTS

Mammadova A.
Ph.D. in Chemistry, Associate Professor of the Department "Petrochemical Technology and Industrial Ecology"
Orcid: https://orcid.org/0000-0002-6964-706X
Asgarli N.
M.Sc. of the department of "Petrochemical Technology and Industrial Ecology"
Orcid: https://orcid.org/0009-0009-2325-340X
Azerbaijan State Oil and Industry University
Republic of Azerbaijan, Baku
DOI: 10.5281/zenodo.15294106

Abstract

Production of dimethyl ether (DME), introduced as an alternative fuel to address the widespread use of fossil fuels, takes place through direct and indirect synthesis. The direct synthesis of DME combines methanol (CH_3OH) formation, integrating both redox and acidic sites. The indirect method includes a two-stage process, starting with CH_3OH synthesis from syngas ($CO + H_2$) over $Cu/ZnO/Al_2O_3$ catalysts, following dehydration over acidic catalysts to form DME.

The purpose of the paper was to study the conversion of CH_3OH to DME and hydrocarbons on Al_2O_3 and H-forms of ZSM-5 zeolite, also modified with phosphoric acid. It was suggested that the formation of C_2H_4 in a structure-sensitive reaction occurs with the participation of the Brønsted acid center and the Lewis basic center.

Keywords: CH_3OH, Al_2O_3, ZSM-5 zeolite, catalyst, conversion, DME, C_2H_4, olefins, hydrocarbons.

INTRODUCTION

The most rational technique for obtaining various hydrocarbons from natural gas, which is available in abundance, includes the sequential transformation of CH_4 through synthesis gas type catalysts involves a preliminary stage of dehydration to DME. Hence, the corresponding final products can likewise be achieved from this compound [2, p. 295].

It is evident that the increased attention in DME production as a green energy carrier defines its prospects [11, p.3]. In this respect, innovative catalysts are being advanced, or mechanical mixtures of catalysts are used for the conversion of $CO + H_2$ to CH_3OH and its dehydration into DME [12, p. 440] [10, p. 3] [9, p. 29]. This initiative lessens the requirements for $CO + H_2$, simplifying the production technology, thereby lowering the product cost. Therefore, combining the processes of derived CH_3OH with its dehydration to DME is considered a flexible way to enhance the competence of hydrocarbons obtained from natural gas over those from oil.

An effective solution to the integration problem of the above processes with the use of DME requires the selection or synthesis of new catalysts with high efficiency to acquire higher hydrocarbons for the selective conversion of $CH_3OH \rightarrow DME$ and $CH_3OH \rightarrow DME \rightarrow$corresponding hydrocarbons. The possibility of combining these technologies into current petrochemical and energy infrastructures can play a decisive role in reducing dependence on crude oil for hydrocarbon production.

PURPOSE. THE URGENCY OF THE PROBLEM

For a long time, the building block of global energy production has been associated with fossil fuels, however, their utilization is bringing increasingly severe environmental impacts with itself. Burning coal, oil, and natural gas results in the release of massive amounts of CO_2 and other GHGs, causing climate change and global warming. Around 70% of the world's total GHG emissions come from CO_2 due to the combustion of fossil fuels. Beyond pollution, fossil fuels are a major contributor to climate change due to their role in the increasing amount of GHGs. When combusted, coal, oil, and natural gas release significant CO_2 and CH_4 gases, two of the most potent GHGs inducing heat trap in the Earth's atmosphere. This initiate rising global temperatures, extreme climatic conditions, rising sea levels, and melting glaciers. During the last century, the continuous dependence on fossil fuels has considerably increased atmospheric CO_2 concentrations, affecting the amplification of wildfires, hurricanes, heatwaves, and droughts. [5, p. 258-274]

DME achieves progressive recognition as a clean and versatile energy alternative, that can replace traditional fuels in a variety of applications. This recognition stems from its unique chemical and physical properties. Its potential as a flexible energy carrier and an alternative fuel is enhanced by its green properties, such as sulfur-free combustion and low particulate emissions. In contrast to traditional hydrocarbons, DME possesses a high cetane number, lacking C-C bonds, which contributes to its clean combustion profile. A distinguishably significant feature of DME is its oxygen content of as high as 35%, enabling smokeless combustion of the fuel and reduced NO_x and sulfur oxide SO_x, and particulate matter. It is considered a viable replacement for diesel fuel in compression ignition engines with its physical features allowing for straightforward integration into current LPG infrastructure. Beyond its utilization as a motor fuel, DME can function

as a fuel for power plants and as an intermediary product easily converting into gasoline, attributed to enhanced ecological properties with minimum undesirable impurities. In addition, DME can be applied as an environmentally friendly refrigerant, especially regarding its impact on the ozone layer of the atmosphere. [3, p. 55-58]

EXPERIMENTAL PART

The study objects were samples developed by granular zeolite of the HZSM-5 (ZSM-5) type (SiO_2/Al_2O_3 = 50). The granules formed underwent air drying at between 90–120°C with following calcination at 550°C (5 h). Part of the catalyst granulated was additionally treated with an aqueous phosphoric acid (H_3PO_4) solution with stirring at 80–95°C (3 h) and then subjected to the same drying and calcination processes. The resulting samples contained 5 wt.% phosphorus, calculated as P_2O_5.

The catalyst samples were tested in a flow-through fixed-bed setup with a 10 g catalyst load at atmospheric pressure, temperatures of 280–450°C, and a liquid CH_3OH feed rate of 4–12 h^{-1}. The catalyst was pretreated with air for 1 h at temperatures 50–100°C higher than the reaction temperature with purging the system by a N_2 stream (0.5 h) afterwards, until the desired temperature was established.

The CH_3OH conversion products were analyzed under gas chromatography through Auto System XL (Perkin Elmer) and Gasochrom.

RESULTS AND DISCUSSION

In accordance with the paper [16, p. 23] and our data (Fig. 1), Al_2O_3 demonstrates consistently high activity in CH_3OH conversion with selective DME formation. The conversion of CH_3OH under similar terms on zeolite catalysts becomes more complex. As shown in Fig. 1, *a*, CH_3OH is converted to hydrocarbons on the H-form of ZSM-5 zeolite, displaying high selectivity and conversion rate in the first 10 minutes of the experiment. However, after 30 minutes of catalysis process, the activity of the catalyst drastically decreases (Fig. 1, *b*), and DME becomes the primary product.

The fluctuation in the catalytic activity of ZSM-5 zeolite poses a challenge in terms of its modification. Considering the acid-type catalyst activity in these reactions, additional studies of CH_3OH conversion were conducted on the treated samples with H_3PO_4.

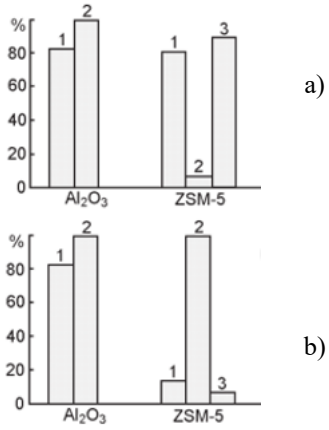


Fig. 1. The effect of experiment duration (a – 10 min; b – 30 min) on CH_3OH conversion on the initial catalysts (1); the selectivity of DME formation (2) and hydrocarbons (3); T = 350°C, space velocity 3 h^{-1}.

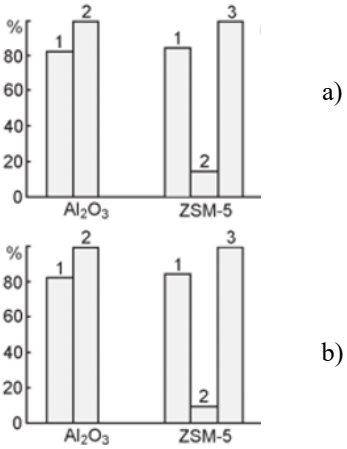


Fig. 2. The effect of experiment duration (a – 10 min; b – 120 min) on CH_3OH conversion on catalysts treated with phosphoric acid (1) and the selectivity of DME formation (2) and hydrocarbons (3); T = 350°C, space velocity = 3 h^{-1}.

Weighing the data in Fig. 1 and Fig. 2, it should be noted that the H_3PO_4 introduction into Al_2O_3 made nearly no impact on its characteristics in CH_3OH conversion. On the other hand, the treatment of zeolites with H_3PO_4 modified their catalytic properties.

The catalyst testing depicted the retainment of its activity up to 10 h^{-1} of feed rates. Hence, following P_2O_5 introduction, zeolite Y-based catalysts, in combination with higher selectivity for DME, demonstrated an enhanced productivity, making them promise to produce DME from synthesis gas alongside CO + $H_2 \rightarrow CH_3OH$ conversion catalysts.

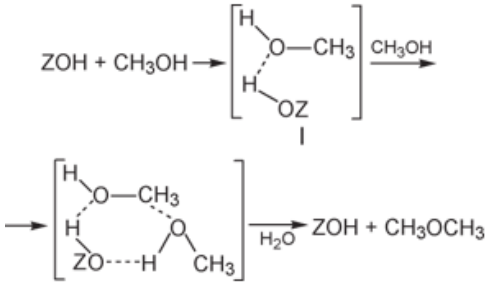
The ZSM-5 modification with H_3PO_4 positively affects its catalytic features in CH_3OH conversion. As shown in Fig. 2, this effect primarily balances the high catalyst activity in converting CH_3OH to higher hydrocarbons.

The contact of strongly bound CH_3OH (methoxonium groups) (I) with a second CH_3OH molecule from the gas phase brings an intermediate state formation with itself which includes bond transfer. The decomposition of this intermediary leads to DME and H_2O formation.

Therefore, the CH_3OH conversion product yield relies upon the zeolite structural type. A comparison of CH_3OH conversion on mesoporous Al_2O_3 (mesopore diameter of 2–4.5 nm) indicates that in both cases, selective conversion to the dehydration dimerization product occurs on Brønsted acid sites (B-sites) [13, p. 8222].

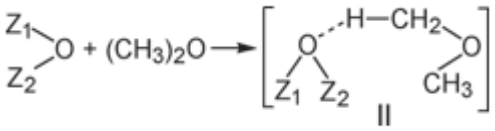
However, selective CH_3OH conversion to higher hydrocarbons is observed on zeolites with even smaller micropores (e.g., SAPO-34, 0.38 nm) or narrower-pored ZSM-5 zeolite (micropore diameter of 0.55 nm) [16, p. 23], even though the formation of the primary hydrocarbon intermediary – C_2H_4 – is preceded by DME formation, as suggested in [13, p. 8222]. According to the results obtained, it could be inferred that, unlike the dehydration dimerization of $CH_3OH \rightarrow$DME, the main hydrocarbon (C_2H_4) relies upon the structural properties of the zeolites, i.e., the dimensional parameters of the micropores, making such reactions structurally sensitive.

Let us examine the obtained data, taking the known CH_3OH conversion mechanism into account, involving strong acids [6, p. 323]. $CH_3OH \rightarrow$DME can be described by scheme (1) beneath:



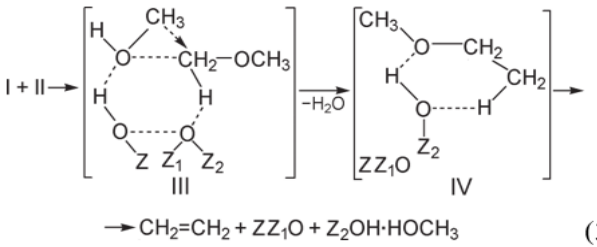
(1)

Based on this scheme, the first alcohol molecule activation occurs on the B-site (ZOH). Then, according to [7, p. 295], the DME molecules produced can contact with similar sites, e.g., adsorb in accordance with scheme (2), forming an intermediary (II).



(2)

When it comes to this process occurring on Al_2O_3, the desorption of the DME molecules formed from its pores is not impeded. However, in the case of narrower-pored ZSM-5 zeolite, where both $(Z_1Z_2)O$ and B-sites (ZOH) are apparent in the micropores, the interaction of intermediate II with the strongly adsorbed methoxonium group I can occur, resulting in the formation of an activated complex (III) based on scheme (3).



(3)

The bond redistribution in this complex substance, with the water molecule release, induces the formation of a new complex (IV), decomposing with the C_2H_4 release. In scheme (3), it is significant that the C_2H_4 formation is accompanied by the transition of the B-site to the L-site:

$$ZOH + (Z_1Z_2)O\ G \leftrightarrow (ZZ_1)O + Z_2OH$$

Such an alteration in surface properties is essential for the conduct of catalytic processes, being the subject of further investigation.

Table 1

Effect of water on the yield of DME conversion products on ZSM-5; T = 450°C; space velocity 1 h^{-1}

Reaction mixture	**Transformation products, %C**				
	C_2H_4	**C_3H_6**	**C_4**	**C_5**	**C_5+**
DME:N_2 = 1:1	6	26	22	15	20
(DME:H_2O = 1:1):N_2	6	36	23	14	8

Therefore, the bond redistribution, illustrated in scheme (3), suggests a possible primary C–C bond formation stage that is the limiting factor in the CH_3OH conversion to hydrocarbons. This assertion is that ethanol (C_2H_5OH) dehydration to C_2H_4, unlike CH_3OH, straightforwardly occurs on Al_2O_3 and zeolite Y [8, p. 7740].

Based on the scheme (3), the process on ZSM-5 is consistent with the defined concepts of the involvement of three CH_3OH molecules in the C_2H_4 formation [14, p. 44-45] [14, p. 9085] and an intermediary similar in structure to methoxyethane [3, p. 58] [15, p. 15260]. Hence, the distances between B-sites (ZOH) and L-sites (Z_1Z_2O), constrained by the dimensional parameters of the zeolite micropores, support the formation of activated complexes III. Furthermore, based on the data obtained, it can be summarized that as the diameter of the micropore lowers from 0.55 nm (ZSM-5), the feasibility of generating such a complex rise to a limiting value (DME absence in the products), hence defining the structural sensitivity of primary C_2H_4 formation during CH_3OH and DME conversion.

From this perspective, it is also noteworthy that regarding narrower-pored zeolites such as SAPO-34 and SAPO-17 (pore diameters 0.32–0.38 nm), the assumption of C_2H_4 formation via C_2H_5OH (via two CH_3OH molecules) [1, p.139] can likewise be depicted by scheme (3). However, due to the smaller distances between B-sites and L-sites in comparison with ZSM-5, the role of CH_3OH (methoxonium) in intermediates I and III is replaced by H_2O molecule (hydroxonium).

The CH_3OH conversion on H-ZSM-5 zeolite to higher hydrocarbons includes the DME and primary C_2H_4 formation in respective order. Despite that, as shown in Fig. 3, the distribution of hydrocarbon products from CH_3OH and DME conversion varies under similar conditions. If CH_3OH fundamentally yields low-molecular-weight olefins, the DME conversion mainly produces higher-molecular-weight aliphatic hydrocarbons of isostructure.

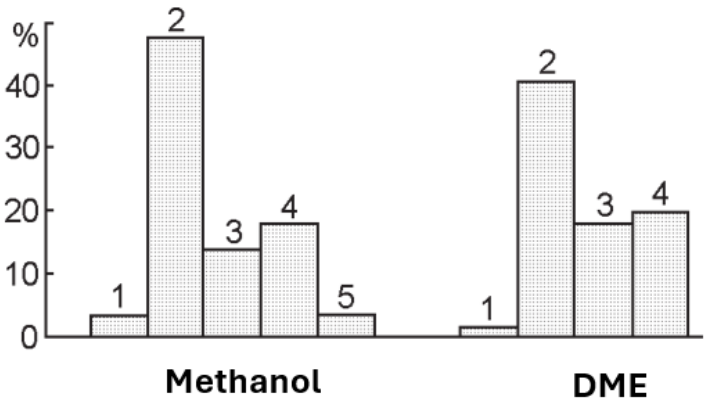


Fig. 3. Distribution (selectivity of formation) of methanol and DME conversion products on ZSM-5 catalyst (T = 375 °C, space velocity = 3 h^{-1}): 1 – C_1–C_3 alkanes; 2 – C_2=–C_4= olefins; 3 – C_{4+} aliphatic hydrocarbons; 4 – aromatic hydrocarbons; 5 – DME.

During CH_3OH conversion to hydrocarbons, twice as much H_2O is released compared to the DME conversion. In this regard, it is valuable to consider the H_2O effect released during the conversion of CH_3OH on the yield of DME conversion products.

Table 1 presents data on the distribution of DME conversion products (without H_2O and with H_2O dilution) as an example. A comparison illuminates that additional H_2O (corresponding to the amount released during 100% CH_3OH conversion, DME:H_2O = 1:1) influences the yield of conversion results. It can be noted that under the introduced water vapor effect, the propylene yield increases, while the C_2H_4 yield remains consistent in practice. Furthermore, there is an almost twofold reduction in the C_{5+} hydrocarbon formation.

Hence, the additional introduction of H_2O does not affect the C_2H_4 yield with only influencing its following oligomerization, decreasing the yield of higher-molecular-weight hydrocarbons. Moreover, it is important to highlight that H_2O vapor, while inhibiting the oligomerization of the formed low-molecular-weight olefins, does not affect the primary C_2H_4 alkylation. Variation of the ratio of DME (CH_3OH):H_2O, to purposefully adjust the hydrocarbon product yield from their conversion becomes feasible.

CONCLUSION

The yield of hydrocarbon products can be purposefully controlled by varying the ratio of DME (CH_3OH):H_2O.

Another conclusion from the analysis of the obtained results is that if the C_2H_4 formation from CH_3OH or DME can be characterized by structurally sensitive reactions depending on the distances between B-sites

(ZOH) and L-sites (Z_1Z_2O), constrained by the dimensional parameters of zeolite micropores between 0.32 and 0.55 nm, then the reactions of other hydrocarbon formation become structurally insensitive, and their yield can be adjusted by selecting both conditions and catalysts for the conversion of CH_3OH and DME.

The examination of the results obtained and literature data indicates that the C_2H_4 formation is a structurally sensitive reaction, including Brønsted acid sites and Lewis basic sites of the catalyst, and is determined by the distance between these sites. Since the diameter of the zeolite micropores lessens from 0.55 nm (ZSM-5) to 0.38 nm (SAPO-34), there is a replacement of one of the CH_3OH molecules by H_2O molecule during the primary C_2H_4 formation.

References

1. Bandiera, J., & Naccache, C. Kinetics of methanol dehydration on dealuminated H-mordenite: Model with acid and basic active centres. – Applied Catalysis, 1991. – 139 p.

2. Ermakov, R. V., & Plakhotnik, V. A. Conversion of methanol on domestic pentasil: obtaining high-octane gasoline components // “Neftyekhimiya” journal, #1 – 2008.

3. Gimaeva, A. R., Fattakhov, M. M., & Mastobaev, B. N. Features of dimethyl ether production and its use as a promising motor fuel // “Neftegazovoe Delo” #3, 2015. – 55–58 p.

4. Jackson, J. E., & Bertsch, F. M. Conversion of methanol to gasoline: new mechanism for formation of the first carbon-carbon bond. – Journal of the American Chemical Society, 1990. – 9085 p.

5. Johnsson, F., Kjärstad, J., & Rootzén, J. The threat to climate change mitigation posed by the abundance of fossil fuels // “Climate Policy” journal, #2, 2019.

6. Khodzhiev, S. Kh., Kolesnichenko, H. B., & Ekhova, N. N. Obtaining lower olefins from natural gas via methanol and its derivatives // “Neftyekhimiya” journal, #5, 2008.

7. Matyshak, V. A., Khomenko, T. H., & Jin, T. I. Production of oxygen-containing methane derivatives from methanol and synthesis gas on supported catalysts // “Kinetics and Catalysis” journal, 2, 1999.

8. Munson, E. J., Kheir, A. A., Lazo, N. D., et al. – Theoretical Study of the Mechanism of Surface Methoxy and Dimethyl Ether Formation from Methanol Catalyzed by Zeolitic Protons – Journal of Physical Chemistry, 1992. – 7740 p.

9. Popov, I. G., Reshetnyak, L. F., Shmeleva, A. S., & Sobolevsky, B. C. Production of dimethyl ether from synthesis gas based on methanol production // “Russian Journal of Chemical Industry”, #7, 2000.

10. Rozovskii, A. Ya. Synthesis of motor fuels from natural gas // “Russian Journal of Chemical Industry”, #3, 2000.

11. Rozovskii, A. Ya. Dimethyl ether and gasoline from natural gas // “Russian Chemical Journal”, #6, 2003.

12. Shikarda, T., Ohno Y., Ogawa T. Kinetics and Catalysis // “Journal of the American Chemical Society” #3, 1999.

13. Tajima, N., Tsuneda, T., Toyama, F., & Hirao, K. A new Mechanism for the first Carbon-Carbon Bond Formation in the MTG Process – “**Journal of the American Chemical Society’,** 1992. – 8222 p.

14. Van Bekkum, H., Elanigen, E. M., Jacobs, P. A., & Jansen, J. C. (Eds.). Introduction to Zeolite Science and Practice. – Elsevier, 2001. – 44-45 p.

15. Wang, W., Buchholz, A., Seiler, M., et al. Evidence for an initiation of the methanol-to-olefin process by reactive surface methoxy groups on acidic zeolite catalysts – Journal of the American Chemical Society, 2003. – 15260 p.

16. Xu, M., Lunsford, J. H., Goodman, D. W., & Bhattacharyya, A. Dehydration of Methanol to Dimethyl Ether over ZSM-5 Zeolite – Applied Catalysis A**,** 1998. – 23 p.

THE ROLE OF CHEMISTRY IN THE TRAINING OF ENGINEERING STAFF

Jabbarova N.
Candidate of Chemical Sciences, Associate Professor,
Maharramova L.
Candidate of Chemical Sciences, Associate Professor
Department of Chemistry and Technology of Inorganic Substances,
Faculty of Chemical Technology,
Azerbaijan State Oil and Industry University, Baku
DOI: 10.5281/zenodo.15294112

Abstract

The article examines the role and importance of chemical disciplines in higher educational institutions for the training of engineering personnel in the Republic of Azerbaijan. Information is provided on the development of the chemical industry - plants for the production of metals, alloys, fertilizers, etc. The work of young scientists carried out at the University is noted.

Keywords: chemical disciplines, industry, engineering personnel, young scientists, Azerbaijan.

Throughout the existence of Mankind, chemistry has served in its practical activities.

The development of such industries as metallurgy, mechanical engineering, transport, production of building materials, electronics, light food industries, household spheres and many other areas is associated with chemistry.

Water is the most amazing substance - the basis of life on Earth. Every year, more than 450 billion cubic meters of household and industrial waste are dumped into rivers around the world. The task of chemistry is to purify contaminated fresh water and desalinate salt water [1-3].

A huge amount of chemical weapons is accumulating all over the world, which even only during storage are a "time bomb". The development of methods for the disposal of chemical weapons and used materials is also the task of chemistry.

Chemistry plays a major role in the development of the pharmaceutical industry, as well as in the search for new materials that can replace living tissue.

New food products, cosmetics, etc. – all this cannot exist without chemistry.

Unfortunately, in the last decade, there has been a decline in the level of chemistry education in secondary schools in Azerbaijan, and an objective attitude has formed towards this subject as complex and unclaimed in further professional activity. Therefore, complications often arise when studying this discipline at a university. The problem is further aggravated by the fact that with the destruction of the Soviet education system, the chemistry course in universities was cut by in half or even more, i.e. a capacious deep course of higher education had to be cut back and completed at a rapid pace, which, of course, cannot but affect the learning outcomes.

But modern society needs educated youth who should be able to implement their own developments in various fields of science, technology, and production in their professional activities.

Such successful activity is possible only on the basis of a harmonious understanding of the world, the environment, and a conscious search for one's own place in everyday life. Therefore, knowledge of fundamental scientific and natural sciences, including chemistry, becomes a necessary basis for ensuring fruitful productive professional activity of university graduates and the ability to solve problems and possible future global problems.

Taking into account many years of experience in training engineering personnel and modern requirements in the preparation of bachelors of general technical fields in light of the requirements of the Bologna education system, the scientific and pedagogical staff of the Azerbaijan State Oil and Industry University consistently works on the problem of forming a high-quality system of students' knowledge in fundamental disciplines (chemistry, mathematics, physics). Mastering knowledge of the main natural sciences in the first years of study becomes the key to forming a fundamental worldview of the nature of objects and the surrounding world around us in students. It is the expansion and improvement of fundamental training that allows us to develop specialists capable of thinking outside the box, analyzing, systematizing and generalizing the information received, and solving real technical problems [4-7].

The Department of Chemistry and Technology of Inorganic Substances has been training masters in the specialty of inorganic substance technology and processing of solid household and industrial waste for several years. Scientific research is conducted under the supervision of the department's teachers, the results of which are published in various scientific journals. Republican and international conferences with the participation of young scientists are held annually [8-13].

A high level of engineering work in solving technological problems can be based on a deep understanding of the chemical laws of processes that are basic in the creation of new technological industries. This requires a significant expansion of pedagogical methods.

The widespread use usage of animation, chemical modeling via a computer makes learning more visual, understandable and memorable. The use of different types of educational activities - creating presentations, performing laboratory work in a virtual laboratory, testing, etc. - allows students to independently obtain the necessary information, think, reason, analyze, and draw conclusions.

An important advantage of using complex technologies in chemistry laboratory classes is the ability to

demonstrate chemical experiments that are difficult to carry out in the laboratory.

The use of "virtual excursions" significantly broadens the horizons of students and facilitates their understanding of the features of production processes.

Ultimately, the knowledge gained during the training allows students to interpret technical, natural science, and humanitarian problems of our time in the context of the relationship between geology, chemistry, ecology, and the study of environmental pollution problems, etc.

Each specialist, whether an instrument engineer, a thermal power engineer, an oilman, or a specialist in the field of biomedical engineering or microelectronics, must, at least, have a sufficient understanding of those "chemical components" of their activities that contribute to the intensification and improvement of work results.

For example, significant qualitative changes in the field of microelectronics can only be realized with the use of new semiconductor materials that can be developed using nanotechnology. Metallic and metal-ceramic materials can be modified with additives of carbides and nitrides, which are characterized by unique performance properties, in particular high resistance to corrosion and wear in various temperature conditions.

In the energy sector, significant achievements are possible due to a deep understanding of the chemical properties of fuel combustion processes, the principles of controlling (managing) the kinetic properties of processes using substances that stabilize combustion processes, prevent scale formation in boilers and reduce wear of parts.

But the allocation of an insignificant amount of credits for the study of a much-needed fundamental discipline as chemistry, or its complete absence as a subject in the curricula of some technical areas of bachelor's degree course does not guarantee the formation of a modern, well-rounded specialist.

It is necessary to deepen and improve the chemical training of bachelors of higher education institutions not only to broaden the worldview of the future specialist, but also to successfully complete engineering developments and solve technological problems.

Currently, our republic has a difficult situation on the labor market. No one can say exactly what kind of specialists and how many need to be trained for the next 5-10 years. There is no understanding of what which specialists are required.

Today, the labor market needs specialists with interdisciplinary knowledge, who can quickly retrain, make effective decisions in dynamically changing conditions.

In Azerbaijan, over the past 20-25 years, there has been a significant growth of industrial facilities, especially those related to the chemical industry. Since 2013, an industrial chemical park (200 hectares) has been launched in Sumgait (Azerbaijan), including 13 operating facilities (including a copper processing plant, a plant for the production of copper wires of various cross-sections, a plant for the production of plastic windows and doors of the Assorep company, etc.), an aluminum rolling plant, a ferroalloy plant, etc.

The Azersun industrial park includes a paper and cardboard plant, a factory for the production of vegetable oils and other products. The oil company SOCAR launched the Methanol plant, a urea carbamide plant, and the Polimer plant. In Balakhani, there is an industrial park with two plants for sorting and recycling household waste (as part of the "clean city" project) [14].

An industrial park has been launched in the city of Mingachevir (since 2016), and food processing plants and factories operate in the regions of the Republic. And the list goes on and on...

Training a new generation of engineers who are capable of ensuring the competitiveness of products both in the national commodity market and in the global world market is an urgent task for engineering universities.

References

1. EPA (2017). United States Environmental Protection Agency-Environmental Topics.

2. EEA (2013). European Environment Agency-Managing municipal solid waste - a review of achievements in 32 European counties.

3. Eurostat, (2017). Statistical office of the European Union Situated in Luxembourg (statistic on Municipal waste statistics in Europe checked in 2017).

4. Glagoleva A.A., Kosmodemyanskaya S.S. Application of active teaching methods in chemistry lessons. Educational system: innovations in the field of modern scientific knowledge: collection of scientific papers. Kazan, 2019. 365 p.

5. Bespalko V.P. Components of pedagogical technology. Publ. "Pedagogy",1989.192 p.

6. Maria S. Pak. Theory and methods of teaching chemistry: textbook for universities. Moscow: St. Petersburg: Publishing house of the Herzen State Pedagogical University, 2015. 306 p.

7. L.R. Mannanova. Innovative technologies in teaching chemistry. Collection of scientific and scientific-methodical works. V International scientific and practical conference "Innovations in Teaching Chemistry" Kazan, 2014. Pp. 90-94.

8. Jabbarova N.E., Najafova E.A. Concrete based on brick waste. Proceedings of the III International Scientific Conference "Reconstruction and Restoration in Post-Conflict Situations", News of the Universities of Azerbaijan, Vol.25, No.4, May 2023, Baku, ASUNP. P. 39-45.

9. Jabbarova N.E., Abbasova N.N The impact of municipal solid waste incineration ash on concrete and cement. International Conference on Actual Problems of Chemical Engineering. Baku, 2020, p.564-569

10. Jabbarova N.E., Abbasova N.N. Study of the properties of cements and concretes modified with ash residues from MSW processing. Journal of Problemy Nauki, No.4 (52), 2020, pp.5-9.

11. Jabbarova N.E., Aliyev K.K. Influence of metallurgical slags on the properties of cement and concretes based on it. Journal of Science, Technology and Education, No. 1 (76), 2021, pp. 11-14.

12. Jabbarova N.E., Mirzayeva Ch.G. Properties of gypsum with the addition of mikrosilica. Журнал

Вестник Науки и Образования. 2024. № 4 (147). С.6-11.

13. Jabbarova N.E. et al. Properties of concrete with filler from brick waste. Journal of construction materials, No. 9 (828), 2024, pp. 36-43.

14. Джаббарова Н.Э. и др. Свойства бетона с заполнителем из кирпичных отходов. Журнал строительные материалы, №9 (828), 2024, с.36-43.

15. https://tamizshahar.az.

ECONOMICS

ANALYSIS OF THE RESULTS OF STUDIES DEFINING THE LEADERSHIP SKILLS OF CHINGGIS KHAN

Bat-Otgon Z.
Magistrate of Physics, Ph.D of Philosophy, Doctoral student of Management
DOI: 10.5281/zenodo.15294118

Abstract
This study examines how the leadership of Chinggis Khan, who founded the most powerful empire in human history, has been explored in management science. It presents the findings within the scope of identifying Chinggis Khan's leadership skills and learning from them.
Keywords: Chinggis Khan, leadership, leadership skills, frequency, comparison, results.

Introduction

In the process of establishing and strengthening the Great Mongol Empire, Chinggis Khan implemented policies and activities in various fields such as politics, society, economy, trade, governance, law, justice, humanity, family, child protection, military affairs, armed forces, foreign relations, and diplomacy, achieving significant success. Numerous studies have confirmed these achievements. This necessitates an analysis and synthesis of the studies defining Chinggis Khan's leadership skills to highlight their unique features.

Leadership Skills of Chinggis Khan Defined by Foreign Scholars

According to some large corporations, globalization is the number one challenge for business leaders in the 21st century. However, after consolidating the Great Mongol Empire, Chinggis Khan established global peace, fostered mutually beneficial trade, and created a unified market, effectively implementing globalization and fighting for its reinforcement throughout his life.

In today's globalized world, where multinational corporations operate beyond borders, leaders like Chinggis Khan are highly needed. Consequently, his leadership characteristics and skills have become subjects of intense academic study.

In 1980, a Gallup survey conducted by the "Wall Street Journal" among 782 top managers of 282 major corporations in the USA revealed that the top three traits for successful leadership are integrity, ability to get along with people, and industriousness[1]. Professor Y. Batsuuri (2016) confirmed through his research that Chinggis Khan exemplified these traits and applied them successfully. Batsuuri also noted that Chinggis constantly sought innovation, creatively utilizing new technologies and foreign experts[2].

The 1997 book "*Leadership Lessons from Great Genghis Khan*" by Blenheim Partners reported that English and American marketing scholars began to recognize Chinggis Khan not merely as a conqueror but as an outstanding leader and top-level manager. His leadership methods have been increasingly studied as essential learning for modern businesspeople[3].

In 1999, South Korean journalist and researcher Kim Jong Rae compared the powerful Great Mongol Empire founded by Chinggis Khan to the present-day USA, drawing significant conclusions[4]. Similarly, American scholar Jack Weatherford shared his findings in an interview with the *History News Network* in 2016[5].

In 2007, Professor Mick Yates from Leeds Business School, UK, proposed the "4E's Leadership Framework" based on his research on Chinggis Khan, which includes:

- Envision – Abilitytoforesee
- Enable – Abilitytoimplement
- Energize – Energytoachievegoals
- Empower – Delegating appropriate authority to subordinates[6].

This theory marked a new contribution to leadership studies[7].

In 2012, *Forbes* magazine published an article emphasizing learning leadership skills from Chinggis Khan. It described him as a leader who built the Mongol Empire in the early 1200s, established religious freedom, protected women's rights, implemented sophisticated governance, and won every battle he led. The article highlighted his goal of unifying the world under a single empire[8] and introduced seven leadership lessons drawn from Jack Weatherford's book *Genghis Khan and the Making of the Modern World*.

The above studies show that modern leadership scholars analyze Chinggis Khan's leadership process, defining leadership qualities and skills that can be applied in business management today.

Table 1.

Leadership Traits and Skills of Chinggis Khan Defined by Foreign Scholars

1997 - Blenheim Partners: Leadership skills and methods of Chinggis Khan	***1999 – Kim Jong Rae:*** Leadership Techniques of Chinggis Khan	***2007 - Mike Yates:*** 4E's Leadership Framework of Chinggis Khan	***2018 - Forbes Magazine:*** Seven lessons of Chinggis Khan from Weatherford's book
• Open-mindedness	• Practicality	• Envision – Ability to foresee	• Not to control, but to lead
• Speed and Strength	• Speed	• Enable – Ability to implement	• Care for others, not just yourself
• Building a System of Trust within the Team	• Adaptability and Strength	• Energize – Energy to achieve goals	• Be visionary
• New Ideas and Solutions	• System for Replenishing Capability	• Empower – Granting appropriate authority to subordinates	• Believe only in yourself
	• Trust Built on Sharing Hardships and Joys		• Be humble
	• Risk-Taking Attempt		• Avoid excessive luxury
			• Change the world, but do so gradually
Source: Blenheim Partners. (1997). Leadership lessons from Great Genghis Khan.	*Source: Kim Jong Rae. (1999). A Millennium of Historical Figures. Ulaanbaatar.*	Source: Mick Yates. (2007). 4E's leadership framework.	*Source: Forbes Magazine. 2018.*

Source: As developed by the author

The frequency of the leadership skills of Genghis Khan mentioned in these studies was calculated, highlighting traits and skills that were repeated more than twice.

Table 2.

Leadership Traits and Skills of Genghis Khan Frequently Mentioned in the Research of Foreign Scholars

	Trait/Skill Studied Scholars	Blenheim Partners	Kim Jong Rae	Mick Yates	Forbes	Frequency
1	Building trust within the group	3	5	4		4→3
2	Vision	4	–	1	3	4→3
3	Caring for others	4	–	1	3	4→3
4	New ideas and solutions	–	4	2	1	4→3
5	Knowledge and skills	2	2, 3, 4	3	–	4→3
6	Speed and strength	–	5	–	2	4→3
7	Self-confidence	–	6	–	4	4→2
8	Simplicity, openness, humility	1	–	–	5, 6	4→2
9	Empowering subordinates	–	–	4	1	4→2
10	Adaptability	–	3	–	–	4→1
11	Risk-taking attempts	–	6	–	–	4→1
12	Changing the world	–	–	–	7	4→1

Source: As developed by the author

The results presented in the table are represented graphically:

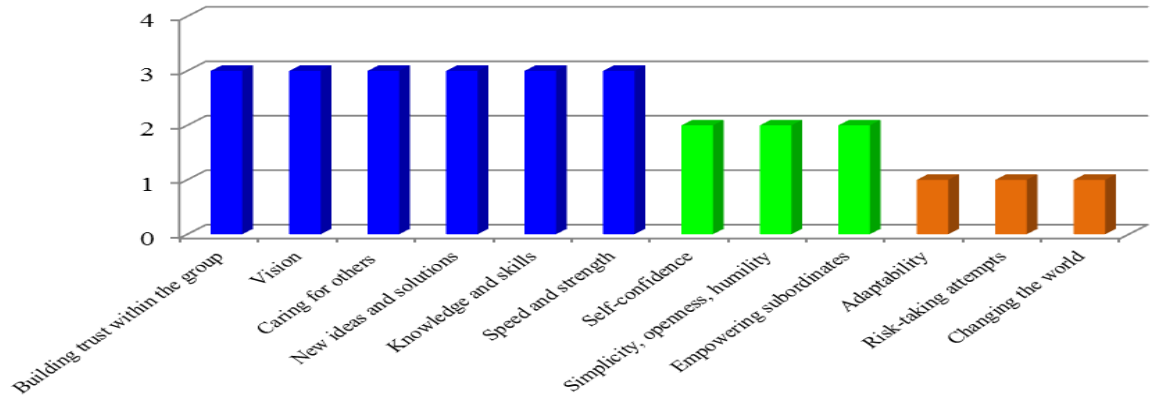


Figure 1. Leadership Traits and Skills of Genghis Khan Frequently Mentioned in the Research of Foreign Scholars

From this, it becomes clear that the most frequently mentioned traits include: vision or goal-setting, the knowledge and skills required to achieve those goals, the ability to generate new ideas and solutions, caring for others, building trust within a team, and the speed and strength needed to accomplish these goals.

The leadership traits of Genghis Khan as defined by local scholars: The works of our respected scholars have contributed specific findings about Genghis Khan's leadership abilities. For example, in his book 'The Art of Leadership of Mongolian Kings and Leaders' (2009), Dr. Professor D. Lkhaashid highlighted five key leadership traits of Genghis Khan[9]. In another example, Dr. Professor H. Purevdagva, in his work 'A Brief Guide to Genghis Khan's Management' (2004), listed nine leadership traits that developed in him up until the age of 18[10]. In addition, academician S. Narangerel, in 'The Ethics and Religion of Genghis Khan' (2013), outlined 28 ethical traits and behaviors that shaped him[11].

In studying the historical events mentioned in the Secret History of the Mongols, English scholar G.Batkhurel (2011) identified 37 traits and skills that he called the 'Secrets of Genghis Khan's Leadership[12]. Likewise, academician T. Dorj, in his work 'The Secret of Genghis Khan's Leadership Wisdom' (2016), defined 10 key traits and abilities[13]. All of these findings are summarized in the table below

Table 3.

Leadership Traits and Skills of Genghis Khan Defined in the Research of Internal Scholars

Scholar	Work	Leadership Traits and Skills of Genghis Khaan
Dr. Professor D. Lkhaashid	*The Art of Leadership of Mongolian Kings and Leaders (2009)*	• During difficult times, Genghis Khan's wisdom was clearer than that of others. • He demonstrated the qualities of a leader who is highly sensitive to the spirit of the times. • His leadership art lay in identifying the core of a problem among countless possibilities and making decisions accordingly. • Although advancing and defending were considered the best strategies, he also knew when it was necessary to retreat. • The foundation of Genghis Khan's statecraft and leadership vision was his deep compassion for people — something that should serve as a guiding principle for any leader.
Dr. Professor H. Purevdagva	*A Brief Guide to Genghis Khan's Management* (2004)	• Began developing the psychological readiness needed to become a great future leader. • Experienced firsthand that the peace and well-being of the people are essential. • I have come to realize that true peace cannot be achieved merely by avoiding conflict. • Started developing the ability to realistically sense his surroundings and learned how to compensate for his weaknesses through his environment. • In order to achieve his goals, he learned to suppress past grievances and even collaborate with former enemies as if they were allies. • This was the time when he started mastering the art of winning people's hearts through compassion and fairness. • Became capable of learning from the mistakes of others. • Began carefully listening even to the words of his enemies, drawing intellectual conclusions, and adopting a decision-making style that combined the advice of friends and the council of elders.

Dr. Professor G. Batkhurel	*The Secrets of Genghis Khan's Leadership* (2012)	• Monitor incoming news. • Accept criticism. • Discover your historical role. • Always fulfill promises and be committed to accepting and correcting the truth. • Share hardships and difficulties with others. • Be aware of personal shortcomings. • Be loyal to benefactors and repay their kindness. • Establish strict and firm laws and rules, and ensure they are well communicated. • View everything with clear and rational thinking. • Prepare for war during times of peace and so on - a total of 37 character traits.
Academician S. Narangerel	*The Ethics and Legal Principles of Genghis Khan* (2014)	• Justice • Courage • Sense of shame and fear • Duty and responsibility • Integrity • Compassion and empathy • Honor • Truth • Trust • Patience and endurance and so on - a total of 28 character traits.
Academician T. Dorj	*The Secrets of Genghis Khan's Leadership Science* (2016)	• 1. Ability to control emotions • 2. Honesty, integrity, and humanity • 3. Courage and decisiveness • 4. Ability to repay kindness and good deeds • 5. Wisdom and skill to develop others • 6. Ability to resolve conflicts • 7. Ability to adapt • 8. Optimistic mindset • 9. Sociability • 10. Charismatic nature

Source: As developed by the author

As before, the leadership skills of Chinggis Khaan that were frequently mentioned in domestic scholars' research were also analyzed and identified.

Table 4.

Characteristics and Skills of Chinggis Khaan's Leadership Most Frequently Mentioned in Domestic Scholars' Research

	Trait/Skill Studied *Scholar*	Doctor, Professor D. Lkhaashid (1999)	Doctor, Professor Kh. Purevdavga (2004)	Doctor, ProfessorG. Batkhurel (2011)	Academician S. Narangerel (2014)	Academician T. Dorj (2016)	Frequency
1	Wise	1	8	9	18, 20, 22, 23	5	5→5
2	Empathetic	2	4	21			5→3
3	Collaborates with others		5, 9	5	6	6	5→4
4	Flexible	4	5			7	5→3
5	Strategic foresight	5		3	18	8	5→4
6	Caring for people		2	7	2, 4, 6, 16, 17, 20, 26	2, 4	5→4
7	Resilient spirit		1		1, 10		5→2
8	Attracts others through compassion		2			10	5→2
9	Hiring the best people	3	4	14		5	5→4
10	Truthfulness			4	1, 8	2	5→3
11	Developing others		4, 7, 8	18		5	5→3

Source: As developed by the author

The results presented in the table are represented graphically:

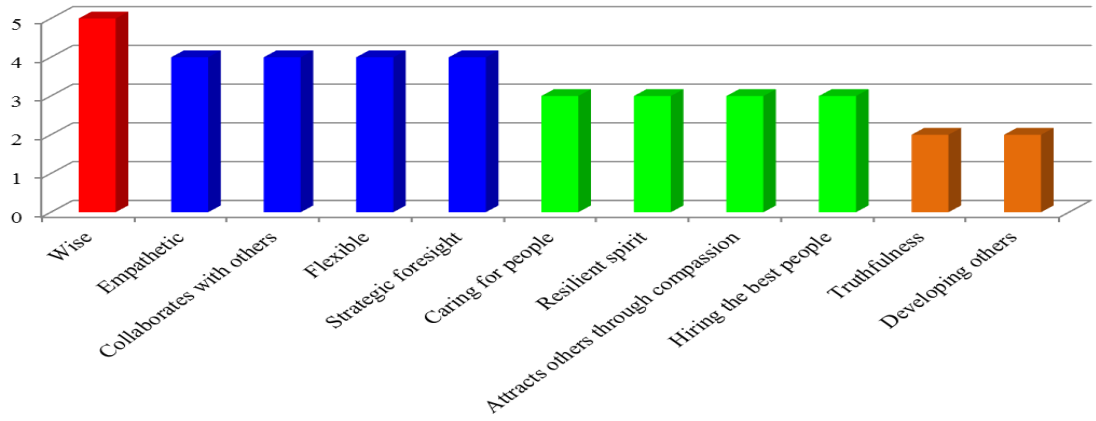


Figure 2. Characteristics and skills of Genghis Khan's leadership most frequently mentioned in internal scholars' research.

Skills marked in red have the highest frequency, skills marked in blue have a high frequency, skills marked in green have a medium frequency, and skills marked in brown have a low frequency. Skills marked in red and blue will have the highest frequency.

In the figure: the attribute 'Wise' is the most frequently mentioned attribute in all scholars' research, while 'Strategic thinking', 'Hiring the best', 'Caring for people', and 'Collaborating with others' are attributes with a high frequency.

Comparative results: Now, let's compare the leadership traits and skills of Genghis Khan, which are frequently mentioned in the research of both internal and external scholars.

Table 5.

Comparative Results of the Leadership Traits and Skills of Genghis Khan Frequently Mentioned in the Research of Internal and External Scholars

	Research by foreign scholars	**Frequency**	**Research by domestic scholars**	**Frequency**
1			Intelligent	5→5
2	Building trust within the team	4→3	Collaborating with others	5→4
3	Vision	4→3	Strategic thinking	5→4
4	Caring for others	4→3	Caring for people	5→4
5	Knowledge and skills	4→3	Hiring the best people	5→4
6	New ideas, solutions	4→3		
7	Speed, strength	4→3		
8	Simplicity	4→2		
9	Empowering subordinates	4→2		
10	Self-confidence	4→2		
11			Empathetic	5→3
12			Flexible	5→3
13			Developing others	5→3
14			Truthfulness	5→3
15			Resilient spirit	5→2
16			Attracting others through compassion	5→2

Source: As developed by the author

The results presented in the table are represented graphically:

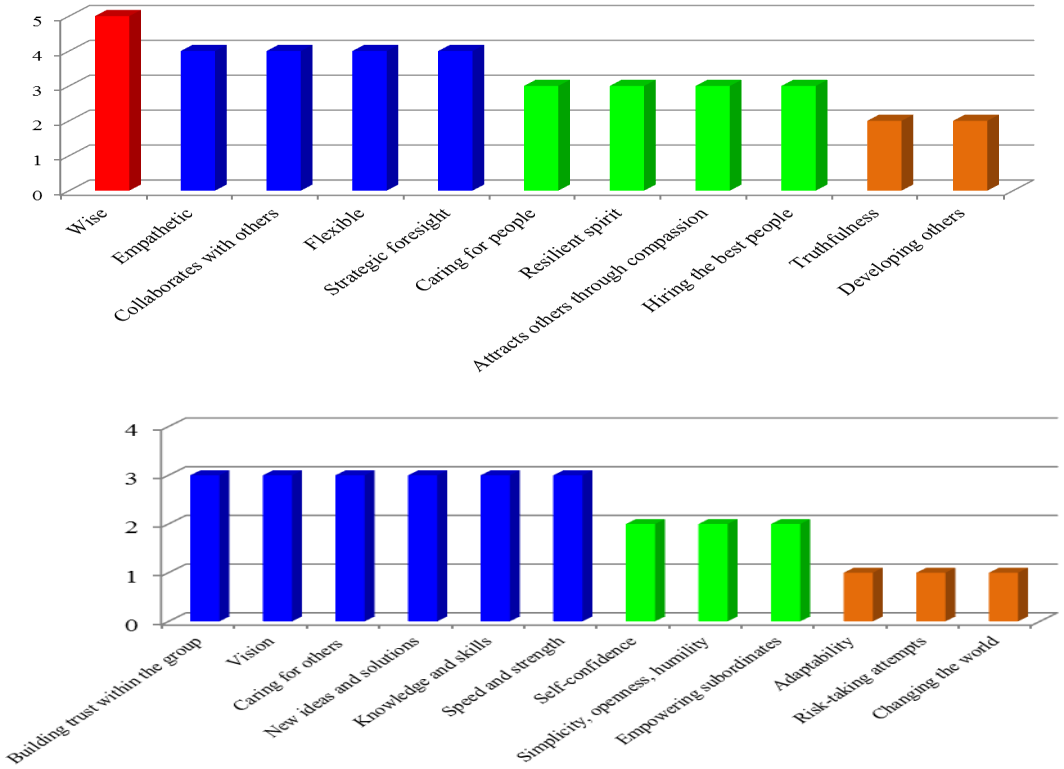


Figure 3. Comparative results of the characteristics and skills of Chinggis Khan's leadership most frequently mentioned in foreign and domestic scholars' research.

When summarizing the characteristics and skills of Chinggis Khan's leadership most frequently mentioned in foreign and domestic scholars' research: the indicator **"Being intelligent"** appears with the highest frequency. Furthermore, the following attributes show both high frequency and overlap between the two groups:

- **Visionary thinking** (or strategic foresight)
- **Knowledge and competence**, **new ideas and solutions** (or recruiting the best talent)
- **Caring for others** (or valuing people)
- **Building trust within the team** (or cooperating with others).

Conclusion

From these results, it can be observed that both foreign and domestic scholars generally emphasize, alongside vision and goals, the importance of intellectual (IQ) attributes such as the knowledge, skills, and innovative solutions needed to achieve them. In addition, they highlight emotional (EQ) attributes such as caring for others, collaborating, and building trust within teams, which also show high frequency and overlap. This indicates that emotional intelligence or spirituality in the workplace was a predominant aspect of Chinggis Khan's leadership. Thus, it is reasonable to conclude that Chinggis Khan was a leader of great intellect and spirit.

References

1. Wall Street Journal. November 14.1980. p 33
2. Batsuuri, Y. (2016). *Chinggis Khaan's management wisdom: How to conquer organizations and teams*. Paper presented at the International Scientific Conference. Retrieved from "http://creativemongolia.com/" "http://creativemongolia.com/" "http://creativemongolia.com/"http://creativemongolia.com
3. Blenheim Partners. (1997). *Leadership lessons from great Genghis Khan*.
4. Forbes. (2012, May 7).
5. History News Network. (2016, October 10).
6. IKON.MN. (2016, December 6). [Jack Weatherford: Genghis Khan did not make the policy mistakes America is making in the Middle East]. (Translated with permission by Ts. Batmunkh).
7. Kim, J. R. (1999). *Myangan jiliin tuukhen khün* [A thousand-year historical figure]. Ulaanbaatar, Mongolia.
8. Lkhaashid, D. (2009). *The art of leadership of Mongolian khans and statesmen*. Ulaanbaatar, Mongolia.
9. Narangerel, S. (2013). *The moral chronicle of Genghis Khan*. Ulaanbaatar, Mongolia.
10. Pürevdagva, Kh. (2004). *A brief management handbook of Genghis Khan*. Ulaanbaatar, Mongolia.
11. Wall Street Journal. (1980, November 14). *Wall Street Journal*, p 33.
12. Man, J. (2012). *The leadership secrets of Genghis Khan* (pp. 114–118). Ulaanbaatar, Mongolia.
13. Dorj, T. (2016). *The scientific secrets of Genghis Khan's leadership*. Ulaanbaatar, Mongolia.

TRANSFORMATION OF INNOVATIVE BANKING MARKETING IN THE CONTEXT OF DIGITALIZATION OF THE BANKING SERVICES MARKET

Gaidukovych D.
Ph.D. (Economics), Independent Researcher and Associate Professor,
California, Los Angeles, USA
DOI: 10.5281/zenodo.15294127

Abstract
This article examines the key aspects of the transformation of innovative banking marketing under the influence of the digitalization of the banking services market. The study analyzes the evolutionary changes in the marketing mix and provides a comparative characterization of traditional and innovative marketing approaches in the banking sector. Particular attention is given to identifying future directions for research regarding the necessity for banks to develop a consistent strategy for marketing banking innovations.
Keywords: bank, banking product, marketing, marketing mix, innovation, digitalization, strategy.

Problem Statement

In the context of the transformation of national economies toward digital models, the efficient organization of the movement and redistribution of resources in their monetary form occupies a central role. Global economic trends clearly demonstrate the objective necessity of ensuring the innovative development of banks as a prerequisite for their survival amid financial instability and for the enhancement of economic potential. The relevance and significance of this issue in the banking services market are further evidenced by the ongoing academic and practical discourse on marketing strategies for banking innovations.

Relevance of the Study

The relevance of this study is also driven by the fact that current trends in the theory and practice of marketing banking innovations necessitate the development of new approaches to utilizing the marketing mix throughout the entire life cycle of innovations—from the generation of an innovative idea to the product's market implementation. The advancement of digital technologies has increased banks' attention to the opportunities offered by digital banking innovations. The innovation-driven nature of modern economic processes imposes new demands on the content, methods, and forms of organizing various types of managerial activities related to the marketing of banking innovations.

Literature Review

The prospects of economic digitalization highlight the need for the development and promotion of approaches to marketing banking innovations aimed at supporting banking businesses and orienting their innovative marketing activities not only toward internal capabilities but also toward market needs. This includes the creation of specialized marketing tools for innovation implementation.

The concept of the "digital economy" emerged from the theoretical work of D. Bell in the 1960s, who introduced the idea of an "information economy." With the development of communication technologies, researchers such as M. Castells proposed the concepts of the "network society" or "network economy" [The concept of a "Digital Economy"]. Since the beginning of the 21st century, both academics and practitioners have widely adopted the term "digital economy."

According to T. Mesenbourg [Mesenbourg, 2001], the concept of the digital economy can be divided into three key components: (1) the supporting infrastructure (hardware and software); (2) e-business (conducting economic and other business processes through computer networks); and (3) e-commerce (distribution of goods via the Internet).

H. Karcheva emphasizes that the digital economy is an innovative and dynamic economy based on the active implementation of innovations and information technologies across all types of economic activity and spheres of social life. This enables increased efficiency, competitiveness of the economy, and an improved standard of living for the population [Karcheva et al., 2017, p. 14]. The fundamental principles of the digital economy include: accessibility, purposefulness, independence, freedom of information dissemination, openness and cooperation, standardization, trust and security, and comprehensiveness.

In the banking services market, the volume of payments made through digital channels continues to grow, and the demand for such services remains consistently high. This primarily involves digital technologies, products, and services that are now considered among the most innovative trends in the current development of society, including BioTech, NanoTech, RetailTech, FinTech, LegalTech, InsurTech, and GovTech [Kraus N. et al., 2018]. Considering digital products and services such as blockchain, digital marketing, CRM & BPM systems, grid technologies, and digital insurance, it can be stated that these technologies are transforming the structure and role of marketing.

Based on the studies dedicated to market transformation by J. Moore [Moore, 2006], C. Christensen and M. Raynor [Christensen and Raynor, 2004], and P. Drucker [Drucker, 1998], the emergence of innovation should be viewed as a process of changing market structures. The process of commercializing banking innovations in the context of the digital economy calls for the development of innovative approaches that align marketing activities with market needs and promote the use of digital marketing tools [Kovalenko V. et al., 2023].

The purpose of this research is to substantiate the transformational changes in the marketing mix of banking innovations under the conditions of economic digitalization. The marketing of banking innovations includes several components. First and foremost, it involves project marketing, idea generation, identification of research directions, identification of promising R&D projects, assessment of their market

and investment attractiveness, market launch, and evaluation of maturity stages. Competitive advantages are gained by those banks that actively implement innovative products, enhance the personalization of customer relationships through internet technologies, accelerate the process of building customer loyalty, and reduce operational costs by automating and digitalizing transactions, calculations, and management processes. In order to effectively leverage the potential of digital technologies, banks must adapt existing marketing tools and introduce new ones.

The combination of marketing factors that accompany the delivery of a product to the end consumer at all stages of the process, aimed at eliciting the desired positive market response, is known as the 4P marketing mix. The marketing mix refers to a set of controllable tools, methods, and actions used by producers to influence the market, stimulate the desired response from the target market, and regulate demand for their product. It includes all necessary product parameters that the marketer manages and develops to ensure successful market positioning. In this study, we will refer to it by its abbreviated name: "4P."

The marketing support of banking innovation implementation is carried out through marketing methodologies that generate key insights about customers (both current and potential users of innovative banking technologies, products, and services), competitors, and the external environment.

Moreover, innovations also include traditional banking products that have been modified under the influence of digitalization, as well as marketing information and communication technologies that provide clients with unique opportunities to meet their banking needs more effectively. These are qualitatively new products capable of satisfying previously unmet demands of potential consumers. As such, since banking innovations require continuous marketing support in the market, there is a growing need to modify traditional and develop new, specialized technologies for such support.

The systemic analysis of the interdependence between new banking products and the marketing technologies supporting them shows that marketing methods themselves should also become the object of innovation marketing. This is because they create opportunities for the positioning and promotion of new banking products in the financial market, aligning with the objectives of modern marketing development.

The analysis of the nature and features of the concepts of banking innovation marketing and innovation marketing indicates a close relationship between their goals, tasks, and principles. Innovation marketing, based on traditional marketing techniques, increasingly requires the application of new marketing technologies. In this way, it creates the foundation for the further development of innovative marketing. The key difference between the two concepts lies in the subject of influence:

- Innovation marketing is based on the development of innovative banking products through the consistent application and enhancement of marketing mix components;
- Innovative marketing is a broader concept, where the object of influence is innovative marketing technologies themselves. Banking innovation marketing is a subset of this broader category and requires the continuous evolution of these technologies (see Table1).

Table 1.

Comparative Characteristics of Innovation Marketing and Innovative Marketing in Banks

Comparison Criterion	Innovation Marketing	Innovative Marketing
Interpretation	Use of traditional marketing mix tools at the initial stage, with gradual improvement and adaptation of innovative elements	A modern direction in marketing formed on the basis of innovative methods and technologies in banking marketing
Subject of Influence	Innovative banking products, services, and technologies at all stages of the innovation process	Marketing of innovative technologies at all stages of the innovation process or at all stages of the banking product life cycle
Definition of Concepts	Innovation marketing is the management of processes related to the development and implementation of new banking products, aimed at improving the efficiency of using innovative marketing tools, as well as the potential capabilities and resources of banks to meet customer needs and generate profit	Innovative marketing in banking is a separate direction of modern marketing (a concept) that is based on the application of innovative methods and technologies. It develops marketing tools and takes into account the specific influence of digital transformation in creating new products and services

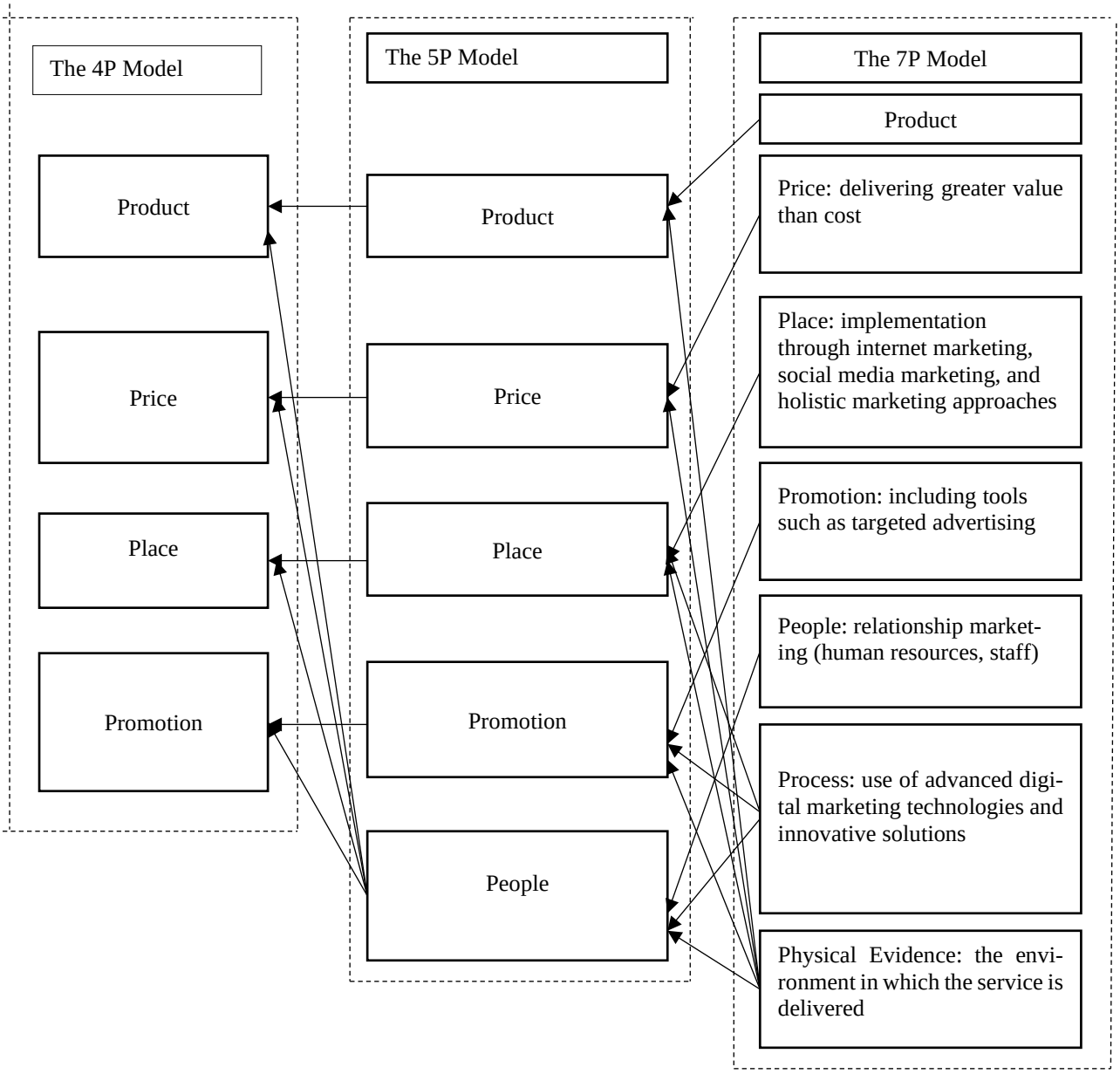
Source: Compiled by the author using materials from [Ilvashenko, S. M., 2008; Sakharov, V. E., and Milovidova, Yu. S., 2011]

The main objectives of innovation marketing lie in ensuring that newly developed and proposed innovative banking products and services possess clear value and usefulness for potential customers, who must be properly informed about them. This, in turn, requires the application of innovative marketing technologies.

These objectives are achieved through the use of marketing mix methods, which were first introduced in 1953 by Neil Borden, then President of the American Marketing Association (2001), further refined by Jerome McCarthy (1993), and subsequently developed by Philip Kotler (2009). It is worth noting that the "4P

marketing mix" model is continually being expanded by modern researchers.

Later, the concepts of "5P" and "7P" were developed to provide a more detailed and comprehensive understanding of the original "4P" model (see Scheme 1).



Scheme 1. Transformation of the 4P Marketing Mix Concept
Source: compiled by the author based on materials from [Kotler, F., 2009; Carniel, A., 2019].

Under the influence of information and communication technologies, in 1990 B. Lauterborn proposed the "4C" model, in which the focus of marketing technologies shifted from the product to the customer. That is, the emphasis was placed not so much on the product and its development, but rather on the consumer and the benefits they receive [Lauterborn, B., 1990, p. 28]. The general structure of this transformation is presented in Table 2.

Table 2.

Transformation of the 4P Marketing Mix into the 4C Model

Elements of the 4P Mix	**Elements of the 4C Model**
Product	Consumer
Place	Convenience
Price	Cost
Promotion	Communication

Source: compiled by the author

Supporters of the "4C" marketing model emphasize that consumers value benefit, low total cost, convenience, and communication — rather than traditional promotion. Given the specific nature of banking products and marketing, it is important to note that the 4C model complements — but does not replace — the fundamental principles of the traditional 4P marketing mix. There are several considerations that support this position.

First, the traditional marketing mix, consisting of the 4Ps, also accounts for consumer preferences. When forming the elements of product, price, promotion, and distribution, marketers study and consider customer expectations. Second, according to the 4C model, marketers should indeed focus on customer value. However, in the process of marketing mix transformation under the influence of digitalization in the financial market, banks also take into account the interests of competitors, investors, and stakeholder audiences — not just customers. Third, the 4C model implies managing the behavior of the consumer. Yet a bank customer is not a fully controllable element of the external environment. Banks can influence customer behavior not directly, but indirectly — through updating product offerings, adjusting prices and fees, and offering attractive distribution channels and service delivery formats.

All the additions made by the 4C approach are fundamentally based on the core elements of the 4P model: product, price, place, and promotion. Depending on the strategic goals of banking marketing, additional elements may be incorporated to help guide customer choices. An optimal 4P mix under digitalization should create a combination of marketing tools that ensures the achievement of strategic goals while making rational use of the available marketing budget. The relative significance of each individual marketing mix element depends on a variety of factors affecting the activities of modern banks.

Digital technologies allow banks to expand their product range and create qualitatively new virtual products that are delivered digitally — thereby enlarging the "product" segment of the marketing mix. The importance of the "promotion" element is also increasing. Social media and direct communication with customers have enabled marketers to significantly expand the reach of their target audiences. The influence of digital advertising has grown to such an extent that proposals for international regulation of advertising have been raised (Gil C. V. L., 2001, p. 664).

Under today's banking conditions, an adaptive approach to the marketing mix is required. This approach is characterized by the situational adaptation of the marketing mix to the digital transformation of banking products. Each bank must carefully analyze the structure of every variable included in the 4P marketing mix, taking into account the specifics of its operations and target audience. After this, it is essential to determine which marketing mix components are controllable and which lie outside the bank's sphere of influence.

This process leads to the formation of an adapted approach to identifying the bank's needs in specific marketing tools, based on three types of variables: basic variables – the traditional components of the marketing mix: product, price, place, promotion; independent components – subcomponents of the basic variables that, considering the bank's specifics, are logically treated as independent; and derived variables – constructed by combining independent components (or even basic ones), when such combinations are reasonable.

This confirms the need for continuous improvement of the existing theoretical and conceptual framework for developing the 4P marketing mix. However, depending on its goals, a bank may emphasize one element over another, and, if necessary, use elements from other marketing models — if it contributes to more effective implementation of strategic marketing objectives related to innovation in banking.

The results of this research indicate that further scientific study is required to clarify the theoretical aspects of forming and developing innovation marketing in the banking sector, as well as the methodological foundations for analyzing how modern marketing concepts influence the organization of processes related to the development and promotion of new banking products and services based on selected marketing mix elements. A strong scientific foundation for these questions will support the creation of effective conceptual approaches for developing and implementing innovation marketing strategies. The design and implementation of an effective banking innovation marketing strategy contributes to the timely launch of new products and services, creating competitive advantages. Therefore, the use of conceptual approaches by banks in shaping an innovation marketing strategy — one that focuses on meeting both current and future customer needs — reduces financial uncertainty and the risks of consumer rejection of new banking products.

References

1. The concept of a "Digital Economy". http://odec.org.uk/the-concept-of-adigital-economy.

2. Mesenbourg, T. L. (2001): Measuring the digital economy. U.S. Bureau of the Census. https://www.census.gov/econ/estats/papers/umdigital.pdf.

3. Karcheva, G. T., Ogorodnya, D. V., Openko, V. A. (2017): Digital economy and its impact on the development of the national and international economy. Financial space, 3 (27), 13–21.

4. Kraus, N. M., Holoborodko, O. P., Kraus, K. M. (2018): Digital economy: trends and prospects of avant-garde development. Effective economy, 1. www.economy.nayka.com.ua.

5. Moore, J. A. (2006): Bridging the gap: marketing and sales of hi-tech products for the mass consumer / Trans. with English Moscow: Williams.

6. Kristinsen, K. M., Raynor, M. E. (2004): Solving the problem of innovations in business. How to create a growing business and successfully support ego growth. Trans. with English Moscow: Alpina Business Books.

7. Drucker, P. (1998): Effective management. Economic tasks and optimal solutions. Trans. with English M. Kotelnikova. Moscow: FAIR-PRESS.

8. Kovalenko, V., Sheludko, S., Cherkashyna, K. (2023): Didgital transformation of banking business present and future. Socio-Eeconomic relations in the

digital society, 4 (50), 25-40. https://doi.org/10.55643/ser.4.50.2023.539.

9. Ilyashenko, S. M. (2008): Marketing of innovations and innovations in marketing: monograph. Sumy: University Book.

10. Sakharov, V. E., Milyutina, Yu. S. (2011): Interpretation, application and development of the conceptual apparatus: marketing of innovations and innovative marketing. Current problems of economics, 5 (119), 122–129.

11. Borden, N. (2001): Marketing mix concept. "Classics of marketing: A collection of works that had the greatest impact on marketing". Trans. with English under the editorship Yu. N. Kapturevskyi. St. Petersburg: Peter.

12. McCarthy, E. Je., Perreault, W. D. Jr. (1993): Basic Marketing: A Global-Managerial Approach. Professional Publishing (R.D. Irwin).

13. Kotler, F., Caslione, J. A. (2009): Chaotic: management and marketing in the era of turbulence. Trans. from English, ed. T. V. Spivakovskaya, S. V. Spivakovsky. Kyiv: Khimzhest, PLASKE.

14. Kotler, F. (2009): Marketing management. St. Petersburg: Peter.

15. Carniel, A. (2019): The ultimate guide to marketing mix: 4Ps, 7Ps, 8Ps, 4Cs, 7Cs. https://www.albertocarniel.com/post/marketing-mix.

16. Lauterborn, B. (1990): New Marketing Litany: Four Ps Passé: C-Words Take Over.
Advertising Age.

17. Gil, C. V. L. (2001): International business in the global market. Translated from English. Kyiv: "Publishing house of Solomiya Pavlychko "Osnovy".

MEDICAL SCIENCES

THE ROLE OF USING SIMULATORS AND VARIOUS MODELS TO TRAIN RESIDENTS IN THE SPECIALTY OF NEUROSURGERY

Kauynbekova Sh.
Department of Surgical Diseases, Karaganda Medical University
Kazakhstan,
Multidisciplinary Hospital named after Professor Kh.Zh. Makazhanov
Karaganda, Kazakhstan
DOI: 10.5281/zenodo.15294135

Abstract

Neurosurgery is a rapidly evolving speciality that requires the physician to constantly evolve with the times and use a variety of modern equipment. Residency graduates must be proficient in a variety of surgical techniques to provide expert care to patients.

The article reflects the analysis of problems of neurosurgical residents training and ways of their solution. It is suggested to introduce the experience of training of foreign colleagues into the system of training of our residents, based on the analysed literature data, described systems of training of residents of different countries, their use of simulators and various models to practice practical skills.

Keywords: neurosurgery residents, simulation training, use of 3 D models.

Introduction: Training of residents in the speciality of neurosurgery (adult, paediatric) is carried out in accordance with the state obligatory standards on the levels of education in the field of health care. The initial stage of postgraduate continuing education in neurosurgery in the Republic of Kazakhstan is currently the residency in adult and paediatric neurosurgery, which is designed for four years (280 credits) [1,2,3]

The entire training plan is conducted in accordance with the educational programme, which includes the objectives, results and content of training, the organisation of the educational process, ways and methods of their implementation, criteria for evaluating the results of training.

The residency programme is aimed at mastering such types of professional activities as: therapeutic, preventive, diagnostic and rehabilitative. In order to provide specialised care to neurosurgical patients, it is necessary to have fundamental theoretical training and to possess practical skills at a high professional level.

Neurosurgery in recent years has become one of the most advanced high-tech surgical specialities and training of specialists in this field requires an individual approach and much more training time. There is an obvious need to increase and include in the course programme the development of various manual skills [3, 4, 5]

Materials and methods:

In Karaganda State University in the educational programme on the specialty of neurosurgery modules and disciplines are distributed as follows: the first year of training is the discipline of the basics of neurosurgery (33 credits), which includes the study of neuroanatomy, propaedeutic of neurosurgical diseases, clinical-diagnostic and instrumental methods of research in neurosurgery, as well as included disciplines such as neurophysiology and neuropathomorphology, general surgery.

Further disciplines by nosologies (pediatric neurosurgery, craniocerebral trauma, spinal cord trauma, vascular pathologies of the brain and spinal cord, degenerative dystrophic diseases of the spine, tumors of the central nervous system) are distributed by years.

The educational process is distributed as follows 30% practical skills, independent work of the resident under the guidance of the teacher -60%, independent work of the resident -10%.

Residents spend most of their training time in neurosurgical departments (adult and pediatric). Under the supervision of clinical mentors, residents learn basic neurosurgical skills in the first year, then participate in surgery as an assistant. In the third and fourth years of training, under the supervision of clinical preceptors, residents perform a variety of access surgeries on the brain, spinal cord, and peripheral nervous system. In addition, residents engage in research activities on a selected topic during their training under the supervision of their mentors. They write articles and participate in competitions of young scientists [1,2].

Analyzing the training systems of different countries by level of development, for example, in the Russian Federation to obtain a certificate of a neurosurgeon undergo a two-year clinical residency. According to the authors, 2 years of training time in residency is considered not sufficient for mastering all neurosurgical skills for further work. It is suggested to include different simulation models in the training process [4,5,6,7]

The U.S. training for a neurosurgeon is 7 years of training. Residents learn their practical skills in simulation laboratories where they can learn various surgical techniques for the brain, spinal cord and peripheral nervous system depending on the intervention required, under the supervision of mentors. One year of training is devoted to research work. In the seventh year of training, the resident performs surgical interventions independently.

A 14-item survey on the role of simulation in neurosurgical resident education was conducted in the United States. 99 directors of educational programs of neurosurgery in the USA participated in the survey. The questionnaire asked about the role of the model and

simulation, the clinical skills of residents that could influence the trainee's future work as a physician.

According to the survey results, 72% responded that the use of simulation improves patient outcomes, 74% responded that it complements basic treatment well, and 25% responded that it can replace traditional treatment. 45% of leaders believe that resident work on simulation models will prepare residents for difficult or rare cases in treating patients in the future. Many supervisors indicated that they would be willing to allocate more time and money to purchase a simulation. Among simulation models, preference was given to cadaver, less to virtual simulations and physical models [8, 9].

In their work, the authors also note the usefulness of a simulator with 3D printing of silicone for training residents in vascular pathologies, for example, cerebral aneurysms, where residents could practice clipping techniques. Various anatomically similar models of the ventricular system of the brain have been modeled from cast hydrogel using 3D printing for residents to perform ventriculostomy surgery for various occlusive hydrocephalus [10, 11,13, 14,15,16,17].

Stimulators were also used to practice the practical skills of residents by combining 3D printing and special effects for minimally invasive surgery in neurosurgery. The authors, with the help of modeling engineers and special effects specialists, created a head model of a 14-year-old child with hydrocephalus, taking into account all anatomical features, on which residents and fellows practiced the skill of performing an endoscopic ventriculostomy of the third ventricle. Skill performance was assessed by experienced senior residents using a 14-item Likert questionnaire and the Objective Structured Assessment of Technical Skills (OSATS) scale. OSATS = Objective Structured Assessment of Technical Skills [12,19,20,21].

Conclusions:

The ways to solve the existing problems can be the active introduction of internships in neurosurgical clinics and simulation laboratories of foreign countries in the educational program of residents. Having analyzed the system of training residents in the specialty of neurosurgery in different countries, we can say that the inclusion of simulators, special effects and 3 D modeling in the training program for the acquisition of surgical skills will allow residents to encounter frequently encountered pathologies, increase not only in the knowledge of anatomy, but also to make progress in surgical skills, to gain self-confidence, which will certainly have a positive impact on the quality of the intervention.

References

1. Order of the Minister of Health of the Republic of Kazakhstan from July 4, 2022 № ҚР ДСМ-63. Registered with the Ministry of Justice of the Republic of Kazakhstan on July 5, 2022, No. 28716.On approval of state mandatory standards for levels of education in the field of health care https://adilet.zan.kz/rus/docs/V2200028716.

2. On making amendments and additions to the order of the Minister of Health of the Republic of Kazakhstan “On approval of the list of medical specialties of residency programs” from May 25, 2021 № ҚР ДСМ - 43 and “On approval of model curricula for medical and pharmaceutical specialties” from January 9, 2023 № 4. https://adilet.zan.kz/rus/docs/V2300033629

3. Kuzgibekova A.B., Abeuova B.A., Kenzhebayeva G.A., Yeryomicheva G.G., Babenko M.B., Zhumakanova K.S Modern aspects of training residents on speciality of pediatrics International Journal of Applied and Fundamental Research №3, 2017 https://s.applied-research.ru/pdf/2017/3-2/11442.pdf

4. Yarikov A.V, Kalinkin A.A, Pavlinov S.E, Garipov I.I, Perlmutter O.A, Fraerman A.P, Tsybusov S.N, Mukhin A.S, Ignatieva O.I, Simonov A.E Neurosurgeon training in Russia: modern problems and ways of their solution [in Russian] Bulletin of Science and Practice Volume: 9Number: 4 Year: 2023 Pages: 349-357 https://doi.org/10.33619/2414-2948/89/40

5. Usachev D. Y., Konovalov A. N., Likhterman L. B., Konovalov N. A., Matuev K. B. Neurosurgeon training: current problems and modern approaches // Voprosy neurosurgery. N.N. Burdenko. 2022. T. 86. № 1. C. 5-16 https://doi.org/10.17116/neiro2022860115

6. Krylov V. V., Levchenko O. V., Zakondyrin D. E. Practical training of neurosurgeons in Russia. Part 1. Problems and ways of their solution // Neurosurgery. 2017. №1. C. 72-78. https://cyberleninka.ru/article/n/podgotovka-neyrohirurga-v-rossii-sovremennye-problemy-i-puti-ih-preodoleniya

7. Yakovenko I. V., Kondakov E. N., Zakondyrin D. E., Pirskaya T. N. Simulation training of basic neurosurgical skills in residency // Russian Neurosurgical Journal named after Prof. A.L. Polenov. 2014. T. 6. №4. C. 50-54. https://cyberleninka.ru/article/n/obuchenie-neyrohirurga-v-rossii-sovremennye-problemy-i-puti-ih-resheniya

8. Ganju A., Aoun S. G., Daou M. R., El Ahmadieh T. Y., Chang A., Wang L., Bendok B. R. The role of simulation in neurosurgical education: a survey of 99 United States neurosurgery program directors // World neurosurgery. 2013. V. 80. №5. P. e1-e8. https://doi.org/10.1016/j.wneu.2012.11.066

9. Fallah A., Ebrahim S., Haji F., Gillis C., Girgis F., Howe K., Wallace M. C. Surgical activity of first-year Canadian neurosurgical residents //Canadian journal of neurological sciences. 2010. V. 37. №6. P. 855-860. https://doi.org/10.1017/S0317167100051568

10. Justin R. Ryan [1 2], Kaith K. Almefty [3], Peter Nakaji [3], David H. Frakes [1 2 4]Cerebral Aneurysm Clipping Surgery Simulation Using Patient-Specific 3D Printing and Silicone Casting https://pubmed.ncbi.nlm.nih.gov/26805698/

11. Ryan JR, Chen T, Nakaji P, Frakes DH, Gonzalez LF Ventriculostomy Simulation Using Patient-Specific Ventricular Anatomy, 3D Printing, and Hydrogel Casting..World Neurosurg. 2015 Nov;84(5):1333-9. doi: 10.1016/j.wneu.2015.06.016. Epub 2015 Jun 20.PMID: 26100167 https://pubmed.ncbi.nlm.nih.gov/26100167/

12. Weinstock P, Rehder R, Prabhu SP, Forbes PW, Roussin CJ, Cohen AR.J Creation of a novel simulator for minimally invasive neurosurgery: fusion of 3D printing and special effects. Neurosurg Pediatr. 2017 Jul;20(1):1-9. doi: 10.3171/2017.1.PEDS16568. Epub 2017 Apr 25. PMID: 28438070

13. Mashiko T, Otani K, Kawano R, Konno T, Kaneko N, Ito Y, Watanabe E. Development of three-dimensional hollow elastic model for cerebral aneurysm clipping simulation enabling rapid and low cost prototyping. World Neurosurg. 2015 Mar;83(3):351-61. doi: 10.1016/j.wneu.2013.10.032. Epub 2013 Oct 16.PMID: 24141000

14. Wang L, Ye X, Hao Q, Ma L, Chen X, Wang H, Zhao Y.J Three-dimensional intracranial middle cerebral artery aneurysm models for aneurysm surgery and training. Clin Neurosci. 2018 Apr;50:77-82. doi: 10.1016/j.jocn.2018.01.074. Epub 2018 Feb 10.PMID: 29439905

15. Leal AG, Mori YT, Nohama P, de Souza MA.Three-Dimensional Hollow Elastic Models for Intracranial Aneurysm Clipping Election - A Case Study. Annu Int Conf IEEE Eng Med Biol Soc. 2019 Jul;2019:4137-4140. doi: 10.1109/EMBC.2019.8856514.PMID: 31946781

16. Graffeo CS, Bhandarkar AR, Carlstrom LP, Perry A, Nguyen B, Daniels DJ, Link MJ, Morris JM That which is unseen: 3D printing for pediatric cerebrovascular education. Childs Nerv Syst. 2023 Sep;39(9):2449-2457. doi: 10.1007/s00381-023-05987-0. Epub 2023 Jun 5. PMID: 37272936

17. Chawla S, Devi S, Calvachi P, Gormley WB, Rueda-Esteban R Evaluation of simulation models in neurosurgical training according to face, content, and construct validity: a systematic review. .Acta Neurochir (Wien). 2022 Apr;164(4):947-966. doi: 10.1007/s00701-021-05003-x. Epub 2022 Feb 4. PMID: 35122126 Free PMC article. Review.

18. Bouattour Y, Sautou V, Hmede R, El Ouadhi Y, Gouot D, Chennell P, Lapusta Y, Chapelle F, Lemaire JJ A Minireview *on* Brain Models Simulating Geometrical, Physical, and Biochemical Properties of the Human Brain. Front Bioeng Biotechnol. 2022 Mar 28;10:818201. doi: 10.3389/fbioe.2022.818201. eCollection 2022.PMID: 35419353 Free PMC article. Review.

19. Breimer GE, Bodani V, Looi T, Drake JM. Design and evaluation of a new synthetic brain simulator for endoscopic third ventriculostomy. J Neurosurg Pediatr. 2015 Jan;15(1):82-8. doi: 10.3171/2014.9.PEDS1447.PMID: 25360853

20. Ploch CC, Mansi CSSA, Jayamohan J, Kuhl E Using 3D Printing to Create Personalized Brain Models for Neurosurgical Training and Preoperative Planning. World Neurosurg. 2016 Jun;90:668-674. doi: 10.1016/j.wneu.2016.02.081. Epub 2016 Feb 24.PMID: 26924117

20. A microcontroller-based simulation of dural venous sinus injury for neurosurgical training. Cleary DR, Siler DA, Whitney N, Selden NR.J Neurosurg. 2018 May;128(5):1553-1559. doi: 10.3171/2016.12.JNS162165. Epub 2017 Jun 2.PMID: 28574314

PEDAGOGICAL SCIENCES

MENTORING E TUTORING NELLA FORMAZIONE DOCENTE: STRATEGIE DI SVILUPPO PROFESSIONALE E INNOVAZIONE PEDAGOGICA

Sacristano A.
Pedagogista
Docente a contratto di Pedagogia Speciale
Dipartimento Corso di Sostegno
Università degli Studi di Salerno
Genovese C.
Docente MIM
Esperto di Pedagogia Speciale
Di Nicola S.
Docente MIM
Esperta di Pedagogia Speciale

MENTORING AND TUTORING IN TEACHER TRAINING: STRATEGIES FOR PROFESSIONAL DEVELOPMENT AND PEDAGOGICAL INNOVATION

Sacristano A.
Pedagogist
Adjunct Professor of Special Pedagogy
Support Course Department
University of Salerno
Genovese C.
MIM Teacher
Expert in Special Pedagogy
Di Nicola S.
Teacher at the Ministry of Education
Expert in Special Pedagogy
DOI: 10.5281/zenodo.15294138

Sintesi

Il mentoring e il tutoring rappresentano strumenti fondamentali per la crescita professionale ed educativa, ma si differenziano per approccio, obiettivi e impatto.

Il mentoring si configura come una relazione trasformativa e a lungo termine, volta a sviluppare competenze, autonomia e consapevolezza, mentre il tutoring è un supporto più immediato e focalizzato su difficoltà specifiche. Nell'era digitale, queste pratiche stanno evolvendo grazie all'integrazione di tecnologie avanzate, che rendono l'apprendimento più accessibile, personalizzato e interattivo.

Innovazioni come il mentoring digitale, le comunità di apprendimento professionale e l'apprendistato cognitivo stanno ridefinendo il modo in cui si trasmettono conoscenze e si costruiscono relazioni formative. L'intelligenza artificiale e la realtà aumentata offrono nuove possibilità di personalizzazione, rendendo il supporto più efficace e adattivo. Allo stesso tempo, l'inclusività e la valorizzazione delle diversità diventano elementi chiave per creare percorsi di apprendimento equi e sostenibili.

Il futuro della formazione si basa su un modello integrato, in cui mentoring e tutoring si combinano con approcci collaborativi e interdisciplinari. Questa evoluzione non solo migliora l'efficacia dell'insegnamento, ma favorisce la costruzione di una cultura dell'apprendimento continuo, capace di adattarsi alle sfide del mondo contemporaneo.

Abstract

Mentoring and tutoring represent fundamental tools for professional and educational growth, but they differ in approach, objectives, and impact.

Mentoring is a transformative, long-term relationship aimed at developing skills, autonomy, and awareness, while tutoring is a more immediate support focused on specific difficulties. In the digital era, these practices are evolving thanks to the integration of advanced technologies, making learning more accessible, personalized, and interactive.

Innovations such as digital mentoring, professional learning communities, and cognitive apprenticeship are redefining the way knowledge is transmitted and formative relationships are built. Artificial intelligence and augmented reality offer new possibilities for personalization, making support more effective and adaptive. At the same time, inclusivity and the appreciation of diversity become key elements in creating equitable and sustainable learning pathways.

The future of education is based on an integrated model, where mentoring and tutoring combine with collaborative and interdisciplinary approaches. This evolution not only enhances teaching effectiveness but also fosters

the development of a culture of continuous learning, capable of adapting to the challenges of the contemporary world.

Parole chiave: mentoring, tutoring, apprendimento digitale, inclusività, innovazione educativa.

Keywords: mentoring, tutoring, digital learning, inclusivity, educational innovation.

1. Beyond the classroom: mentoring, tutoring, and reflective practices for a resilient teaching professionalism.

Mentoring and tutoring represent two fundamental strategies for the professional development of teachers, based on the transmission of knowledge, accompaniment, and shared reflection. The construction of professional teacher identity is a complex process that requires time, dialogue, and awareness. As Hobson et al. state, "structured induction and mentoring programs play a fundamental role in supporting teachers at the beginning of their careers" (Hobson et al., 2009, p. 207).

Similarly, Ingersoll and Strong highlight that "effective mentoring improves both teacher job satisfaction and student achievement" (Ingersoll & Strong, 2011, p. 46), emphasizing the positive impact of these practices not only on individual teachers but on the entire school community.

In recent years, innovative approaches such as skills assessment (bilancio di competenze) and narrative guidance (orientamento narrativo) have enriched the training landscape, fostering paths of self-reflection and awareness. The skills assessment, developed in the French and Canadian contexts, enables individuals to recognize, value, and mobilize their personal and professional resources. As Boutinet states, "[…] it promotes greater awareness of one's resources and limitations, supporting professional autonomy and the ability to plan for the future" (Boutinet, 2004, p. 39).

Narrative guidance, introduced in the Italian context by Batini and Zaccaria, also plays a significant role in the teacher training process. According to Batini, "narrating oneself means consciously building one's identity and outlining one's professional project" (Batini, 2011, p. 22). Through narration, the teacher reworks experience, gives meaning to lived events, and constructs developmental paths consistent with personal values and goals.

Peer dialogue and mutual observation are also valuable tools. Lave and Wenger observe that "learning is a social process that occurs through shared participation in meaningful practices" (Lave & Wenger, 1991, p. 29). Such practices allow teachers to emerge from professional isolation, building a collaborative culture based on dialogue, trust, and continuous improvement.

In this perspective, the construction of professional identity is not a single event but a continuous process. Day and Gu emphasize that "[…] the development of professional identity is influenced by context, relationships, and emotions" (Day & Gu, 2010, p. 27), highlighting the relational and emotional dimension of the teaching profession.

Mentoring takes the form of an educational relationship between an experienced teacher and one at the beginning of their career, based on listening, support, and mutual exchange. Hudson affirms that "effective mentoring is based on a relationship of trust and mutual exchange, in which the mentor's experience guides but does not impose" (Hudson, 2016, p. 39), stressing the value of a horizontal relationship in the learning process.

Tutoring, on the other hand, is characterized by a more operational accompaniment, focused on direct support for everyday teaching practices. Cornelius-White points out that "a student-centered educational relationship supported by an effective tutor has a significant impact on improving teaching" (Cornelius-White, 2007, p. 113).

These practices are part of a broader formative vision, in which the teacher is seen as a reflective professional in continuous evolution. As Darling-Hammond affirms, "successful education systems invest in continuous teacher training, promoting professional learning communities and collaboration" (Darling-Hammond, 2017, p. 98).

Finally, digital technologies have expanded the possibilities of tutoring, making resources more accessible and facilitating peer dialogue even at a distance. According to Redecker, "teachers' digital competence is essential to ensure effective and inclusive education in the 21st century" (Redecker, 2017, p. 21). In this sense, tutoring can also take the form of digital support, fostering teachers' technological literacy.

In summary, mentoring and tutoring, integrated with reflective and narrative practices, are essential tools for developing teachers' professional identity, within a framework of lifelong learning and the construction of educational communities. As Morin states, "[…] contemporary opinion places the artist above the knower, the producer above the consumer" (Morin, 2001, p. 56), and likewise today the teacher cannot merely reproduce knowledge but is called to generate understanding, innovation, and meaning.

2. Skills, connections, and digital culture: reflections on mentoring and tutoring in teacher education.

Mentoring and tutoring are two strategies based on supportive interpersonal relationships aimed at facilitating learning and professional growth. Both approaches are grounded in pedagogical and psychological theories that highlight the value of interaction between more experienced and less experienced individuals within an educational context (Vygotsky, 1978; Bandura, 1997). However, while mentoring focuses on building conscious professionalism and long-term growth, tutoring is a more structured method aimed at resolving specific teaching issues (Harrison, Dymoke & Pell, 2020).

Mentoring develops according to theoretical models that emphasize the relational dimension and continuous support. Among these, Kram's (1985) "Career Development Model" distinguishes four fundamental phases: initiation, cultivation, separation, and redefinition, outlining a path where the mentee gradually acquires greater autonomy and confidence in their abilities. Recent studies have shown that mentoring not only involves the transfer of knowledge but also promotes

essential transversal skills such as interpersonal relationship management, leadership, and critical reflection (Hudson, 2016; Kutsyuruba & Walker, 2021).

From a learning perspective, mentoring can be analyzed through Vygotsky's (1978) theory of the "zone of proximal development" (ZPD), which posits that the support of an experienced mentor enables the mentee to develop skills that they would not be able to acquire independently. This concept has been further developed in contemporary educational contexts, highlighting the mentor's role as a facilitator of professional growth in increasingly complex and digitalized environments (Lindgren, 2022).

The mentor's role as a facilitator of teachers' professional growth has been explored in various educational contexts, especially concerning the increasing complexity and digitalization of learning environments. Induction programs for newly hired teachers through mentoring have proven effective in promoting professional development and improving teaching quality.

Media education has become an essential component in the initial and ongoing training of teachers. It aims to develop critical skills in using digital media, enabling teachers to effectively integrate information and communication technologies into teaching processes. This approach enriches pedagogical methodologies and contributes to building a professional identity that is updated and aware of current technological dynamics.

In Italy, the "National Digital School Plan" (PNSD) is a concrete example of how educational policies are supporting the transition to digitalized learning environments. The PNSD promotes the continuous training of school staff on digital skills, encouraging the adoption of innovative practices and the integration of technologies into daily teaching. The plan emphasizes the importance of educational leadership capable of guiding change and supporting teachers in adapting to new technological challenges.

Another significant example is "eTwinning," an initiative of the European Commission that promotes collaboration between schools through the use of digital technologies. Through eTwinning, teachers develop digital skills, exchange best practices, and participate in a European professional community, thus enriching their training and that of their students.

Tutoring, on the other hand, is based on the principles of constructivism and situated learning (Piaget, 1950; Bruner, 1966; Lave & Wenger, 1991). This approach recognizes that learning occurs through active interaction between teacher and student, where the tutor acts as a guide for constructing meaningful knowledge based on experience. Roscoe and Chi (2007) highlight how tutoring fosters deeper learning through interaction and constructive feedback.

Recent research has shown that tutoring is particularly effective in improving teachers' self-efficacy and their ability to face daily challenges, such as classroom management, personalized teaching, and inclusion (VanLehn, 2011; European Commission, 2021). In this perspective, the tutor acts as a "didactic mediator" and supports the teacher in experimentation and pedagogical reflection.

Integrating mentoring and tutoring into the initial and ongoing training paths of teachers is now considered an essential strategy to address new educational challenges, including the digital transition and the increasing complexity of school environments (Darling-Hammond, 2017).

The synergy between mentoring and tutoring contributes to building an integrated training ecosystem, where teachers can develop solid professional skills, improve teaching quality, and promote meaningful learning for students (Harrison et al., 2020). This ecosystem is configured as a dynamic and interconnected environment, where various elements work together to support teachers' professional growth and promote educational innovation.

A fundamental element of this ecosystem is continuous and personalized training. The adoption of structured mentoring and tutoring programs allows teachers to access flexible training paths that meet the specific needs of the school context. Lifelong learning and in-service training thus become tools for professional empowerment.

Another central aspect is the "communities of practice" and collaboration among teachers. Creating professional networks enables teachers to share experiences, reflect on their practices, and build effective educational strategies. These communities, developed both in-person and through digital environments, foster mutual learning and the dissemination of best practices (Indire, 2024).

Digitalization represents another pillar of the training ecosystem. Integrating digital technologies into mentoring and tutoring expands training and collaboration opportunities, making online resources, webinars, sharing environments, and professional platforms accessible. Initiatives like the "School Plan 4.0," within the "PNRR," highlight the importance of technological innovation for an inclusive, open, and connected school.

Within this ecosystem, evaluation and feedback processes are also fundamental. The possibility of receiving continuous and structured feedback on one's practices promotes critical reflection and self-improvement. Tools such as self-analysis, peer review, and participatory observation contribute to strengthening teachers' professionalism and developing a culture of quality in schools (Pensamultimedia, 2023).

Finally, institutional support is an essential element to ensure coherence, continuity, and quality in training paths. Educational policies, support from research institutions, and collaboration with universities represent the structural framework within which mentoring and tutoring can fully express their transformative potential.

The training ecosystem based on the integration of mentoring and tutoring thus proposes itself as an effective strategy to build a resilient, innovative, and aware teaching community. Through personalized training, communities of practice, digitalization, continuous evaluation, and institutional support, it is possible to proactively respond to the educational challenges of the 21st century, improving teaching quality and fostering authentic and meaningful learning.

3. From operational support to professional transformation: a comparative analysis of mentoring and tutoring.

Although mentoring and tutoring share the general aim of supporting teachers' professional growth, they differ in approach, duration, and objectives. Mentoring takes the form of a long-term relationship aimed at the overall development of the mentee, whereas tutoring has a more immediate and targeted nature, focusing on practical aspects of teaching. It is a relational and transformative process that goes beyond the simple transmission of knowledge, encompassing motivational, reflective, and identity-related dimensions.

In addition to the sharing of experiences, values, and pedagogical strategies (Kram, 1985; Hudson, 2016), mentoring develops through practices of knowledge co-construction and professional empowerment, fostering a bidirectional learning process between mentor and mentee (Haggard et al., 2011). Innovative approaches such as reverse mentoring (Murphy, 2012) and peer mentoring (Terrion & Leonard, 2007) are redefining the traditional relationship between mentor and mentee, valuing the contribution of both parties in a collaborative and intergenerational learning perspective.

In the educational field, effective mentoring is based on three fundamental pillars: emotional support, professional guidance, and the promotion of critical reflection (Schwille, 2008). Furthermore, through the use of digital technologies, new forms of distance and online mentoring are emerging, which expand access to professional and practice-based communities (Liu, 2020). […]

Integration with evidence-based approaches, such as cognitive apprenticeship (Collins, Brown & Holum, 1991), strengthens the connection between theory and practice, developing skills that go beyond disciplinary knowledge and are rooted in adaptability, leadership, and educational innovation.

In contrast, tutoring is structured according to a more technical and methodological approach, aimed at solving specific difficulties and improving the teacher's operational skills (VanLehn, 2011; Harrison, Dymoke & Pell, 2020). Another substantial difference concerns the learner's level of autonomy: in mentoring, the mentee goes through a gradual growth process with a progressive reduction of dependency on the mentor (Vygotsky, 1978); in tutoring, support is often more intensive but of shorter duration, with the goal of providing tools that are immediately applicable in teaching practice (Roscoe & Chi, 2007).

However, both models are based on the construction of a relationship of trust and the enhancement of the learner's skills, contributing to the effectiveness of teaching and the professional well-being of educators (Mullen, 2012; Lindgren, 2022). […]

Despite their differences, they should not be seen as alternative approaches, but rather as complementary. Integrating both into teacher training and professional development programs allows educators to respond both to long-term growth needs and to immediate support demands.

In today's educational context—marked by rapid technological and methodological transformations—continuous teacher training is essential to ensure effective and inclusive teaching. Professional development can no longer be conceived as a one-off event, but must be configured as a cyclical and dynamic process, in which mentoring and tutoring are integrated with innovative professional development strategies.

An increasingly widespread approach is that of the Professional Learning Community (PLC), where teachers participate in collaborative learning groups to share experiences, analyze teaching practices, and develop new pedagogical strategies (DuFour, 2016). Similarly, the Lesson Study model, originating in Japan, promotes observation and continuous improvement through co-designing lessons, classroom experimentation, and collective reflection (Lewis & Perry, 2017). […]

Another key element of innovation in teacher training is the use of digital technologies for e-learning and distance education. Online learning platforms, interactive webinars, and augmented reality environments enable teachers to access flexible and personalized training resources, promoting ongoing professional development in line with the needs of 21st-century schools (Redecker & Punie, 2017). Moreover, the blended learning approach, which combines in-person and online training, allows for the integration of theoretical learning with hands-on field experiences, ensuring an effective transfer of knowledge into daily practice (Means et al., 2014).

In an increasingly diverse and challenging educational context, the ability to adapt to change and innovate teaching practices becomes an essential competence for educators. Only through an integrated and sustainable approach to teacher training will it be possible to build a truly innovative educational system, capable of meeting future challenges and ensuring the academic success of all students.

4. Mentoring 4.0: personalization, collaboration, and inclusive societies

Mentoring and tutoring are undergoing a profound transformation, evolving into dynamic, interconnected, and adaptive learning systems. The integration of digital technologies is revolutionizing these practices, making the educational experience more immersive and effective through the use of augmented reality (AR) and virtual reality (VR). These environments, supported by artificial intelligence and machine learning tools, enable real-time personalization of learning pathways, offering adaptive support and predictive models aimed at improving academic performance and student engagement (Luckin, 2018).

At the same time, the application of neuroscience to education is redefining the approach to personalized learning. Evidence-based strategies such as *micro-learning* and *adaptive learning* are proving effective in tailoring instruction to the cognitive and emotional characteristics of each individual (Tokuhama-Espinosa, 2019). This type of approach allows for more comprehensive mentoring, capable of supporting the development of both academic and socio-emotional skills, which are essential for personal and professional success.

The role of mentoring is expanding beyond the school and university contexts, increasingly emerging as a strategic tool for professional growth and career

guidance. New models are being incorporated into pathways that accompany learners toward emerging professions, in line with the recommendations of Cedefop (2021), through intersectoral initiatives involving businesses, institutions, and professional communities. These pathways aim to develop the *transversal skills* increasingly required in complex and evolving work environments.

An increasingly widespread approach is the *Professional Learning Community* (PLC), in which teachers and tutors participate in collaborative learning groups to share experiences, analyze teaching practices, and develop new pedagogical strategies (DuFour, 2016). Similarly, training based on the *Lesson Study* model, originally from Japan, promotes continuous improvement through lesson co-design, classroom experimentation, and collective reflection (Lewis & Perry, 2017). These models highlight the value of collaboration among education professionals, enhancing the effectiveness of mentoring programs through a participatory and reflective approach.

Inclusivity will represent a central pillar in the future development of mentoring and tutoring. The use of advanced digital technologies will enable better responses to the needs of students with disabilities, from disadvantaged socio-economic backgrounds, or belonging to cultural minorities, thus promoting a more equitable and accessible education (UNESCO, 2022). In this context, *intercultural mentoring* plays a key role: by valuing cultural diversity as a resource, it promotes collaborative and inclusive learning, capable of stimulating dialogue and cooperation among individuals from different backgrounds.

In education, intercultural mentoring helps to counter inequalities by offering specific support to students with a migrant background or from ethnic minorities, fostering integration and the construction of positive and inclusive identities (UNESCO, 2022). In the workplace, it facilitates the professional integration of individuals from different cultures, helping them to understand communicative codes, organizational practices, and the professional expectations specific to each context.

The use of digital technologies further expands the opportunities of intercultural mentoring, enabling global connections between mentors and mentees through online platforms, thematic forums, and virtual exchange programs. These tools promote *lifelong learning* and mutually enriching experiences, contributing to the development of *intercultural competences* that are increasingly essential in a globalized world.

Looking ahead, intercultural mentoring will be increasingly integrated into educational and professional pathways, becoming a key lever for building inclusive, cohesive, and interconnected societies. The growing collaboration between educators, tutors, and professionals from various sectors will lead to the creation of *shared learning networks*, similar to *communities of practice* (Wenger, 1998), transforming mentoring into a collective process based on the integration of interdisciplinary skills.

This interprofessional approach represents an innovative and flexible response to the educational challenges of the present and future, reinforcing the value of mentoring as a tool for both individual and collective growth.

5. Conclusions. Towards a new paradigm of mentoring

In a world characterized by rapid change, mentoring will no longer be seen as occasional support but will take the form of a widespread, accessible, and multidimensional *learning network*. The centrality of *intercultural mentoring*, the focus on *inclusivity*, and *interdisciplinary collaboration* will become key elements in shaping resilient individuals equipped with critical, social, and digital skills—essential for navigating the complexities of contemporary society.

The education of the future will not be based solely on the transmission of knowledge but on the ability to build *meaningful relationships* and *support networks* capable of accompanying learning throughout the entire lifespan. Mentoring and tutoring will no longer be isolated tools but integral parts of a global, flexible, and inclusive *educational ecosystem*, capable of adapting to both individual and collective needs.

Moreover, mentoring will play an increasingly strategic role in enhancing *transversal skills*, acting as a bridge between formal and informal education. Through the creation of hybrid learning pathways that integrate academic experiences with practical activities such as internships, workshops, applied research projects, and volunteering, it will be possible to enrich and contextualize learning. Digital platforms will play a crucial role in facilitating connections among students, professionals, and communities, promoting knowledge exchange in non-traditional contexts. At the same time, informal mentoring—based on *networking* and experience sharing—will help bridge the gap between theory and practice, making learning more dynamic and responsive to the real needs of the working world.

The adoption of advanced technologies such as *artificial intelligence* and *augmented reality* will further personalize learning pathways and enhance the effectiveness of mentoring. Tools like *gamification*, *immersive simulations*, and *interactive platforms* will be essential for stimulating engagement and creativity, contributing to the creation of a more engaging and meaningful learning process.

At the same time, new types of mentors will emerge—not simply experts with a directive role, but true *learning facilitators*, capable of guiding individuals in interpreting change and transforming challenges into opportunities. *Collective mentoring*, where peer groups share experiences in a spirit of mutual exchange, will foster the democratization of access to skills and the development of connected and supportive *learning communities* (Wenger, 1998). […]

The mentoring of the future, therefore, will not be limited to supporting professional development but will become a pillar for *personal and social well-being*. Through the building of authentic, trust-based relationships, mentoring pathways will promote emotional growth and self-awareness, encouraging the development of individuals who are not only competent but also empathetic and responsible.

In this ever-evolving scenario, mentoring will establish itself as an indispensable resource for addressing the challenges of the future. It will no longer be merely a process of knowledge transmission but a *journey of discovery, sharing, and transformation*, capable of strengthening self-awareness and one's potential through dialogue and mutual support. In this perspective, mentoring becomes a means to cultivate *emotional intelligence* and *adaptability*—fundamental elements for successfully navigating an ever-changing reality.

The sharing of experiences between mentors and mentees will foster not only the acquisition of new skills but also the creation of an educational culture based on *cooperation* and *mutual growth*. Mentoring will thus be transformed into a *catalyst for social innovation*, capable of promoting a mindset open to change and a strong sense of belonging to a *global community*. This journey will contribute not only to strengthening personal and professional skills but also to building a more cohesive, equitable, and innovative society, able to face global challenges of the present and future with collaborative and resilient spirit.

References

1. Cedefop. *Empowering adults through upskilling and reskilling pathways*. Luxembourg: Publications Office of the European Union, 2021.

2. Collins A., Brown J.S., Holum A. Cognitive apprenticeship: Making thinking visible // *American Educator*, Vol. 15, №3, 1991. — P. 6–11.

3. DuFour R. *Learning by doing: A handbook for Professional Learning Communities at work*. Bloomington, IN: Solution Tree Press, 2016.

4. Gruvov E. Come sviluppare, formalizzare e implementare il sistema KPI in azienda // Giornale "Finance manager", №12, 2007.

5. Haggard D.L., Dougherty T.W., Turban D.B., Wilbanks J.E. Who is a mentor? A review of evolving definitions and implications for research // *Journal of Management*, Vol. 37, №1, 2011. — P. 280–304.

6. Harrison J., Dymoke S., Pell T. Mentoring beginning teachers in secondary schools: An analysis of practice // *Teaching and Teacher Education*, Vol. 28, №5, 2020. — P. 833–843.

7. Hudson P., Hudson S. Mentoring beginning teachers and goal setting // *Australian Journal of Teacher Education*, Vol. 41, №10, 2016. — P. 48–62.

8. Kram K.E. *Mentoring at work: Developmental relationships in organizational life*. Glenview, IL: Scott, Foresman, 1985.

9. Lewis C., Perry R. Lesson study to scale up research-based knowledge: A randomized, controlled trial of fractions learning // *Journal of Research in Educational Effectiveness*, Vol. 10, №1, 2017. — P. 121–137.

10. Lindgren U. Mentoring for professional development and learning: Possibilities and challenges // *Scandinavian Journal of Educational Research*, Vol. 66, №1, 2022. — P. 1–15.

11. Liu Y. E-mentoring for early childhood teachers: A case study of an online mentoring program in China // *Early Years*, Vol. 40, №3, 2020. — P. 311–326.

12. Luckin R. *Machine learning and human intelligence: The future of education for the 21st century*. London: UCL Institute of Education Press, 2018.

13. Means B., Toyama Y., Murphy R., Bakia M., Jones K. The effectiveness of online and blended learning: A meta-analysis of the empirical literature // *Teachers College Record*, Vol. 115, №3, 2014. — P. 1–47.

14. Mullen C.A. Mentoring: An overview // In: Fletcher S.J., Mullen C.A. (Eds.) *The SAGE Handbook of Mentoring and Coaching in Education*. Thousand Oaks, CA: SAGE Publications, 2012. — P. 7–23.

15. Murphy W.M. Reverse mentoring at work: Fostering cross-generational learning and developing millennial leaders // *Human Resource Management*, Vol. 51, №4, 2012. — P. 549–573.

16. Orlov A. KPI e motivazione del personale. La collezione completa di strumenti pratici. — Exmo, 2009. — 160 p.

17. Redecker C., Punie Y. *European framework for the digital competence of educators: DigCompEdu*. Luxembourg: Publications Office of the European Union, 2017.

18. Roscoe R.D., Chi M.T.H. Understanding tutor learning: Knowledge-building and knowledge-telling in peer tutors' explanations and questions // *Review of Educational Research*, Vol. 77, №4, 2007. — P. 534–574.

19. Schwille S.A. The professional practice of mentoring // *American Journal of Education*, Vol. 115, №1, 2008. — P. 139–167.

20. Terrion J.L., Leonard D. A taxonomy of the characteristics of student peer mentors in higher education: Findings from a literature review // *Mentoring & Tutoring: Partnership in Learning*, Vol. 15, №2, 2007. — P. 149–164.

21. Tokuhama-Espinosa T. *Neuromyths: Debunking false ideas about the brain*. New York, NY: W.W. Norton & Company, 2019.

22. UNESCO. *Reimagining our futures together: A new social contract for education*. Paris: UNESCO, 2022.

23. VanLehn K. The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems // *Educational Psychologist*, Vol. 46, №4, 2011. — P. 197–221.

24. Vygotskij L.S. *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press, 1978.

25. Wenger E. *Communities of practice: Learning, meaning, and identity*. Cambridge: Cambridge University Press, 1998.

СУЧАСНІ ПРОБЛЕМИ ДО ПРОФЕСІЙНОЇ ПІДГОТОВКИ МАЙБУТНІХ ФАХІВЦІВ МОРСЬКОГО ТРАНСПОРТУ: МЕТОДОЛОГІЧНИЙ ПІДХІД

Герганов Л.Д.
Дунайський інститут
Національного університету
«Одеська морська академія», професор

CURRENT PROBLEMS IN VOCATIONAL TRAINING OF FUTURE MARITIME TRANSPORT SPECIALISTS: A METHODOLOGICAL APPROACH

Herhanov L.
Danube Institute of the National
«Odessa Maritime Academy»,
Professor
DOI: 10.5281/zenodo.15294146

Анотація

У статті розкрито сутність роботи фахівця морського профілю в умовах сучасного автоматизованого судна, що потребує від нього системності в отриманих знаннях та навичках, а також сформованості інтелектуальної компетентності, яка є невід'ємною складовою у морській інженерній практиці. Визначено, що така компетентність включає значний обсяг професійних знань, гнучкість мислення, швидкість у прийнятті рішень, актуалізацію отриманої інформації. Забезпечити такий рівень формування провідних характеристик професійної компетентності майбутніх фахівців можливо лише за умови впровадження в освітній процес наступних інноваційних методологічних підходів: міжпредметний зв'язок, багатовекторність, багатофункціональність, багатокомпонентність, багатовимірність, суб'єктність.

Abstract

The article reveals the essence of the work of a maritime specialist in the conditions of a modern automated vessel, which requires him to be systematic in the knowledge and skills he has acquired, as well as to have developed intellectual competence, which is an integral part of marine engineering practice. It is determined that such competence includes a significant amount of professional knowledge, flexibility of thinking, speed in decision-making, and updating of the information received. It is possible to ensure such a level of formation of the leading characteristics of professional competence of future specialists only if the following innovative methodological approaches are introduced into the educational process: interdisciplinary connection, multi-vector, multifunctionality, multi-component, multi-dimensionality, subjectivity. According to the results of the study on the need to reform maritime education, it is possible to assert that the professional image of a Ukrainian maritime specialists in the maritime labor market will significantly decrease if the formation of basic theoretical, graphic, technical and other knowledge is not laid as the basis for cognitive skills, which are subsequently isolated and transformed into an active, active position of the specialist. The sequence of formation of the competence of a future maritime specialist, which provides the active basis of professional training and determines the complex of knowledge, understanding, skills, and abilities, is the main factor in the planned level of qualification.

Ключові слова: морська освіта, фахівець морського профілю, компетентність, Конвенція ПДНВ, методологічний підхід.

Keywords: maritime education, maritime specialist, competence, STCW Convention, methodological approach.

Визначення проблеми. Відповідно до прийнятої «Стратегії розвитку вищої освіти в Україні на 2022-2032 роки» (Схвалена Кабінетом Міністрів України 23.02.2022 року), «основними слабкими сторонами закладів вищої освіти, що впливають на якість вищої освіти на рівні закладу та її сприйняття, є недостатнє урахування інтересів та думок зацікавлених сторін під час визначення змісту та напрямів підготовки, слабкий зворотній зв'язок з результатами опитування учасників освітнього процесу та внутрішнього оцінювання навчальних планів та освітніх програм, неефективні інструменти оцінювання та стимулювання якісної викладацької діяльності, недостатнє використання зовнішніх об'єктивних та прозорих інструментів та залучення зовнішніх зацікавлених сторін для оцінювання якості результатів навчання, та ін.» [6].

Таким чином, щоб майбутній фахівець морського профілю був спроможний діяти чітко, приймати адекватні рішення, швидко адаптуватися до мінливих умов праці на морі, вміти працювати з інформацією, яку надають йому автоматизовані системи управління на містку та у машинному відділенні, необхідно вийти на рівень сучасних вимог судновласників і постійно поповнювати знання та практичні навички як предметного, так і професійного характеру. Успішна праця фахівця в умовах сучасного судна потребує від нього системності в отриманих знаннях та навичках, а також сформованості інтелектуальної компетентності, яка є невід'ємною складовою у морській інженерній практиці, під якою розуміють значний обсяг професійних знань, гнучкість мислення, швидкість у прийнятті рішень, актуалізацію отриманої інформації.

Аналіз останніх досліджень і публікацій. Аналіз сучасних наукових досліджень вітчизняних та зарубіжних учених показав, що проблема професійної підготовки фахівця морського профілю, різноманітні аспекти підвищення якості майбутніх фахівців, а також застосування інноваційних методологічних підходів у педагогічному процесі відображено у дослідженнях наступних науковців: Безлуцька О., М. Братко, В. Биков, С. Волошинов, С. Гончаренко, А. Гуржій, Р. Гуревич, Л. Герганов, О. Гриб'юк, О. Дендеренко, В. Дулін, В. Кузьменко, М. Макаренко, І. Рябуха та ін.

За думкою В. Дуліна, є необхідність того, щоб майбутній фахівець морського профілю мав достатні теоретичні знання та значні практичні навички; мав психологічну стійкість і вольові якості; адекватно реагував на виникнення небезпечних ситуацій, які викликані, наприклад, екологічними, соціальними, природними та іншими несприятливими умовами [1, с. 3]. Для цього дослідник пропонує впровадити організаційно-педагогічні умови розвитку професійного практичного досвіду суднових механіків в умовах навчально-тренажерного центру, який буде найбільш повно забезпечувати збереження людського життя на морі при діях в екстремальних ситуаціях професійного середовища. Теоретична і практична підготовка майбутніх фахівців до дій у аварійних або екстремальних ситуаціях доопрацьовані В. Дуліним в спеціальну модель, яка включає: лабораторно-практичне обладнання, як засіб віртуальної імітації реальних аварійних ситуацій і умову розвитку готовності фахівця до дій у цих ситуаціях; опис практичних дій з використанням тренажерного комплексу для прискореного набуття курсантами досвіду поведінки в аварійних ситуаціях; методи демонстрації на тренажерах за вимогами міжнародної Конвенції з підготовки та дипломування моряків і несення вахти 1978 р. (з поправками) (Конвенція ПДНВ); показники та критерії для оцінки рівня професійної готовності морських фахівців з урахуванням їх психофізичної готовності до дій в екстремальних ситуаціях.

Особливості використання інноваційних підходів у підготовці майбутніх моряків висвітлювали В. Кузьменко, І. Рябуха [2, с. 304-308], динаміку психофізіологічних функцій у курсантів та судноводіїв при вирішенні завдань судноводіння на радіолокаційному тренажері досліджували А. Мальцев та В. Голікова [3, С. 20-26].

Відокремлення невирішених аспектів проблеми. За останні роки на світовому ринку морської праці постійно спостерігається дефіцит компетентного командного складу, який спроможний обслуговувати автоматизовані судна, підтримувати їх у належному стані та надавати повну інформацію про якість роботи усіх систем судна будь-якої контролюючої організації або інспекції державного портового нагляду Port State Control (PSC). За висновками BIMCO (Балтійська морська рада) та Міжнародної палати судноплавства (ICS), які опублікували Звіт про трудові ресурси моряків за 2021 рік (Seafarer Workforce Report), констатовано брак офіцерів із технічним досвідом роботи на конкретних суднах, таких як танкери для перевезення хімікатів або нафти, а також на керівних рівнях. Згідно з прогнозом, ситуація, швидше за все, погіршиться в найближчі роки, оскільки він складає потребу в 89510 офіцерів до 2026 року. У звіті наголошується, що з впровадженням технологічних інновацій на борту, для управління та обслуговування суден сучасного покоління, фахівцям необхідно засвоїти комплекс додаткових навичок, а екіпажу потрібно пройти додаткове навчання, щоб безпечно керувати цими змінами [8, с. 113]. Така глобальна проблема для морської галузі потребує інтеграції окремих цілей та різноманітних задач, адекватних сучасному становищу з морським транспортом у нашому суспільстві, яке знаходиться в умовах воєнного стану. До того ж, перед морською спільнотою стоїть важлива проблема – визначити потребу у кадрах морських фахівців на майбутнє, у післявоєнні часи.

Мета нашого дослідження: методологічно обґрунтувати необхідність впровадження теоретичних і методичних засад професійної підготовки фахівців морського профілю на достатньому рівні, для забезпечення національного флоту кваліфікованими фахівцями суден сучасного покоління.

Своїми дослідженням і теоретичними інноваційними програмами на шляху розбудови професійної морської вищої освіти, діяльністю в сфері співпраці з судноплавними компаніями та фірмами як морського, так і річкового флоту та партнерськими відносинами з різноманітними секторами спільнот морської інфраструктури, морська освіта України має призначення – сприяти пошуку і створенню нових підходів до економічного розвитку майбутнього держави.

Аналіз сучасного стану морської освіти дозволяє зробити висновок про зміну її ролі в економічній частині суспільства, а саме: вона «переміщається» з основної складової «сфери послуг» в певний «прошарок» економіки держави, не звертаючи уваги на необхідність зростання вимог до її інтелектуального та освітнього потенціалу під час швидких темпів змін у суднобудуванні. При такому підході державна політика у морській галузі повинна була б стати фундаментом для економічного розвитку держави і, перш за все, забезпечити флот кваліфікованими фахівцями для суден сучасного покоління [5]. На теперішній час ми стаємо свідками того, що освітні реформи в Україні, зокрема в морській галузі, проводяться без освітнього пріоритету галузі, гублять орієнтир, ведуть до втрати пріоритету закладів морської вищої освіти (надалі – ЗВО) з підготовки кадрів для майбутнього національного флоту, економічної та технологічної безпеки, незалежності й конкурентноспроможності країни.

Результати проведених досліджень у Дунайському інституті Національного університету «Одеська морська академія» показують, що у багатьох курсантів недостатньо розвинений цілий ряд інтелектуальних вмінь, а саме: близько 70 % курсантів недостатньо володіють прийомами розуміння складної інформації; 72% – не вміють систематизувати, структурувати, виокремлювати необхідні зв’язки у

матеріалі для кращого розуміння та поняття; 16% – не вміють давати аналітичну оцінку проблем. Значна частина курсантів (близько 65%) відмічають, що швидко забувають матеріал та не пов'язують його з практикою, не використовують раціональні прийоми збереження інформації та не володіють прийомами керівництва своєю увагою. Близько 72% курсантів визнають, що їм важко сконцентруватися на лекційних заняттях; 74% –- мають труднощі сприймання великого обсягу інформації; ефективність використання лекційного матеріалу на практичних та лабораторних заняттях складає близько 25%. За отриманими результатами дослідження, є можливість констатувати, що перед ЗВО морського профілю на теперішній час стоїть головне завдання –- збереження пріоритету формування ключових компетенцій у майбутніх фахівців, а саме:

–- мотивації їх вчитися потягом всього життя, що є актуальною соціальною і психолого-педагогічною проблемою;

–- психологічна готовність до здійснення професійної діяльності в небезпечних і аварійних ситуаціях;

–- чіткого поняття про те, що їх професійна діяльність пов'язана з роботою у замкнутій системі фахового простору;

–- діяльнісної характеристики майбутнього фахівця з конкретної спеціалізації, що демонструє його здатність і готовність працювати на певному рівні, оскільки це проявляється в процесі професійної діяльності на судні в умовах багатонаціонального екіпажу;

–- визначати свою суб'єктивну позицію, при якій фахівець знає та усвідомлює свої посадові компетенції за розкладом судна і здатний усвідомлено їх реалізувати;

–- інтегрованої якості майбутнього фахівця, яка проявляється в його здатності здійснювати фахову діяльність і демонструвати готовність її виконання за вимогами мінімальних стандартів компетентності.

У зв'язку з цим на науково-педагогічний склад морських ЗВО покладені завдання з вирішення питань збереження якості професійної підготовки фахівців морського профілю на рівні вимог міжнародної Конвенції з підготовки та дипломування моряків і несення вахти 1978 р. (з поправками) (ПДНВ) [4]. Забезпечити такий рівень формування провідних характеристик професійної компетентності майбутніх фахівців можливо лише з впровадження в освітній процес наступних інноваційних методологічних підходів, а саме:

— *міжпредметний зв'язок* в рамках освітньо-професійних програм, що відповідає сучасним вимогам і містить інформацію про мінімальні стандарти компетентності: опис необхідних знань, розумінь та професійних навичок, методів демонстрації, показників та критеріїв для оцінки їх виконання;

– *багатовекторність* у вирішенні завдань, які виникають у професійній діяльності фахівця та характеризують якісний аспект його виконання особистістю як творчим суб'єктом;

— *багатофункціональність*, можливість майбутнього фахівця реалізувати багато функцій, у тому числі інтегральних, у процесі професійної діяльності, що дає можливість розглянути професійну компетентність, яка враховує різні аспекти його діяльності: мотиваційний, інтелектуальний, професійний, фаховий, суб'єктний;

— *багатокомпонентність,* яка складається з достатньої кількості визначених компонентів: мотиваційних, інтелектуальних, діяльнісних, професійних якостей тощо, за відсутністю яких особистість не може набути актуалізуватися в професійній діяльності як професіонал, фахівець і суб'єкт діяльності [7, с. 114 - 115]. Складовими компонентами мінімальних стандартів компетентності вахтових помічників та механіків, як суб'єктів професійної діяльності, є професійна позиція фахівця; система професійних теоретичних знань і розумінь; система практичних навичок, умінь і спроможностей (метод демонстрації); акмеологічні інваріанти фахівця; професійна суб'єктність фахівця.

— *багатовимірність*, яка визначає різні форми діагностування готовності майбутнього фахівця до роботи на морських суднах, показники та критерії оцінювання його професійної діяльності;

— *суб'єктність* – визнання професійної компетентності конкретної особистості, та спроможність її виконувати свої функції в умовах судна відповідно до суднової ролі, на рівні вимог до професіоналізму, майстерності та індивідуального досвіду.

Висновок та пропозиції. За результатами проведеного дослідження про необхідність реформування морської освіти, є можливість стверджувати, що професійний імідж українського фахівця морського профілю на ринку морської праці значно знизиться, якщо формування базових теоретичних, графічних, технічних та інших знань не будуть покладені в основу когнітивних навичок, які надалі виокремлюються і трансформуються в активну, діяльнісну позицію фахівця.

Послідовність формування компетентності майбутнього фахівця морського профілю, що забезпечує діяльнісну основу професійної підготовки і визначає комплекс знань, розумінь, умінь, навичок є головним чинником запланованого рівня кваліфікації. Це зумовить: по-перше, не тільки мотивацію і зацікавлення молоді до здобуття професії моряка, але й прагнення її пов'язати з нею своє майбутнє; по-друге, дасть можливість значно підвищити конкурентноспроможність українського фахівця на ринку морської праці за рахунок технологічної послідовності виконання робочих операцій на технологічній і плавальній практиці, застосуванню здобутих знань та навичок у майбутній професії; по-третє, дасть можливість закріпити та примножити позитивну думку зарубіжних судновласників про достатній рівень підготовки і професіоналізм українського моряка. Все вище викладене, сприятиме підвищенню статусу України, як морської держави.

Список літератури

1. Дулин В. Н. Развитие профессионального опыта морских специалистов в учебно-тренажерных центрах: дис. ... канд. пед. наук: 13.00.08. Калининград, 2006. С. 3

2. Кузьменко В. В, Рябуха І. М. Особливості використання навчально-тренажерного комплексу у підготовці майбутніх моряків. *Сучасні інформаційні технології та інноваційні методики навчання в підготовці фахівців: методологія, теорія, досвід, проблеми*. 2018. Вип. 50. С. 304–308.

3. Мальцев А. С., Голикова В. В. Динамика психофизиологических функций у курсантов и судоводителей при решении задач судовождения на радиолокационном тренажере. Актуальні проблеми транспортної медицини. 2007. № 1 (7). С. 20–26.

4. Міжнародна конвенція про підготовку і дипломування моряків та несення вахти 1978 року (консолідований текст з манільськими поправками). К.: ВПК «Експрес– Поліграф», 2012. 568с.

5. Морська доктрина України на період до 2035 року. Постанова Кабінету Міністрів України від 07 жовтня 2012 року №1307: [Електронний ресурс]. URL: http://www.mtu.gov.ua/uk/resolution_kmu/print/15623.html

6. «Стратегії розвитку вищої освіти в Україні на 2022-2032 роки Схвалена Кабінетом міністрів України 23.02.2022 року №: [Електронний ресурс]. URL: https://mon.gov.ua/osvita-2/vishcha-osvita-ta-osvita-doroslikh/strategiya-rozvitku-vishchoi-osviti-v-ukraini-na-2022-2032-roki

7. Ягупов В.В. Методологічні вимоги компетентністного підходу до професійної підготовки фахівців. Актуальні проблеми вищої професійної освіти: Матеріали міжнародної науково – практичної конференції 21- 22 березня 2013 р. К.: НАУ, 2013. С. 114 – 115.

8. What are the Main Technological Innovation in the Maritime Industry for 2023? SINAY Maritime Data Solutions (October 24, 2023) [https://sinay.ai/en/insights/].

PHILOLOGY

О ЗАПАДНОСЛАВЯНСКИХ ЗАИМСТВОВАНИЯХ В РУССКОМ ЯЗЫКЕ

Ахвледиани М.
Батумский государственный университет Шота Руставели (Грузия)
Ассоциированный профессор

ABOUT WEST SLAVIC BORROWINGS IN THE RUSSIAN LANGUAGE

Akhvlediani M.
Batumi Shota Rustaveli State University (Georgia)
Associate Professor
DOI: 10.5281/zenodo.15294155

Аннотация

Данная статья посвящена вопросу заимствования западнославянской лексики русским языком. В исследовании приводится и классифицируется большая часть наиболее употребительных слов, заимствованных из польского языка. Указывается посредническая функция польского языка при заимствовании слов из западноевропейских языков. В работе прослеживается путь вхождения почти всех чешских заимствований (богемизмов) в лексическую систему русского языка. Отмечается единичный характер проникновения собственно словацких слов в русский язык. Однако приводятся десятки словацких слов, имеющих одинаковое с русским языком звучание, но разное значение. Все западнославянские заимствования ассимилированы русским языком, близки его грамматической системе и лишь этимологически могут быть названы заимствованиями.

Abstract

This article is devoted to the borrowing of West Slavic vocabulary into the Russian language. The work cites and classifies all commonly used words borrowed from the Polish language. The mediating role of the Polish language for borrowing from Western European languages is indicated. The work presents almost all Czech borrowings (bohemisms) that have been established in the Russian lexical system. The study notes the isolated nature of Slovak words' penetration into Russian. However, several dozen Slovak words are presented that have a similar sound to Russian words but differ in meaning. All West Slavic borrowings are assimilated by the Russian language, are close to its grammatical system and can only be called borrowings etymologically.

Ключевые слова: западнославянские заимствования, богемизмы, чужеродные корни, словацкие заимствования, польские заимствования.

Keywords: West Slavic borrowings, Bohemisms, foreign roots, Slovak borrowings, Polish borrowings.

Российское государство всегда находилась на обширных пространствах Европы и Азии, на перекрестках путей с запада на восток и с севера на юг. Это обстоятельство обусловливало его политические, торговые и культурные связи с соседними странами и народами и, следовательно, постоянное заимствование иноязычных слов в лексический состав русского языка. Этот процесс то замедлялся, то усиливался, но никогда не прекращался.

В словарном составе русского языка выделяется огромная масса заимствованных слов. В разные эпохи в русский язык приходили вместе с новыми понятиями и новые слова, которые русифицировались и по внешнему облику мало чем отличаются от исконно русских слов. Только специальный этимологический анализ помогает выяснить истинное происхождение слов и источник заимствования.

Славяне никогда не являлись единым народом, поскольку каждому из них всегда были присущи индивидуальные культурные, языковые и территориальные особенности.

В результате переселения и естественной ассимиляции с другими этносами, незначительная первоначальная разница между славянскими народами и их языками существенно увеличилась. Восточные славяне расселились на Восточно-европейской равнине и северо-востоке. Западные отправились на запад — к Одре, Лабе и Заале и на юго-запад — на средний Дунай, где в наши дни располагается Бавария.

Основываясь на генетических и лингвистических исследованиях славянских народов, некоторые учёные пришли к выводу о схожести восточных и западных славян, а также значительном отличии от них южной ветви.

Таким образом, славяне, живущие в Центральной части Европы, считаются западными славянами и говорят на чешском, польском или словацком языках. Они используют латинский алфавит и в основном католики.

Эти народы поддерживали прочные отношения с Европой, они часто считают себя европейцами с отличной этнической принадлежностью от того, что классифицируется как славянский.

В то же время, тесное генетическое родство с восточными славянами проявляется у поляков, в меньшей степени у словаков и чехов, тяготеющих к немцам.

Несмотря на схожесть языка и культуры, между данными славянскими народами сложились непростые взаимоотношения. Попытки восточной

ветви к сближению, зачастую не находило поддержки у западной, которая, как правило, видела в восточных «братьях» лишь завоевателей и тяготела к проявлению собственной национальной идентичности. Видимо, это обстоятельство является одной из причин сравнительно небольшого количества взаимных заимствований из русского и западнославянских языков.

Среди заимствований из близкородственных западнославянских языков следует выделить польские заимствования, осуществлённые вследствие интенсивных русско-польских контактов на протяжении многих веков (русско-польские военные столкновения в XV в., вхождение Польского царства в состав Российской империи и др.).

Через посредство польского языка в русский язык пришли многие слова из западноевропейских языков.

Польский учёный В. Витковский в «Новом словаре польских заимствований в русском языке» приводит список около 7500 полонизмов, в том числе исторических (Витковский В. 2006). Он отмечает, что до сих пор в литературном русском языке употребляется больше 1000 слов, принятых из польского языка или через его посредство. В известном и популярном «Кратком этимологическом словаре», вышедшем под редакцией С. Г. Бархударова, приводится более 220, заимствованных русским языком, полонизмов (Шанский Н. 1970).

Большая часть польских заимствований в русском языке образована от чужеродных корней и, в свою очередь, восходит к немецкому, латинскому, французскому, итальянскому и другим языкам.

Через посредство польского в русский язык вошли следующие слова с **немецкими** корнями: *аист, бант, бляха, брак, ванна, вахмистр, вахта, винт, гвалт, гоголь-моголь, грунт, гурт (стадо), дратва, дышло, замша, каплун, карлик, кацавейка, крахмал, кухня, малевать, маляр, мещанин, мордовать, обшлаг, отвага, пачка, рада, рисовать, рисунок, рыдван (род экипажа), рынок, рычаг, скарб, смак, смачный, сталь, танец, трамбовать, фалда, фальшивый, фартук, фехтовать, фига, фиолетовый, фунт, цель, шалфей, шельма, шинок, шкодить, шлея, шлифовать, шляхта, шнур, шомпол, шоры, шпик (сало), шпилька, шрам, штука, штурм, штык, шулер, шуровать, юбка, ярмарка* и некоторые другие.

К **латинскому** языку восходят полонизмы*: автор, аккуратный, вариация, гитара, индюк, каникулы, канцелярия, кляуза, нуль, медик, монета, объект, оказия, опека (калька), пенсия, персона, подданный (калька), публика, титулярный, трактир, шпаргалка и др.*

Французскими по происхождению являются полонизмы: *адрес, аллея, артиллерия, бригада, бутылка, деликатный, кальсоны, каналья, курьер, легавый, пунцовый, тасовать, фармазон, шаль и др.*

Сравнительно меньше слов через посредство польского языка вошло в лексический состав русского языка **из других** европейских языков: *балясы, бандит, жупан, казарма, карета, композитор, фабрика (итал.); гусар, шеренга (венгер.); краля, поручик, смертельный (чешск.); блат, шабаш (еврейск.) и т.д.*

Многие полонизмы, прежде чем попасть в русский язык, прошли сложный путь. В польский язык они попали через посредство нескольких языков.

Например, слово *барвинок* (растение) заимствовано русским языком из польского в 16 веке. В свою очередь, польское barwinek является заимствованием из чешского языка, в котором barvinek через немецкое посредство восходит к латинскому pervinca.

Другое слово *бутылка* заимствовано из польского языка в начале 18 века. Польское butelka является переоформлением французского bouteille, восходящего через уменьшительно-ласкательное среднелатинское butticula к латинскому buttis – «бочонок». Слово «рыцарь» образовано от польского rycerz, которое восходит к средне-верхне-немецкому ritter, которое, в свою очередь, калькирует французское chevalier (рыцарь). Немецкое Vortuch дало в польском fartuch, а затем в русском *фартук*. Французское rote через немецкий пришло в польский, где известно в виде rota, а уже из польского заимствовано русским – *рота.* Ещё более сложный путь прошло слово *пастернак* (латинское pastinaka – древневерхненемецкое pastinak – чешское pasternak – польское pasternak), заимствованное в русский уже непосредственно из польского.

Польский язык служил языком-передатчиком для слов, заимствованных из западных языков, преимущественно до XVIII века. Начиная с этого времени значительно усилились связи России с западноевропейскими странами, и заимствования из европейских языков стали уже в основном непосредственными.

Но в русском языке немало и собственно польских слов (полонизмов): *белизна, булка, бунт, бакалея, бекеша, вензель, вербовать, вирши, витамин, гурьба, дозволить, дуля (груша), если, забияка, зразы, клянчить, кролик, лава, мазурка, отвага, повидло, плохой, подлый, поединок, позволить, полковник, пончик, предместье, причина, пуля, сбруя, сейм, скромный, уважать, урядник, шпенёк, цинга, стоить, и др.*

Полонизмы и заимствования из западноевропейских языков через посредство польского языка, тематически многообразны. Они являются:

1) названиями жилья, предметов быта, одежды, средств передвижения: *квартира, скарб, дратва, дышло, байка (ткань), бляха, бекеша (Бекеш - венгерский полководец короля Стефана Батория), замша, кофта, карета, коляска, козлы, сбруя, сума, фуражка;*

2) названиями кушаний, пищевых продуктов и напитков: *булка, зразы, фрукт, миндаль, повидло, пончик;*

3) названиями лиц по деятельности, должности, положению, званию: *полковник, поручик, вахмистр (устар.), рекрут, гусар, мещанин, писарь, шляхта;*

4) обозначением действия: *гарцевать, дозволить, доконать, малевать, рисовать, тасовать, клянчить, мешкать, потрафить, подначить, позволить, уважать, шарить;*

5) названием животных, растений: *кролик, петрушка, каштан, крыжовник, барвинок, легавый (собака охотничьей породы) и т.д.*

6) некоторые другие наименования: *аккуратный, дармовой, деликатный, доскональный, фальшивый, шкодливый, строгий, блат, вариация, ванна, вензель, забияка, заядлый, быдло, подлец, карлик, фигляр, опека, отвага, отчизна, предместье, штука, фабрика, шпаргалка.*

Под влиянием польского языка возникли такие грамматические единицы, отсутствующие в древнерусском, как союзы ***если*** (jeśli) и ***так что*** (takco), частица ***якобы*** (jakoby), конструкция ***что за*** (co [to] za), ***принимать за кого*** (przyjąćzakogo) (Фасмер 204).

С польским языком связан фонетический облик ряда имён собственных *Париж, Венгрия* (ср. укр. Угорщина, сохранившее древнерусскую огласовку). Через польский язык в русский вошло много интернационализмов.

Языком-передатчиком при заимствованиях в русский из западных языков (в том числе и западнославянских) служили украинский и белорусский языки.

Например, заимствованное русским языком из украинского слово ***бричка*** пришло в украинский язык из польского ***bryczka***, которое является переоформлением немецкого ***brutsche***, восходящего в свою очередь к итальянскому ***biroccio*** и, наконец, к латинскому ***birota*** .

Таким же образом пришли в русский язык через посредство украинского или белорусского языков польские по происхождению слова: бандура, брюква, завзятый, карбованец, молчком, пампушка, цибуля (через украинский язык); заядлый (через белорусский); маёвка, маляр (укр., бел.), пан (укр., бел.), шарпать (укр., бел.), шлях (укр., бел.), шпарить (укр., бел.) и т.д.

В русском языке заимствования из ***чешского языка*** малочисленны. Филологи называют их богемизмами, от латинского названия территории, на которой находится нынешняя Чехия.

Количество богемизмов в русском языке составляет около двух десятков лексических единиц. Некоторые из них непосредственно заимствованы из чешского языка (замок, робот, колготки и др.), а некоторые вошли в словарный состав русского языка через посредство польского (франт, поручик, краля и др.).

Во многих случаях западнославянское происхождение заимствованных русским языком слов не вызывает сомнения, однако их принадлежность к богемизмам или же полонизмам проблематична: «фортель», «барвинок», «мещанин», «пушка».

Спорным, например, является происхождение слова «беженец». Чешские исследователи считают его русизмом. Русские же лингвисты рассматривают его как заимствование из чешского языка - běženec.

Рассмотрим наиболее употребительные **богемизмы**, в разное время заимствованные русским языком:

Самым известным интернациональным богемизмом является слово «робот», изобретённое Карелом Чапеком для пьесы «R. U. R.» (1920).

• «**робот**» ← robot ← robota (чеш. «тяжелый труд») ← работа

Среди широко распространившихся в разных языках слов чешское происхождение также имеет слово «гаубица».

• «гаубица» (в русском из немецкого *Haubitze* ← чеш. *houfnice*, от чешского *houfný* «кучный»);

гаубица ← haubitze (нем.) ← haufnicě ← houfný (др.- чеш.«кучный») ← купа (куча);

• «пистолет» (в русском из нем. *Pistolet* ← чеш. *píšťala*, соответствующего исконно русскому пищаль);

• «зáмок» (семантическая калька) из чеш. *zámek*, в котором был по аналогии с нем. *Schloß* осуществлён перенос значения с «запор, затвор» на «отдельно стоящее укреплённое жилище»; в результате в русском языке заимствованное «зáмок» и исконно русское «замóк» различаются ударением;

• «**франт**» (щёголь; возможно, через польское посредство) из чеш. *franta* со значением «шут, плут», первоначально от имени собственного, уменьшительного от *Франтишек*);

• «поручик» (через польское посредство *porucznik*) из чеш. *poručík*, то есть порученец, офицер для поручений — чешская калька термина «лейтенант» (locum tenens — «держащий место»); *поручик ← poručník (чеш.) ← поручать*

• «колготки» из чеш. *kalhoty (калготы)* переводится как брюки, но в СССР во второй половине XX века стали ввозить колготки из Чехословакии, и на упаковках было написано punčochové kalhoty, что можно примерно перевести как «маленькие штаны», «штанишки»;

колготы ← kalhoty (чеш.) ← caligotte (ит.) ← калиги (обувь; лоскуты кожи)

• «**табор**» - по одной из версий, от чеш. *tábor* «военный лагерь», вошедшего в употребление в эпоху гуситских войн (ср. также одноимённый город) и восходящего, в свою очередь, к названию библейской горы Фавор, происходит русское «табор», употребительное главным образом по отношению к цыганскому лагерю.

• «**гачек**» (чеш. háček) — галочка-птичка (диакритический знак), которая превращает обычный твердый звук в мягкий или шипящий. «Гачек» ставят над некоторыми согласными или над гласной буквой Е. Выглядит это так: Ž, Č, Š, Ř, Ť, Ň, Ď, Ě.

гачек ← háček ← hák (чеш.) ← hāk (др.-гер.) ← якъ (др.-рус. «крюк; коготь; остриё»)

• *«краля» (красавица)← krala (польск. 18 в.) ←kral - король (чеш.) ← общеслав. karla (король)*

• «**пемза**» ← pemza (чеш.) ← пенза (пористый камень) ← пенати (др.-рус. «резать; пороть»)

• «**полька**» — вопреки распространенному мнению, название этого танца связано не с женщиной польской национальности, а с тем, что ее музыкальный размер — 2/4, то есть, половина: полька ← polka (чеш. «половинка») ← полъ (половина);

• «**шпекачк**а» ← špekačka ← špek (чеш.) ← speck (нем. «шпик, свиное сало»)

• **«помлазка»** - *пасхальная плётка, пасхальное стегание*, чеш. *Pomlázka* (народный обряд в Чехии, Словакии и Польше в Пасхальный (Поливальный) понедельник, во время которого парни символически бьют девушек по ягодицам вербными или иными свежесрезанными веточками, чаще всего сплетёнными в специальную плётку);

• «**грубиян**» ← *hrubian (чеш. 16 в.)* ← *Grobian (нем. «грубый человек»)*

В русском языке заимствования из словацкого языка единичны и часто затруднительно их выделение. Однако достаточно много слов, имеющих похожее звучание и значение, аналогичное словацкому. Есть и **слова, которые имеют совершенно иной смысл, хотя и звучат довольно похоже**. Вот словацкие слова, которые очень похожи на русские, поэтому многим может показаться, что в словацком языке они имеют такое же значение:

• palec (словацкое слово) – «большой» палец, дюйм (перевод на русский); палец (русское слово) - prst (перевод на словацкий язык);

• krásny (словац.) – красивый, прекрасный (перевод на русский) красный (русск.) – červený (перевод на словацкий);

• električka – трамвай, электричка - lokálny vlak;

• smotana – сливки, сметана - kyslá smotana;

• pozor – внимание, позор – hanba;

• vrah – убийца, враг - nepriateľ, odporca;

• pohoda – комфорт, благодать; погода – počasie;

• starosť – забота, попечение; старость – staroba;

• trup - туловище, торс, корпус, остов (судна); труп – mŕtvola;

• umelec - артист, художник, музыкант; умелец – majster;

• vlažný - тёплый, прохладный; влажный – vlhký;

• náhly - внезапный, мгновенный, наглый – drzý;

• voňať – пахнуть, вонять – smrdieť;

• ráno – утро; рано – skoro;

• byt – квартира, быт - každodenný život;

• pohreb – похороны, погреб – pivnica;

• izba – комната, номер в отеле; изба – chalupa;

• nájomník – квартирант; наёмник - žoldnier (военн.);

• školník - технический работник школы (столяр, слесарь и проч.); школьник – školák;

• priemer - средняя величина, средний уровень, диаметр; пример – príklad и т.д.

Есть также слова, которые помимо привычных нам, **имеют и дополнительные значения**, которые зачастую используются даже чаще, чем знакомые нам.

Вот некоторые из них:

• **druh** (словацкое слово) – друг (основное, привычное значение) – ***вид, тип, сожитель*** *в незарегистрированном браке* (дополнительные значения);

• **cena** (словацкое слово) **–** цена (основное, привычное значение) – ***приз*** (дополн. знач.)

• **trpieť** (словац. слово) **–** терпеть **(**привычн. знач.) – ***страдать, мучаться*** (доп. знач.)

• **dobiť** – добить – *пополнить (счёт);*

• **zlý** – злой – *плохой, некачественный*;

• **vstúpiť** – вступить (в партию) – *войти*;

• **vystúpiť** – выступить (на сцене) – *выйти*;

• **nabiť** – набить, избить - *зарядить (аккумулятор, смартфон, обойму, и т.п.);*

• **prázdny** – праздный – *пустой, безлюдный*;

• **chytrý** – хитрый – *умный*;

• **úzkosť** – узкость - *тревога, подавленность, тоска, страх;*

• **bordel** – бордель - *бардак, дебош*;

• **dielo** – дело - *произведение, сочинение* и т.д.

Многие устаревшие в русском языке слова, более века назад уже ставшие архаизмами, в словацком и сегодня находятся в активном употреблении, например: глаза – *«очи»*, пальцы - *«персты»,* лоб – *«чело»*, ладонь – *«длань»,* живот – *«брюхо» и др.*

Есть слова, одновременно встречающиеся сразу в нескольких близкородственных славянских языках. Часто трудно определить их принадлежность к тому или иному славянскому языку. Например, слово «*миска»* употребляется как в русском, так и в польском, чешском, словацком и украинском языках; слово *«хобот»* с одним и тем же значением встречается в русском, чешском и болгарском языках и др.

Таким образом, заимствования из родственных западнославянских языков немногочисленны и практически не выделяются среди исконно русской лексики. Все они близки грамматической системе русского языка, быстро ассимилировались и лишь этимологически могут быть названы заимствованиями.

Список литературы

1. Витковский В. Новый словарь польских заимствований в русском языке (Nowysłownik zapożyczeń polskich w języku rosyjskim) — Kraków: «Universitas», 2006.)

2. Шанский Н.М., Иванов В.В., Шанская Т.В. Краткий этимологический словарь русского языка./Под ред. С.Г. Бархударова. Москва, «Просвещение», 1971.

3. Фасмер М. Этимологический словарь русского языка: В 4-х т.: Пер. с нем. = Russisches etymologisches Wörterbuch / Перевод и дополнения О. Н. Трубачёва. — 4-е изд., стереотип. — М.: Астрель — АСТ, 2004.

4. Ковалёв В.П. Современный русский литературный язык. Часть II. М., 1982.

5. http://lingvomania.info/2010/bg-lozhnye-druzya.html.

6. http://babr.ru/kuluar/8.pdf.

7. https://svetorusie.livejournal.com/2420.htm. Чешские заимствования в русском языке. 30 марта 2016, 21:28

8. http://slovenskyjazyk.info/pohozhie-no-druhoe-znachenie/ Словацкие слова с похожим звучанием, но отличающимся значением (переводом).

ИСПОЛЬЗОВАНИЕ ИИ ПРИ ПЕРЕВОДЕ ОБРАЗНОЙ ЛЕКСИКИ ХУДОЖЕСТВЕННОЙ ЛИТЕРАТУРЫ РАЗНЫХ КУЛЬТУР

Лема А.
Международный Университет Кыргызстана, студент PhD

THE USE OF ARTIFICIAL INTELLIGENCE IN TRANSLATING FIGURATIVE LANGUAGE IN LITERARY WORKS ACROSS DIFFERENT CULTURES

Lema A.
International University of Kyrgyzstan, PhD student
DOI: 10.5281/zenodo.15294162

Аннотация

В статье рассматривается использование искусственного интеллекта (ИИ) для перевода образной лексики, такой как метафоры и идиомы, в литературных произведениях. Оцениваются проблемы, с которыми сталкивается ИИ при сохранении культурного и эмоционального контекста, и предлагаются рекомендации для улучшения работы ИИ в этой области.

Abstract:

This article explores the use of Artificial Intelligence (AI) in translating figurative language, such as metaphors and idioms, in literary works. It examines the challenges AI faces in preserving the cultural and emotional context of figurative expressions and provides recommendations for improving AI's ability to handle these tasks in the future.

Ключевые слова: перевод, искусственный интеллект, образная лексика, метафоры, идиомы, культурный контекст, литературный перевод, машинный перевод, эмоции, ограничения ИИ.

Keywords: AI translation, figurative language, metaphors, idioms, cultural translation, literary translation, machine learning, translation tools, cultural nuances, AI challenges.

Introduction

In recent years, Artificial Intelligence (AI) has made a transformative impact across various industries, with language translation being no exception. Translation, particularly in the realm of literature, plays a crucial role in enabling the exchange of ideas, culture, and artistic expression across linguistic boundaries. However, one of the most difficult aspects of translation—translating figurative language—remains a significant challenge, even for the most advanced AI systems. Phrases like metaphors, idioms, and cultural references are often deeply tied to the emotional and cultural fabric of a language, which can make them difficult for AI to interpret accurately [1, p.45]. This article explores the current state of AI in translating figurative language within literary texts, examining both the successes and limitations of AI systems, and offering recommendations for how these systems can be enhanced in the future [2, p.72].

Definition of the Problem

Figurative language is a cornerstone of literary expression, and it transcends the literal meaning of words. Metaphors, idioms, and proverbs serve not just as tools for communication, but as means of conveying deeper emotions and cultural insights. Take, for example, the English phrase "breaking the ice." Although a simple expression, its underlying meaning goes beyond its literal sense, signifying the act of initiating conversation or removing social barriers [3, p.118]. AI systems, which often focus on literal translations, are frequently challenged by such expressions, resulting in translations that miss these deeper layers of meaning. In literary translation, this problem is even more acute. If AI is to become a reliable tool in literary translation, it must learn to account for both the emotional and cultural context of figurative language [2, p.72].

Analysis of Recent Research and Publications

Several recent studies have explored the potential and limitations of AI in translating figurative language. Li Qi (2024) discusses the role of generative AI in translating literary poetry, noting that while AI offers valuable assistance in translating certain phrases, it is not yet capable of preserving the nuance and emotional depth embedded in literary works [4, p.101]. Likewise, research by Aghazadeh et al. (2024) highlights the limitations of current machine translation models, particularly when tasked with translating idiomatic expressions and metaphors. Their findings suggest that AI translation models are often incapable of grasping the cultural context in which figurative language is rooted [5, p.200].

Further research conducted by Kabra et al. (2023) focuses on the creation of a figurative language inference dataset to evaluate the quality of AI translations in various languages. Their work provides valuable insight into the challenges of training AI systems to handle culturally specific expressions, as figurative language often has no direct equivalent in other languages [6, p.45]. The need for specialized datasets to improve AI's understanding of metaphorical language has thus become increasingly apparent [6, p.60].

Unsolved Aspects of the Problem

While AI translation has seen significant improvements over the years, there are still several unresolved issues in the translation of figurative language. One of the most pressing concerns is the inability of AI systems to recognize and preserve the cultural and emotional subtext of figurative expressions. AI tools, which rely on large multilingual datasets, are often trained without an understanding of the cultural significance

that underlies these expressions. This results in translations that are technically correct but culturally inappropriate or emotionally flat [7, p.28].

Additionally, while current AI systems are proficient at translating routine texts, they are still prone to errors when dealing with literary works that employ figurative language in innovative ways. Literary texts often feature metaphors and idioms in nontraditional contexts, which poses a particular challenge for AI systems. AI must be able to understand not just the words in a sentence, but the underlying intent and emotional tone to produce an accurate and meaningful translation [5, p.200].

Purpose of the Article

The primary aim of this article is to evaluate the role of AI in translating figurative language, particularly in literary works. By examining the capabilities and limitations of AI translation tools, such as Google Translate and Deeply, this article seeks to highlight the challenges AI faces in translating culturally rich expressions. It also aims to propose solutions for improving AI's ability to handle these challenges, providing recommendations that may lead to more accurate and culturally sensitive translations [8, p.44].

Main Material

Case Studies:

- Translation of Gabriel García Márquez's Works:

In a study of the English translation of *One Hundred Years of Solitude*, it was found that AI translation systems often struggle with preserving the emotional depth of Márquez's metaphorical language. For example, the metaphor "the smell of death" was translated too literally, losing the intended poetic quality [3, p.118]. This case highlights the limitations of AI in conveying the emotional and cultural weight of figurative language.

- ChatGPT and Figurative Language:

A study assessing ChatGPT's ability to translate figurative language revealed that while the tool can handle some idiomatic expressions, it often falls short when dealing with more complex metaphors. The study concluded that AI models like ChatGPT are useful tools for general translation but still require refinement to capture the nuanced meanings of figurative language [6, p.45].

Evaluation of AI Tools:

- Google Translate:

Google Translate, powered by neural machine translation (NMT), can process and translate a wide variety of languages. However, as shown in the case study of Márquez's work, it struggles with figurative expressions, providing translations that may be technically correct but fail to preserve the original meaning or emotional tone [9, p.22].

- DeepL:

DeepL has demonstrated a greater fluency in translating text compared to other translation tools, but it still faces challenges in translating figurative language accurately. In particular, DeepL often misinterprets idiomatic expressions and cultural metaphors, resulting in translations that lack the emotional richness of the original text [10, p.35].

Suggestions for Improvement:

1. Training on Specialized Literary Datasets:

One recommendation is to train AI systems on a more specialized corpus of literary texts. By incorporating a diverse range of literary works that feature rich figurative language, AI systems can learn to handle metaphors and idioms more effectively [6, p.60].

2. Incorporating Cultural Context:

AI models must incorporate cultural data and context-specific knowledge to handle idiomatic expressions. Training AI systems on texts that are culturally rich and contextually specific will help them grasp the subtleties of figurative language [7, p.28].

3. Human-AI Collaboration:

A hybrid approach, where human translators work alongside AI, is another recommendation. While AI can handle the bulk of the translation, human translators can focus on ensuring that the figurative language retains its cultural and emotional significance [8, p.44].

4. Improvement of Neural Machine Translation Models:

Neural machine translation models, such as DeepL, have made strides in handling more complex sentence structures, but they still need improvement when it comes to figurative language. Enhancing these models to recognize cultural shifts and idiomatic expressions will help bridge the gap in translating literary works [9, p.22].

Conclusions and Recommendations

AI has certainly made strides in language translation, but it is still far from perfect when it comes to translating figurative language in literary works. The challenges faced by AI in accurately translating metaphors, idioms, and culturally rich expressions underline the importance of integrating cultural knowledge, emotional intelligence, and human oversight. With continued development and by embracing a more collaborative approach between human translators and AI, we can expect significant improvements in the quality of literary translations.

References

1. Jones M., Smith J., Wang L. AI in Literary Translation: A Review of Progress and Challenges // *Journal of Translation Studies*, vol. 29, no. 3, 2021, pp. 42-58.

2. Silva A. Understanding the Limitations of AI in Figurative Language Translation // *Linguistic and Cultural Studies*, vol. 15, no. 2, 2020, pp. 67-85.

3. Garcia M., Li X. Neural Machine Translation and Literary Texts: A Case Study on Gabriel García Márquez // *Translation Technologies Review*, vol. 9, no. 4, 2022, pp. 112-129.

4. Li Q. Generative AI and Literary Translation: Analyzing the Yuefu Poem Translation // *Ewa Direct Journal*, vol. 32, no. 1, 2024, pp. 101-118.

5. Aghazadeh M., Hojjat M. Multilingual Metaphor Corpus for Machine Translation: A Case Study // *Journal of Linguistic Analysis*, vol. 16, no. 3, 2024, pp. 200-220.

6. Kabra P., Sharma S., Gupta R. Figurative Language and Machine Translation: A Comparative Dataset of Seven Languages // *AI Linguistics Journal*, vol. 24, no. 4, 2023, pp. 45-60.

7. Kuhn M., Siegel J. Sentiment Analysis in AI Translation Systems: Improving Emotional Intelligence in Machine Translation // *Natural Language Processing Review*, vol. 11, no. 2, 2023, pp. 12-28.

8. Baker M. The Translator's Invisibility in the Age of AI: Challenges in Literary Translation // *Translation Studies Quarterly*, vol. 20, no. 1, 2023, pp. 44-59.

9. Orlando S., Lee A. Cross-Cultural Metaphor Translation: AI Tools and Their Implications in Literary Works // *International Journal of Computational Linguistics*, vol. 35, no. 3, 2022, pp. 67-85.

10. Zhang F., Wei J. Challenges of Idiomatic Translation: Case Studies and AI's Limitations // *AI Translation & Linguistics Journal*, vol. 18, no. 2, 2021, pp. 22-35.

БЕЗЭКВИВАЛЕНТНАЯ ЛЕКСИКА КАК ПРЕДМЕТ ЛИНГВОКУЛЬТУРОЛОГИЧЕСКОГО АНАЛИЗА

Жумашева А.Ш.
Доктор филологических наук, профессор кафедры иностранной филологии, Торайгыров университет, Павлодар, Казахстан
Жетписбай А.К.
Кандидат филологических наук, доцент Высшей школы гуманитарных наук НАО «Павлодарский педагогический университет имени Әлкей Марғұлана», Павлодар, Казахстан
Сарыбаева Б.Ж.
Кандидат филологических наук, доцент Высшей школы гуманитарных наук НАО «Павлодарский педагогический университет имени Әлкей Марғұлана», Павлодар, Казахстан

NON-EQUIVALENT VOCABULARY AS A SUBJECT OF LINGUACULTURAL ANALYSIS

Zhumasheva A.
Doctor of Philology, Professor of the Department of Foreign Philology, Toraigyrov University, Pavlodar, Kazakhstan
Zhetpisbay A.
Candidate of Philology, Associate Professor of Higher School of Humanities, NPJSC Pavlodar Pedagogical University named after Alkey Margulan, Pavlodar, Kazakhstan
Sarybaeva B.
Candidate of Philology, Associate Professor of Higher School of Humanities, NPJSC Pavlodar Pedagogical University named after Alkey Margulan, Pavlodar, Kazakhstan
DOI: 10.5281/zenodo.15294164

Аннотация

Статья посвящена лингвокультурологическому анализу безэквивалентной лексики как лингвокультурологической единицы. В работе рассматривается понятие безэквивалентной лексики с различных точек зрения, анализируется многообразие определений данного понятия. Авторы считают, что определения безэквивалентной лексики, которое удовлетворяло бы всех исследователей, пока нет. Отсюда нет и ясности в классификации этой обширной и сложной группы слов, четко не очерчены ее границы. В работе принята классификация Е.М.Верещагина и В.Г. Костомарова, согласно которой к безэквивалентной лексике относят обозначения специфических для данной культуры явлений, которые являются продуктом кумулятивной (накопительной) функции языка и могут рассматриваться как вместилища фоновых знаний. В практической части производится лингвокультурологический анализ безэквивалентной лексики на основе семиотической модели Ч.Морриса. Согласно данной модели рассмотрение безэквивалентной лексики как лингвокультурологической единицы возможно с позиции семиотики в рамках четырех аспектов изучения, затрагивающих практически все уровни языка: синтактики и сигматики, семантики и прагматики.

Abstract

The article is devoted to the linguacultural analysis of non-equivalent vocabulary as a linguacultural unit. The work examines the concept of non-equivalent vocabulary from various points of view, analyzes the diversity of definitions of this concept. The authors believe that there is no definition of non-equivalent vocabulary that would satisfy all researchers. Therefore, there is no clarity in the classification of this extensive and complex group of words, its boundaries are not clearly defined. The work adopts the classification of E.M. Vereshchagin and V.G. Kostomarov, according to which non-equivalent vocabulary includes designations of phenomena specific to a given culture, which are a product of the cumulative (accumulative) function of language and can be considered as repositories of background knowledge. In the practical part, a linguacultural analysis of non-equivalent vocabulary is carried out based on the semiotic model of C. Morris. According to this model, the consideration of non-equivalent vocabulary as a linguacultural unit is possible from the position of semiotics within the framework of four aspects of study that affect almost all levels of language: syntactics and sigmatics, semantics and pragmatics.

Ключевые слова: безэквивалентная лексика, лингвокультурема, лингвокультурологический анализ, слова-реалии, лакуны, семиотическая модель, синтактика, сигматика, семантика, прагматика.

Keywords: non-equivalent vocabulary, linguaculture, linguacultural analysis, words-realia, gaps, semiotic model, syntactics, sigmatics, semantics, pragmatics.

Введение. Предметом лингвокультурологического анализа являются единицы языка, которые «приобрели символическое, эталонное, образно-метафорическое значение в культуре и которые обобщают результаты собственно человеческого сознания – архитипического и прототипического, зафиксированные в мифах, легендах, ритуалах, обрядах, фольклорных и религиозных дискурсах, поэтических и прозаических художественных текстах, фразеологизмах и метафорах, символах и паремиях (пословицах и поговорках)» [1]. Это те единицы,в значении которых заключена национально-

культурная специфика, которые аккумулируют и транслируют культурный опыт из поколения в поколение.

К ним относятся:

1. Безэквивалентная лексика и лакуны (по Е.М.Верещагину и В.Г.Костомарову) [2].

2. Мифологизированные языковые единицы: архетипы и мифологемы, обряды и поверья, ритуалы и обычаи, закрепленные в языке.

3. Паремиологический фонд языка.

4. Фразеологический фонд языка.

5. Эталоны, стереотипы, символы.

6. Метафоры и образы языка (ассоциации, создаваемые внутренней формой слова).

7. Стилистический уклад разных языков.

8. Речевое поведение.

9. Область речевого этикета [1, 36-37].

Исследование направлено на выявление лингвокультурологической сущности безэквивалентной лексики как лингвокультурологической единицы.

Теоретическая часть. Попытки лингвистического анализа безэквивалентной лексики предпринимались многими исследователями. Одним из первых термин «безэквивалентная лексика» ввел Г.В. Шатков, анализировавший способы перевода безэквивалентных лексических единиц на норвежский язык. Он относит к безэквивалентной лексике имена собственные, национальные реалии, слова с национально-экспрессивной окраской (очи, уста), лексику с суффиксами субъективной оценки, определяя их как слова или одно из его значений (прямое или переносное), не имеющие в данный исторический период «готового» точного соответствия в лексике другого языка.

Позднее Г.В. Чернов внес значительные коррективы в теорию слов, выделяемых только при сопоставлении словарного состава русского языка с лексическими единицами другого языка. Проблема безэквивалентной лексики рассматривается им в зеркале английского языка. Он ввел понятие «полная безэквивалентность» и дал свое толкование термина, предложенного его предшественником: безэквивалентными являются слова, «не имеющие постоянного, устойчивого эквивалента в словарном составе другого языка. [3, 19]

Исследователь отказался от понятия «частичная безэквивалентность», расценивая безэквивалентную лексику как отсутствие соответствия той или иной лексической единице или ее семантическому компоненту в словарном составе другого языка.

Как отмечает Г.Г. Панова, безэквивалентную лексику следует рассматривать в интерпретации специалистов по переводу и с точки зрения лингвострановедения. В свою очередь, теоретиков и практиков перевода она условно разделяет на две группы в зависимости от толкования ими термина «безэквивалентная лексика». С одной стороны, это А.В. Федоров, выделяющий безэквивалентность в чистом виде, с другой, - А.Д. Швейцер, который под безэквивалентной лексикой подразумевает слова, служащие для наименования специфических реалий. Надо заметить, что в более поздних своих работах по теории перевода А.В. Федоров расширяет понятие безэквивалентной лексики, причисляя к ней и перевод слов, обозначающих национально-специфические реалии - имена собственные из области истории, географии, культуры.

Отождествляют безэквивалентные единицы и слова-реалии также Л.Н. Соболев и М. Мухамедова.

Однако гораздо большее число исследователей придерживается иной точки зрения, т.к. становится все более очевидным, что границы безэквивалентной лексики шире понятия «реалии», которые являются всего лишь разновидностью безэквивалентных единиц, некоторой ее частью (В.Н.Крупнов, Б.М. Минкович, Л.С. Бархударов, С. Влахов и др.).

Так, Л.С. Бархударов, И.И. Ревзин, Г.В. Чернов и В.Ю. Розенцвейг сходятся во мнении относительно дифференциации безэквивалентной лексики, выделяя следующие ее группы: прежде всего это «национально-специфические реалии» в понимании Г.В. Шаткова. Их же имеют в виду И.И. Ревзин и В.Ю. Розенцвейг, когда ведут речь о «бытовых реалиях». Л.С. Бархударов, сопоставляя исходный язык и язык перевода, относит к безэквивалентной лексике «слова и устойчивые словосочетания одного из языков, которые не имеют ни полных, ни частичных эквивалентов среди лексических единиц другого языка» [4, 68]:

– имена собственные, географические названия, названия учреждений, организаций, газет, пароходов и пр.;

– реалии - слова, обозначающие предметы, понятия и ситуации, не существующие в практическом опыте людей, говорящих на другом языке (предметы материальной и духовной культуры);

– случайные лакуны - единицы словаря одного из языков, которым по каким-то причинам нет соответствий в лексическом составе другого языка (сутки, кипяток, именинник, погорелец, пожарище).

Не только Л.С. Бархударов, но и остальные авторы выделяют в разряд безэквивалентной лексики также имена собственные, географические наименования, названия учреждений, организаций, газет, пароходов и т.д.

А.В. Федоров считает безэквивалентными единицами отдельные термины: «в настоящее время в русском языке есть целый ряд научных терминов (в частности, философских и общественно-политических), еще не имеющих определенного лексического соответствия в других языках». [3, 62]

В числе самых значительных исследований безэквивалентной лексики с позиций теории перевода следует назвать Л.С. Бархударова, С. Влахова и С. Флорина, которые обстоятельно проанализировали практически все случаи безэквивалентности: слова-реалии, ряд терминов из различных терминосистем, специфические, свойственные тому или иному языку звукоподражания, междометия, обращения, всякого рода исключения из общепринятой нормы, имена собственные, а также собственно без-

эквивалентную лексику в узком смысле – «единицы, не имеющие по тем или иным причинам соответствий в языке перевода.

В.С.Виноградов рассматривает безэквивалентную лексику как слова, отражающие фоновые знания, «фоновую информацию» определенной национальной общности. Под фоновой информацией он подразумевает специфические факты истории и государственного устройства национальной общности, особенности национальной культуры в прошлом и настоящем, особые географические приметы, данные фольклора и этнографии.

Таким образом, осмысление, изучение и дифференциация безэквивалентных единиц как обширной многослойной лексической группы в теории и практике перевода нашли выражение в многообразных определениях этой категории слов. Однако определения безэквивалентной лексики, которое удовлетворяло бы всех исследователей, пока нет. Отсюда нет и ясности в классификации этой обширной и сложной группы слов, четко не очерчены ее границы.

С иных, дидактических, позиций безэквивалентная лексика характеризуется лингвострановедами. Если теория перевода озабочена особенностями передачи этих слов на другой язык, то для лингвострановедения важнее их смысловое содержание, поскольку они являются важнейшим средством информации об истории, культуре, быте, традициях и обычаях народа и нуждаются в дополнительном комментировании. Лексика, столь важная с дидактической точки зрения, так определяется Е.М. Верещагиным и В.Г. Костомаровым: «Слова, план содержания которых невозможно сопоставить с какими-либо лексическими понятиями, называются безэквивалентными. Такие слова в строгом смысле непереводимы». [2, 56]

С точки зрения лингвострановедения эти авторы классифицировали и безэквивалентный

пласт лексики [5, 92]:

– советизмы;
– слова нового быта;
– наименования предметов и явлений традиционного быта;
– историзмы;
– лексика фразеологических единиц;
– слова из фольклора;
– слова нерусского происхождения - тюркизмы, украинизмы и т.д. Сюда же они относят слова-варваризмы, что методически важно для понимания специфики различных культур.

Лингвострановедческую классификацию безэквивалентной лексики дополняют Г.Д. Томахин, Б.Н. Павлов, Н.В. Подольская, М.И. Гореликова, Н.И. Формановская, Ю.А. Федосюк, С.С. Волков и др.

Г.Г. Панова, сравнивая переводческую и лингвострановедческую классификации безэквивалентной лексики, приходит к выводу: «специалисты обеих областей филологии считают, что это сложный комплексный разряд лексики, включающий разнообразные группы слов» [3, 19-21]. При этом лексические группы двух классификаций в основном совпадают.

Таким образом, значения термина «безэквивалентная лексика» в переводоведении и лингвострановедении чрезвычайно близки. Различие – в целях исследования этого вида лексических единиц и особенностях их функционирования.

Полная невозможность найти какое бы то ни было соответствие слову подлинника, явление безэквивалентности в чистом виде, встречается относительно редко. Она возникает тогда, когда слово оригинала обозначает местное явление, которому нет соответствия в быту и в понятиях другого народа.

В настоящее время в русском языке есть ряд научных терминов, еще не имеющих определенного лексического соответствия в других языках. Таковы термины «закономерность», «идейность», «партийность», которые вызывают трудности при переводе на некоторые западноевропейские языки и требуют расширительно-описательного перевода в применении к контексту.

Отсутствие точных и постоянных лексических соответствий тому или иному термину отнюдь не означает:

– ни невозможности передать его смысл в контексте (хотя бы и описательно и не одним словом, а несколькими);
– ни его непереводимости в будущем

История каждого языка свидетельствует о постоянных изменениях словарного состава в связи с постоянными изменениями в жизни общества, с развитием производства, культуры, науки.

К лексике с культуроспецифическим компонентом значения относится безэквивалентная лексика, которая выявляется при сопоставлении двух культур. Обычно под безэквивалентной лексикой понимают слова и словосочетания, не имеющие эквивалентов в одном из сопоставляемых языков по следующим причинам:

– в силу отсутствия в жизни его носителей соответствующих реалий;
– из-за отсутствия в нем лексических и фразеологических единиц, обозначающих соответствующие понятия.

Без знания безэквивалентной лексики невозможно понять реалии и специфические слова-понятия других народов. Именно через безэквивалентную лексику мы постигаем культуру, обычаи, традиции народов. Безэквивалентная лексика обычно заимствуется из языка в язык.

Безэквивалентная лексика окажется совершенно необъятной группой слов (и словосочетаний), практически включающей чуть ли не всю лексику данного языка; исключение составляют значительная часть терминов, небольшое количество общеязыковой лексики и некоторое число имен собственных.

Безэквивалентными грамматическими единицами могут быть как отдельные морфологические формы и части речи, так и синтаксические струк-

туры. Как и соответствия, безэквивалентные единицы выявляются только по отношению к одному из пары анализируемых языков.

Таким образом, в русском языке можно выделить пять групп безэквивалентной лексики:

– еще остающиеся советизмы (комсомолец, Верховный Совет, колхоз и т.д.) и слова-наименования советского быта (субботник, стенгазета и т.д.);

– слова-наименования традиционного быта (квас, валенки, городки, ушанка и т.д.);

– лексика фразеологических единиц (Мамаево побоище, отложить в долгий ящик, подковать блоху, филькина грамота и т.д.);

– историзмы (кириллица, губерния, крепостной, бурлак и т.д.);

– фольклорная лексика (добрый молодец, чудо-юдо, жар-птица и т.д.);

– слова, заимствованные у народов России и бывшего СССР (шашлык, тюбетейка и т.д.).

Количественно безэквивалентная лексика занимает существенное место в словарном составе языка и потому не может опускаться при его изучении. Хотя число таких слов не очень велико, но они отражают самое существенное в культуре народа.

Таким образом, к безэквивалентной лексике (по Е. М. Верещагину и В. Г. Костомарову) относят обозначения специфических для данной культуры явлений (гармошка), которые являются продуктом кумулятивной (накопительной) функции языка и могут рассматриваться как вместилища фоновых знаний [2].

Эти слова обозначают предметы или явления, которые не имеют соответствий в другой культуре.

По классификации В.С. Виноградова слова-реалии подразделяются на 6 групп:

1. Бытовые:

– одежда и обувь: кимоно, лапти;

– строения и предметы: изба, сауна, самовар;

– реалии-меры и реалии-деньги: аршин, рубль;

2. Реалии природного мира:

– термины физической географии: степь, фиорд, прерия, саванна;

– эндемики: кенгуру, баобаб;

3. Этнографические реалии:

– обычаи, ритуалы, игры: вендетта, тамада, лапта;

4. Мифология и культы: Дед Мороз, тролль, ксендз;

5. Общественно-политические реалии: перестройка, виги и тори, большевики;

6. Ономастические реалии-антропонимы (имена известных личностей, требующиекомментариев), топонимы;

7. Ассоциативные (анималистические символы, цветосимволы, аллюзии) [6].

Лакуны – это то, что «в одних языках и культурах обозначается как отдельности, а вдругих не сигнализируется, то есть не находит общественно закрепленного выражения» [7].

В самом общем понимании под лакуной подразумевают несовпадение при сопоставлении понятийных, языковых, эмоциональных и других категорий двух или нескольких лингвокультурных общностей. Два слова, являющиеся переводными эквивалентами в двух разныхязыках, зачастую связаны с нетождественным содержанием в культуре этих народов. Это связано с отличиями в познавательной деятельности этих народов, разным социально-историческим опытом и т. д. Приведем примеры безэквивалентных единиц и лакун в английском и русском языках. Например, в английском языке: *gown, bible-clerk, after-born, alien child, public school, dresser, multicompany*. В русском языке: *пионер, общежитие, попустительство, воспитанник, банщик, витязь, тамада,ухнет в никуда.*

Целью данной статья является рассмотрение безэквивалентной лексики как предмета лингвокультурологического анализа. Задача заключается в анализе безэквивалентной лексики как комплексной межуровневой лингвокультурологической единицы.

Методика лингвокультурологического анализа. Лингвокультурологический анализ безэквивалентной лексики и лакун целесообразно, по мнению В.В.Воробьева, производить через представление семиотической модели Ч.Морриса, Так, в своей известной работе культурная составляющая лингвокультуремы баня наглядно представлена с точки зрения описания языковой и внеязыковой семантики лингвокультуремы через представление семиотической модели [Воробьев В.В. Лингвокультурология (теория и методы). – М.: Изд-во РУДН, 1997. – 331., С.36-37].

Согласно данной модели, в современной семиотике выделяют 3 уровня исследования знаковых систем: синтактика – отношения между знаками и способами их употребления; семантика – отношения между знаком и смыслом, их содержанием; прагматика – отношения между знаковыми системами и теми, кто пользуется ими [8]. Кроме того, немецкий философ, логик и семиотик Г. Клаус выделил еще один аспект семиотики, имплицитно присутствующий в семантике: отношение «знак (единица) – предмет». Эти отношения называются сигматическими, а дисциплина, их изучающая, – сигматикой [9].

Выделение сигматики открывает выход в предметно-понятийный, внеязыковой мир, сигматические отношения характеризуются национально-культурной значимостью. Таким образом, с позиции современной семиотики лингвокультурема, объединяя в себе языковое значение и культурный смысл, является сложной комплексной единицей, состоящей из четырех различных аспектов, затрагивающих практически все уровни языка: синтактики, семантики, прагматики и сигматики.

Таким образом, лингвокультурема, объединяя в себе языковое значение и культурный смысл, отличается от знака (слова как собственно языковой единицы) по содержанию, но совпадает с ним по форме; она представляет собой целое инокультурное (иноэтническое) явление; следовательно, как комплексная межуровневая единица, лингвокультурема может быть охарактеризована комплексно,

с различных сторон, в рамках семиотической модели языка, что предполагает обращение к различным уровням языка.

Ниже представлена таблица 1 с описанием семиотической модели Ч.Морриса.

Таблица 1.

Семиотическая модель Ч.Морриса

Уровни исследования знаковых систем	Характеристика уровней
Синтактика	Отношения между знаками и способами их употребления.
Семантика	Отношения между знаком и смыслом, их содержанием.
Прагматика	Отношения между знаковыми системами и теми, кто пользуется ими.
Сигматика (Г.Клаус)	Отношение «знак (единица) – предмет»

Приведем в качестве примера отрывок из стихотворения «Домик в Коломне» А.С.Пушкина:

Играть умела также на гитаре
И пела: Стонет сизый голубок,
И Выду ль я, и то, что уж постаре,
Всё, что у печки в зимний вечерок,
Иль скучной осенью при самоваре,
Или весною, обходя лесок,
Поет уныло русская девица,
Как музы наши, грустная певица.

В приведенном отрывке национальная картина мира создается при помощи таких лингвокультурем, как: названий русских песен (“Стонет сизый голубок”,“Выду ль я”), слов печка (-к- здесь не суффикс уменьшительности: печка- то же, что печь), лесок (с уменьшительно- ироническим оттенком), девица , самовар, вечерок.

Для доказательства межуровневого характера лингвокультуремы возьмем для анализа лингвокультурему «самовар» как образец русского культурно-языкового явления. Так, лингвокультурологический анализ лингвокультуремы предполагает:

1. Характеристику лексического значения слова, ограниченное представлением о предмете как представителе класса однородных предметов, содержащем наиболее существенные признаки (указание на материал, на назначение) по данным толковых словарей: самовар – металлический сосуд для кипячения воды с краном и внутренней топкой в виде высокой трубки, наполняемой углями [10, 618].

2. Описание внеязыковой семантики, которая вместе с языковой семантикой раскрывает представление о реалии как предмете национальной культуры, материальной и духовной, по данным энциклопедических словарей. Так, в «Толковом словаре живого великорусского языка» В.И. Даля в толковании слова «самовар» содержится внеязыковая информация, раскрывающая характеристику обозначаемого как русского культурного артефакта (самовар, самоварец, самоварчик; Самоваришка, самоварища-водогрейный, для чаю, сосуд, б.ч. медный, с трубою и жаровнею внутри, шутч. самодур, самограй. Ярс.-пош.: самогарь вят.-кур.: самогрей или кур.: самокипец. Самоварник, -ница – любитель самовара, чая; самоварницы – чайные торговки, бол. на гуляньях. // Самоварник, самоварщик – медник, самоварный мастер; самоварничать – чайничать, наслаждаться питьем чая. Например: «Купчихи в поле выехали самоварничать» [11, 31].

Таким образом, сведения о предмете как явлении национальной культуры дополняют собственно лингвистическое значение слова, при этом отчетливо проявляется различие, с одной стороны, между словом как языковой единицей, а с другой – единицей лингвокультурологического уровня как единства собственно языкового и внеязыкового содержания.

3. Анализ с точки зрения синтактики, характеризующей парадигматические (синонимические и гипонимические отношения: самовар – медный, металлический, электрический, дровяной и т.д.) и синтагматические (линейные, функциональные отношения единиц, их позиции в тексте, их типовая сочетаемость: разжечь самовар, вскипятить самовар, самоварничать и т.д.) отношения знака в семиотической системе.

4. Употребление лингвокультуремы в пословицах, поговорках, фразеологизмах, в поэтических произведениях национальной литературы и т.д. Так, лингвокультурема «самовар» играет важную роль в жизни крестьянской семьи на Руси, слово «самовар» - это не только явление материальной культуры, это образ домашнего очага, хозяйства, которое ведет человек. Например, это значение передается и в загадках: Стоит козелок на маленьких ножках, пышет и дышит, а души нет; В небо дыра, в землю дыра, посередь огонь да вода; Медный бес на стол залез; Стоит ферт – подбоченившись; Стоит поп на мосту, кричит: «Всех оболью»; По краям вода, а в середине огонь; Четыре ноги, два уха, один нос да брюхо.

Лингвокультурная значимость реалии наглядно выявляется через показ эстетических возможностей слова, демонстрацию его изобразительных возможностей в национальном восприятии мира. В приведенном нами отрывке национальный колорит художественного произведения создается всей совокупностью названных выше лингвокультурем: они рисуют не только зрительный, но и звуковой и даже осязательный образ ситуации (у печки, у самовара хорошо, тепло, уютно), передают характер русской песни, задушевной, согретой печалью. Вся эта культурная информация вызывает в сознании человека устойчивую сеть ассоциаций, связанных с неосознаваемым носителем русской культуры ощущением родного, близкого – своего.

Произведем лингвокультурологический анализ на примере лингвокультуремы «изба», представляющей русское национальное жилище.

Русское жилище, как и жилище любого народа, имеет много разных типов. Но есть общие черты, которые характерны для жилья разных слоев общества и разных времен. Прежде всего, русское жилище – это не отдельный дом, а огражденный двор, в котором сооружалось несколько строений, как жилых, так и хозяйственных. Жилые строения носили наименования: изба, горница, повалуши, сенник. Слово «изба» служило общим названием жилого строения, поэтому чаще всего русские дома назывались избами. Слово «изба» происходит от древнеславянского «истьба» (ударение на «и»). («Истьбой» или «истопкой» в летописях назвали отапливаемый жилой сруб в отличие от клети, неотапливаемого сруба.) Изба - это русское срубное жилище, преимущественно сельское, а до 17-18 веков оно было и городским. Сруб (иструб) - деревянное сооружение без пола, перекрытий, лестниц, дверей и оконных рам, возведенное из горизонтально уложенных бревен или брусьев.

Народное деревянное жилище в России всегда имело много особенностей, сохранившихся иногда до нашего времени, различаясь даже в разных местностях. Соответственно, было много типов изб. Тип зависел от расположения клетей между собой и их количества (двойни, тройни, четверни и т.д.), от количества внутренних стен (пятистенная, крестовая), от способа отопления, расположения двора и т.д.

Большинство сохранившихся изб относится к середине 19-го века. Изб, построенных до конца 18-го века, не было уже до революции. Это объясняется тем, что избы – жилые отапливаемые помещения – изнашиваются быстрее церквей. В настоящее время избы являются памятником деревянной архитектуры, еще во второй половине 20-го века в ряде мест России устраиваются музеи на открытом воздухе, в которые переносят образцы зодчества, в том числе и жилые дома. Так были созданы прекрасные музеи на острове Кижи, под Суздалем, Малые Карелы под Петрозаводском и т.д.

Таким образом, традиционно являясь национальным видом жилища, лингвокультурема «изба» относится к безэквивалентной лексике. В “Словаре русского языка” С.И.Ожегова эта лингвокультурема получила следующую трактовку: «изба – деревянный крестьянский дом»[10, 213].

Этимология данной лингвокультуремы следующая: «изба – общеслав. Этимология точно не установлена. Традиционно считается заимствованным из германского языка с начальным ц неясного происхождения, как в иволга, изумруд и т.п. Др.-рус. истьба < изба после падения слабого редуцированного ъ, упрощения стб в сб и последующего озвончения с перед б. В таком случае первоначально – «постройка с печью, баня» (ср. др.-в.-нем. stuba «теплое помещение, баня»). Ср. и см. комната, камин. Требуют дополнительной аргументации попытки толковать слово изба как родственное диал. стебель «ствол (дерева)», болг. стобор «дощатый забор», сербохорв. стобор «двор», латышск. stabs «столб» и пр. (см. стебель). Сближение изба с истопить является вторичным и обязано народной этимологии» [12, 103-104].

В «Словаре русского языка» под ред. А.П. Евгеньевой данная лингвокультурема определяется следующим образом: «Изба, -ы, вин. избу, мн. избы. ж. 1. деревянный крестьянский дом. 2. Внутреннее помещение крестьянского дома; жилое помещение» [13, 634].

Таким образом, лексическое значение ограничивается представлением о предмете как представителе класса однородных предметов, содержащем наиболее существенные признаки (указание на материал, на назначение). Однако такой дефиниции явно недостаточно, чтобы получить представление о самой реалии как предмете материальной культуры. Такую «культурную картину» представляют словари энциклопедического типа, а также частично и некоторые толковые словари. Так, в «Толковом словаре живого великорусского языка» В.И. Даля в толковании существительного «изба» содержится внеязыковая информация, раскрывающая характеристику обозначаемого как русского культурного артефакта («крестьянский дом, хата; жилой деревянный дом; жилая горница, комната, чистая (не стряпная) половина; людская или кухня, жилье для прислуги в барском дворе; стар. внутр. покой в деревянном дворце царском; стар. палата, приказ, присутств. место. Избушкой зовут и будку, балаган, сторожку, караулку, маленькое жилье разного вида. В Сибири избой зовут отдельную стряпную, кухню, и переднюю избу, в отличие от кути, задней, стряпной, бабьей избы. Сборная изба - наемная миром, для сходок и для приезжих старшин. Черная или курная изба - в которой печь без трубы. Белая изба, или изба по-белому - в которой печь с трубою и потому нет копоти. Красная изба - с красным, т.е. большим или переплетным окном и т.д.» [11, 34].

В Большой советской энциклопедии об избе читаем: «Изба – русский срубный жилой дом (преим. сельский, до 17-18 вв. – и городской); в узком смысле слова – отапливаемое помещение, комната (древнерусское «истьба, истобка», упоминается в летописях с 10в.). В южнорусских районах, в Белоруссии и на Украине сельский жилой дом, в т.ч. срубный, называемый хатой. Крестьянский дом мог состоять: из одной избы; избы с сенями; избы, сеней и клети; двух изб с сенями. В избе зимой сосредоточивалась вся жизнь семьи, здесь держали и молодой скот. Изба с древней беструбной печью называлась курной, или черной, изба с трубой – белой. Планировка избы определялась положением печи. По диагонали от печи был передний, или красный, угол, где висели иконы, стоял стол и скамьи; перед ее устьем – середа, или бабий кут, где хозяйка готовила пищу; по диагонали от середы – кут с широкой лавкой – коником, на котором обычно спал хозяин дома и мужчины занимались домашними хозяйственными работами. Сбоку от печи наверху до стены настилали полати, внизу устраивали деревянный ящик – голбец. Строилась изба в основном из хвойных бревен, скреплявшихся на концах в обло (с выступающими концами бревен), реже – в лапу (с врубкой бревен на концах без остатка) и образующих 4-угольный венец. В зависимости от того, в какой от низа венец врубались

доски пола, образовывался подклет (высокий на Севере, средний или низкий в центр. р-нах). В центре и на Юге подклет чаще отсутствовал, а пол был земляным; для утепления делали завалинки. Кровля избы, деревянная на Севере, соломенная на Юге, опиралась на самцы, позднее – на стропила (тогда она бывала не только двух -, но и трех – и четырехскатной). Окна в черной избе были волоковые (маленькие, прорубленные в двух соседних венцах, задвигавшиеся задвижкой), в белой избе – т.н. косящатые, или красные (с рамами, закрытыми пузырем, слюдой, с 18-19в. стеклом, снаружи – ставнями). Двери одностворчатые, с порогом. В украшении избы сказывались художеств. вкус и мастерство рус. крестьянина. Силуэт избы венчали резной конек (охлупень) и кровля крыльца; фронтон украшали резные причелины и полотенца, плоскости стен – наличники окон, зачастую отражавшие влияние архитектуры города (барокко, классицизма и т.п.). Потолок, дверь, стены, печь, реже наружный фронтон расписывали. С развитием капиталистических отношений и классового расслоения крестьянства появились избы усложненного типа – пятистенки, в которых сруб разделен пятой рубленой стеной на два жилых помещения, и многокомнатные – с подвижной мебелью, дополнительными печами и др.» [14, 49-50].

Таким образом, сведения о предмете как явлении национальной культуры дополняют собственно лингвистическое значение слова, при этом отчетливо проявляется различие, с одной стороны, между словом как языковой единицей, а с другой – единицей лингвокультурологического уровня как единства собственно языкового и внеязыкового содержания.

Кроме семантического и внеязыкового аспектов слова как знаковой единицы, значимы парадигматические и синтагматические характеристики лингвокультурологической единицы, которые указывают на системные нелинейные отношения: гипонимические, например, изба-сборная, деревянная, рубленая, бревенчатая; синонимические: изба - дом, хата, терем, хоромы, хижина, дворец; названия составных частей: стряпная, людская или кухня, спальня, светлица, горенка, горница. Например, у В.И. Даля: «Изба делится на четыре угла: по одну сторону входа стряпной, бабий куть и печь; по другую - хозяйский куть или коник, от койки; прямо против печи - печной угол; прямо против коника - красный, с иконами и столом».

Синтагматические характеристики указывают на линейные, функциональные отношения единиц, их позиции в тексте, типовую сочетаемость: идти в избу, строить избу, рубить избу. Культурная семантика слова ярче проявляется в области безэквивалентной лексики, составляющей определенный тематический круг: изба, дом, хата, горница, палата, печь, куть, лавка, ларь, жернов, икона, залавок, амбар.

Указанная лингвокультурема закреплена также в ритуалах и обычаях, пословицах и фразеологизмах, например, с лингвокультуремой «изба»: 1. Изба жилом (жильем) пахнет. 2. Коли изба крива - хозяйка плоха. 3. Всего дороже честь сытая, да изба крытая. 4. Своя избушка - свой простор. 5. Всякая избушка своей кровлей крыта. 6. Добрая то речь, что в избе есть печь. 7. Не красна изба углами, красна пирогами.8. Они живут ни вон, ни в избу. 9.Лавка бела, да изба гола. 10.Не брався за топор, избы не срубишь. [15, 254].

Лингвокультурема «изба» играет огромную роль в жизни крестьянской семьи на Руси, особенно значима сема «место, предназначенное для жилья», слово «изба» - это не только материальное строение, это образ домашнего очага, хозяйство, которое ведет человек. Пословицы передают гостеприимство русского народа. Образ избы используется в русских народных сказках: Избушка на курьих ножках, пирогом подперта, блином покрыта. Избушка, избушка на курьих ножках, повернись к лесу задом, ко мне передом!

С лингвокультуремой «изба» связаны различные народные приметы, поверья, загадки: Одна труба, четыре избы, восемь улиц; Над бабушкиной избушкой висит хлеба краюшка; Заставливая избу, кладут под угол деньги - для богатства, шерсть - для тепла, ладан - для святости. Еще: В одной избе разными вениками не мети: разойдется по углам богатство; Под капель избы не ставят.

В старину у русского народа был обычай: избная помощь – устраивается тем, кто хочет рубить новую избу; полагается 100 бревен и столько же помощников, для вырубки и привозки по бревну.

Культурная специфика слова проявляется и во фразеологизмах: белая изба; черная изба; выносить сор из избы и т.д. [16, 255].

Образ русской избы ассоциируется в поэтических произведениях с домом, родным очагом, родиной: Потонула деревня в ухабинах, Заслонили избенки леса. Только видно, на кочках и впадинах, Как синеют кругом небеса. (С. Есенин. «Русь»)

Для С. Есенина изба – символ России, как российский, национальный поэт, он пишет о себе:

И теперь, когда вот новым светом
И моей коснулась жизнь судьбы,
Все равно остался я поэтом
Золотой бревёнчатой избы [17, 38].

Кроме того, изба – часть воспоминаний поэта о доме, о деревенском детстве: Изба крестьянская.

Хомутный запах дегтя,
Божница старая,
Лампады кроткий свет.
Как хорошо,
Что я сберег те
Все ощущенья детских лет [17, 38].

Таким образом, внеязыковой культурный смысл лингвокультуремы особенно ярко проявляется в пословицах, поговорках, фразеологизмах, в поэтических произведениях национальной литературы.

Языковая лингвокультурема «изба», воплощающая собой специфические и исконные явления в русской культуре, присутствует в художественных произведениях русских авторов. Об избе писали С. Есенин, С. Антонов, А. Толстой, Н.С. Лесков и др., например:

1. Потонула деревня в ухабинах,
Заслонили избенки леса.

Только видно, на кочках и впадинах,

Как синеют кругом небеса [17].

2. Вдруг все захотели пить, - вскочили в тёмные сени вслед за облаком пара и дыма из прокисшей избы. [18].

3. Чада кинулись в тёмную избу, полезли на печь, стучали зубами. Под чёрным потолком клубился тёплый, сухой дым, уходил в волоковое окошечко над дверью: избу топили по-чёрному [18].

4. На Варварке стоит низенькая изба в шесть окон. С коньками и петухами, - кружало- царёв кабак [18].

5. В курной избе топилась печь, дым стоял такой, что человека было видно лишь по пояс, а на полатях вовсе не видно [18].

6. В этой комнате жили и учились две сиротки, которых мать Агния взяла из холодной избы голодных родителей… [19].

Заключение. Таким образом, данный лингвокультурологический анализ позволяет сделать вывод о том, что лингвокультуремы «изба» входит в лексическую систему русского литературного языка и обладает ярко выраженной национально-культурной спецификой. Обозначая специфические для данной культуры явление материальной культуры (изба – традиционное национальное жилище для русской культуры), эта лингвокультурема относится к области безэквивалентной лексики и может вызвать непонимание сто стороны представителя другой культуры вследствие своей лакунарности.

Итак, лингвокультурологический анализ безэквивалентной лексики подтверждает комплексный межуровневый характер лингвокультуремы, представляющей собой диалектическое единство лингвистического и экстралингвистического (понятийного или предметного) содержания.

Таким образом, рассмотрение лингвокультуремы как сложной комплексной единицы возможно с позиции семиотики в рамках четырех аспектов изучения, затрагивающих практически все уровни языка: синтактики и сигматики, семантики и прагматики.

Список литературы

1. Маслова В.А. Лингвокультурология. – Учебное пособие. – М., 2001.

2. Верещагин Е.М., Костомаров В.Г. Язык и культура. – М.: Индрик, 2005. – 1040 с.

3. Иванов А.О. Безэквивалентная лексика. – СПб: Издательство Санкт- Петербургского университета, 2006. - 192с.

4. Бархударов Л.С. Язык и перевод. – М.: Издательство ЛКИ, 2010. – 240 с.

5. Красных В. В. Этнопсихолингвистика и лингвокультурология: курс лекций. – М.: ИТДГК «Гнозис», 2002. - 284 с.

6. Виноградов В.С. Введение в переводоведение. – М: Изд-во института общего и среднего образования РАО, 2001.

7. Жельвис В.И. К вопросу о характере русских и английских лакун. – М: Наука, 1977.

8. Моррис Ч.У. Основы теории знаков. Семиотика. – М., 1983.

9. Воробьев В.В. Лингвокультурология (теория и методы). – М.: Изд-во РУДН, 1997. – 331 с.

10. Ожегов С.И. Словарь русского языка // Под ред. Н.Ю. Шведовой. – 15-е изд., стереотип. – М.: Русский язык, 1984. – 816 с.

11. Даль В.И. Толковый словарь живого великорусского языка: В 4-х т. – М.: Русский язык, 1999.

12. Шанский Н.М., Боброва Т.А. Школьный этимологический словарь русского языка: Происхождение слов. – 3-е изд., испр. - М.: Дрофа, 2000. – 400 с.

13. Словарь русского языка: в 4-х т. /АН СССР, Ин-т рус. яз. // Под ред. А.П. Евгеньевой. – 2-е изд., испр. и доп. – М.: Русский язык, 1981. – Т.1. – 698 с.

14. Большая советская энциклопедия // Гл. ред. Прохоров А.М., 3-е изд. – М.: Изд-во «Советская энциклопедия», 1976. – Т. 24. - Кн. 1, с. 546.

15. Ю.Г. Круглов. Русские народные загадки, пословицы, поговорки. – М..: Просвещение, 1990. – 335 с.

16. Фразеологический словарь русского языка: Свыше 4000 словарных статей Л.А. Войнова, В.П. Жуков, А.И. Молотков, А.И. Федоров // Под ред. А.И. Молоткова. 4-е изд., стереотип. – М.: Рус. яз., 1986. – 543 с.

17. Есенин С.А. Собрание сочинений. В 6-ти томах. Т. 1, 2/ Под общ. ред. В.Г. Базанова, А.А. Есениной и др. – М.: Художественная литература, 1997.

18. Толстой А.Н. Петр Первый //Собрание сочинений. Том I.– М.: Худ. лит., 1963.– 228 с.

19. Лесков Н.С. Избранные сочинения. – М.: ОГИЗ Гос. Изд. Худ. лит. – 1945. – 566 с.

PHYSICS AND MATHEMATICS

МАТЕМАТИЧЕСКАЯ МОДЕЛЬ ДВИЖЕНИЯ ВЯЗКОГО СЛОЯ ПО СКЛОНУ ВОЗВЫШЕННОСТИ

Куралбаев З.
Профессор, доктор физико-математических наук
Алматинский университет энергетики и связи,
г.Алматы, Казахстан

MATHEMATICAL MODEL OF THE MOVEMENT OF A VISCOUS LAYER ALONG THE SLOPE OF A HILL

Kuralbaev Z.
Professor, Doctor of Physico-mathematical Sciences
Almaty University of Energy and Communications,
Almaty, Kazakhstan
DOI: 10.5281/zenodo.15294168

Аннотация

Изменение вязкостных слоев осадочных горных пород приводит к возникновению оползней под воздействием силы тяжести или других внешних факторов. Исследование процесса возникновения оползней осадочных горных пород, находящихся на поверхности возвышенности является актуальной проблемой для горных регионов. В статье предлагается использовать для таких исследований метод механико-математического моделирования, в результате которого получена математическая задача о квазилинейном уравнении параболического типа. Для решения полученной математической задачи использован конечно-разностный метод; была выбрана нелинейная неявная расчетная схема, на основе которой сформулирован алгоритм решения задачи и разработана компьютерная программа. Проведено математическое моделирование рассматриваемого процесса, в результате проведен численный эксперимент для различных возможных вариантов; в качестве исходных данных физических параметров взяты механические характеристики глинистых пород. Результаты исследования представлены в виде графиков и таблиц.

Abstract

Changes in the viscous layers of sedimentary rocks lead to the occurrence of landslides under the influence of gravity or other external factors. The study of the occurrence of landslides of sedimentary rocks located on the surface of high ground is an urgent problem for mountainous regions. The article suggests using the method of mechanical and mathematical modeling for such studies, as a result of which a mathematical problem on a quasi-linear equation of a parabolic type is obtained. To solve the resulting mathematical problem, a finite-difference method was used; a nonlinear implicit calculation scheme was chosen, on the basis of which an algorithm for solving the problem was formulated and a computer program was developed. Mathematical modeling of the process under consideration was carried out, as a result, a numerical experiment was conducted for various possible variants; the mechanical characteristics of clay rocks were taken as the initial data of physical parameters. The results of the study are presented in the form of graphs and tables.

Ключевые слова: осадочные породы, реологические свойства, ползучесть, механизм возникновения оползней, математическая и компьютерная модель.

Keywords: sedimentary rocks, rheological properties, creep, mechanism of occurrence of landslides, mathematical and computer model.

1. Введение

Одной из актуальных проблем для горных районов являются исследования, связанные с таким явлением как оползни, возникающие в высокогорных областях вследствие различных причин, в частности изменения вязкостных свойств материалов из-за природных или климатических процессов. Предполагается, что происходит движение некоторого верхнего слоя, состоящего из рыхлого грунта, который не способен выдерживать нагрузку собственного веса, поэтому происходит смещение. Такое геолого-горное явление представляет определенную угрозу сооружениям и населению, находящимся в таких районах.

При сохранении определенных геологических и климатических условий, в таких местах достаточно долгое время сохраняется устойчивое положение грунтовых материалов. Однако часто имеет место увлажнение и размытие горных пород дождевой или талой водой, что приводят к изменению вязкостных свойств материалов, составляющих верхние слои грунта. Либо под влиянием тектонических или техногенных процессов могут возникать ползущие движения верхних слоев возвышенностей под воздействием собственной тяжести. Исследования такого явления является *актуальным* по известным причинам [1,2,3,4].

Многолетние наблюдения и изучение таких процессов показывали [3,4,5], что осадочные гор-

ные породы, которые покрывают более 75% поверхности земной суши, обладают свойством ползучести. «Ползучесть – явление постепенного роста деформации во времени при постоянном напряжении и снижением прочности при длительном нагружении» [7, стр. 36]. Учитывая, что ползучесть является причиной таких явлений, как оползни, селевые потоки, течения ледников и других, в данной работе приведено теоретическое исследование их с помощью математического и компьютерного моделирования.

Данная работа посвящена компьютерному моделированию одного из вариантов механизма возникновения оползней, когда происходит опускание грунтов под воздействием собственного веса при изменении их реологических свойств. Здесь используется физическая модель «ползущих» течений в вязком слое [3,4], а для исследования рассматриваемого процесса - метод математического и компьютерного моделирования с проведением численного эксперимента.

2. Математическая модель задачи

В данном случае рассматривается вязкий слой определенной толщины (мощности), покоящийся на поверхности возвышенности и в начальный момент времени этот слой находится в устойчивом положении, отсутствует в нем какое-либо движение (Рис.1).

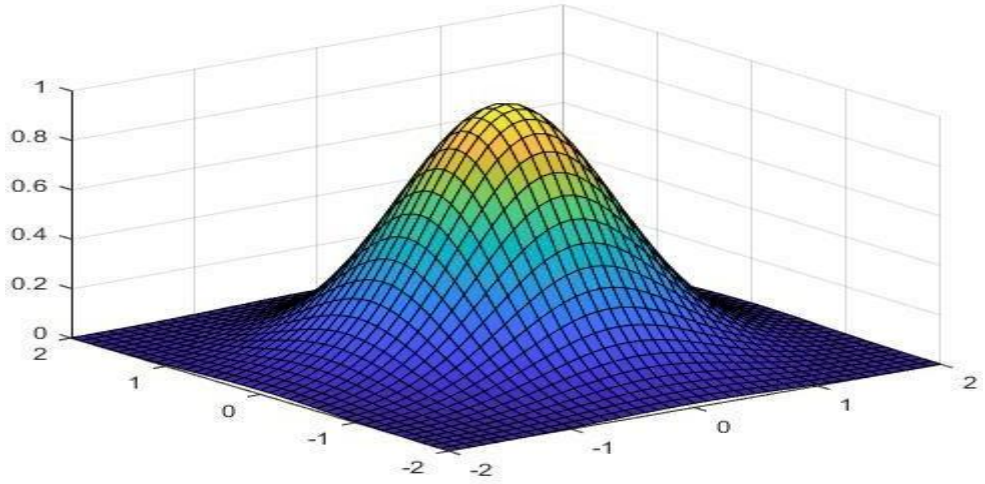


Рис.1 – Начальное положение возвышенности

Предполагается, что происходит снижение значения динамического коэффициента вязкости слоя, и из-за этого происходит движение материалов слоя вниз по склону возвышенности под воздействием собственного веса. Возникает необходимость создания математической модели этого процесса, и сформулировать математическую задачу.

Для создания математической модели рассматриваемого процесса определяются основные его параметры и вводятся соответствующие обозначения. Здесь принята прямоугольная система координат, в которой x и y - горизонтальные координаты, а z — вертикальная координата; ось z направлена вверх, обратно направлению вектора силы тяжести $\vec{g}$.

Для упрощения были использованы известные из гидродинамики допущения о «мелкой воде» [4]. Для проведения расчетов на компьютере использованы безразмерные параметры, для чего осуществлен переход к безразмерным параметрам. Проведен анализ слагаемых в безразмерных уравнениях, получены упрощенные математические зависимости, совокупность которых явилась математической моделью изучаемого процесса. Для описания свободной поверхности вязкого слоя получено следующее квазилинейное дифференциальное уравнение параболического типа в безразмерных переменных:

$$\frac{\partial u}{\partial t} = \frac{ER}{3}\left[\frac{\partial}{\partial x}(u-\xi)^3 \cdot \frac{\partial u}{\partial x} + \frac{\partial}{\partial y}(u-\xi)^3 \cdot \frac{\partial u}{\partial y}\right] (1)$$

Основание вязкого слоя описано следующей функцией [6-8]:

$$\xi(x,y) = (1-f)\cdot e^{-\frac{x^2+y^2}{b}} \cdot \left[1 - \frac{2(x^2+y^2)}{b}\right] (2)$$

где f — первоначальная толщина вязкого слоя.

В уравнении (1) имеется единственный безразмерный параметр $ER = \frac{\rho g H^3}{\eta UL}$, который зависит от физических и геометрических свойств вязкого слоя; где ρ — плотность материала и □□□динамический коэффициент вязкости слоя, g —ускорение силы тяжести, U, H, L — характерные величины: скорость, вертикальный и горизонтальный размеры слоя соответственно.

Решение уравнения (1) позволяет вычислить значения скоростей движения материалов слоя по следующим формулам:

$$\begin{cases} u_x = \frac{ER}{2}\cdot\frac{\partial z}{\partial x}\cdot[(z-u)^2 - (u-\xi)^2], \\ u_y = \frac{ER}{2}\cdot\frac{\partial z}{\partial y}\cdot[(z-u)^2 - (u-\xi)^2]. \end{cases} (3)$$

Предполагается, что в начальный момент времени ($t = 0$), когда вязкий слой находится в состоянии устойчивого положения, его свободная поверхность была описана следующей безразмерной функцией:

$$u(x,y,0) = e^{-\frac{x^2+y^2}{b}} \cdot \left[1 - \frac{2(x^2+y^2)}{b}\right]. (4)$$

Из допущения о малости характерного вертикального размера слоя в сравнении сего характерным горизонтальным размером, можно с достаточно большой точностью предположить выполнение следующего условия:

$u \to 0$ при условии $x \to \pm\infty, y \to \pm\infty$, (5)

Приняты следующие граничные условия:

$$\begin{cases} x = \pm d, u(\pm d, y, t) = 0; \\ y = \pm d, u(x \pm d, t) = 0; \end{cases} \quad (6)$$

Сформулирована постановка математической задачи (1)-(6). В связи с тем, что относительно переменных x и y имеется симметрия, можно ограничиваться рассмотрением одномерной задачи. Для решения данной задачи использован конечно-разностный метод и алгоритм нелинейной расчетной схемы [9]:

$$u_i^{j+1} - u_i^j = \frac{ER}{3h} \cdot \tau \cdot [(u_{i+1}^{j+1} - \xi_{i+1})^3 \cdot \frac{u_{i+1}^{j+1} - u_i^{j+1}}{h} - \left(u_i^{j+1} - \xi_i)^3 \cdot \frac{u_i^{j+1} - u_{i-1}^{j+1}}{h}\right], \quad (7)$$

$i = 1,2,3,\dots,n;\ j = 1,2,3,\dots,m;$

где $n -$ количество точек по переменной x, а $m -$ по переменной t.

Полученные алгебраические уравнения (7) являются нелинейными относительно неизвестных $u_i^j, i = 1,2,3,\dots,n;\ j = 1,2,3,\dots,m.$ Для решения таких уравнений может быть использован итерационный метод. В данном случае вводятся следующие обозначения:

$u_i = u_i^{j+1} -$ вычисляемое в следующей итерации значение искомой функции для $j + 1$;

$w_i = u_i^{j+1} -$ вычисленное в предыдущей итерации значение искомой функции для $j + 1$;

$v_i = u_i^j -$вычисленное значение искомой функции в предыдущий момент времени (для j).

Учитывая введенные обозначения, из формулы (7) можно получить следующую систему уравнений:

$$A_i \cdot u_{i-1} - (1 + A_i + A_{i+1}) \cdot u_i + A_{i+1} \cdot u_{i+1} = -v_i, \quad (8)$$

где $i = 1,2,3,\dots,n;\ j = 1,2,3,\dots,m.$

Коэффициенты этой системы уравнений определены формулой:

$$A_i = \frac{ER}{3h} \cdot \tau \cdot (w_i - \xi_i)^3, i = 1,2,3,\dots,n. \quad (9)$$

Итак, поставленная задача приведена к системе алгебраических уравнений (8). Для каждого значения параметра j данную систему можно рассматривать как систему уравнений с «трехдиагональной матрицей».

3. Алгоритм решения задачи

Расчетная схема, которая основана на формулах (7), представляет собой итерационный процесс. В качестве нулевого приближения для метода итерации используется значение искомой функции на предыдущем слое (j).

Внутри итерации будут выполнены следующие операции:

1. Определены значения коэффициентов системы уравнений (8) по формулам (9):

2. В прямой прогонке будут определены неизвестные коэффициенты:

$$\alpha_1 = 1;\ \beta_1 = 0. \quad (10)$$

$$\begin{cases} \alpha_{i+1} = \frac{A_{i+1}}{1 + A_i + A_{i+1}}, \\ \beta_{i+1} = \frac{v_i + A_{i+1} \cdot \beta_i}{1 + A_i + A_{i+1}}, \end{cases} \quad i = 1,2,3,\dots,n - 1. \quad (11)$$

3.В обратной прогонке будут определены значения искомой функции по формулам:

$$u_n = 0;\ u_i = \alpha_{i+1} \cdot u_{i+1} + \beta_{i+1}, i = n - 1, n - 2, \dots, 1. \quad (12)$$

4. Итерационный процесс продолжается до тех пор, пока не будет выполнено условие заданной точности вычислений:

$\max\{|u[i] - w[i]|\} < \varepsilon,$

где $\varepsilon -$малое положительное число.

4. Численная реализация алгоритма

Проведен численный эксперимент с помощью разработанной компьютерной программы. В данном случае решение задачи зависит только от одного безразмерного параметра ER. Элементарные расчеты показали, что для большинства осадочных пород, в том числе глинистых, покрывающих значительную часть земной поверхности, порядок значений безразмерного параметра ER могут быть в пределах 0,01; 0,1; 1,0; 10. Для этих значений данного параметра были проведены расчеты.

В план численного эксперимента включены следующие данные:

- для безразмерного параметра ER приняты четыре значения: $ER = 0{,}01;\ ER = 0{,}1; ER = 1{,}0; ER = 10;$

- шаги по независимым переменным: $h = 0{,}002;\ \tau = 0{,}0001;$

- первоначальная толщина слоя принята постоянной и равной $f = 0{,}3;$

- для определения точности вычислений принято $\varepsilon = 0{,}0001;$

- расчеты проводились для промежутка времени $0 \le t \le 10;$

- промежуток по горизонтальной переменной составил $-3 \le x \le 3.$

Результаты численного решения задачи. В результате численной реализации алгоритма решения данной задачи получены результаты, которые представлены в виде графиков. Определены положения вязкого слоя для различных моментов времени в промежутке 0 t ≤≤ 10 для разных значений безразмерного параметра ER. Из-за того, что при ER = 0,01, когда динамический коэффициент вязкости имеет достаточно большое значение, изменение первоначального положения вязкого слоя оказалось незначительным, график для этого случая здесь не представлен.

На рисунках 2-4 показаны некоторые положения вязкого слоя в момент времени t =10 для значений параметра ER: 0,01; 0,1; 1,0; 10.

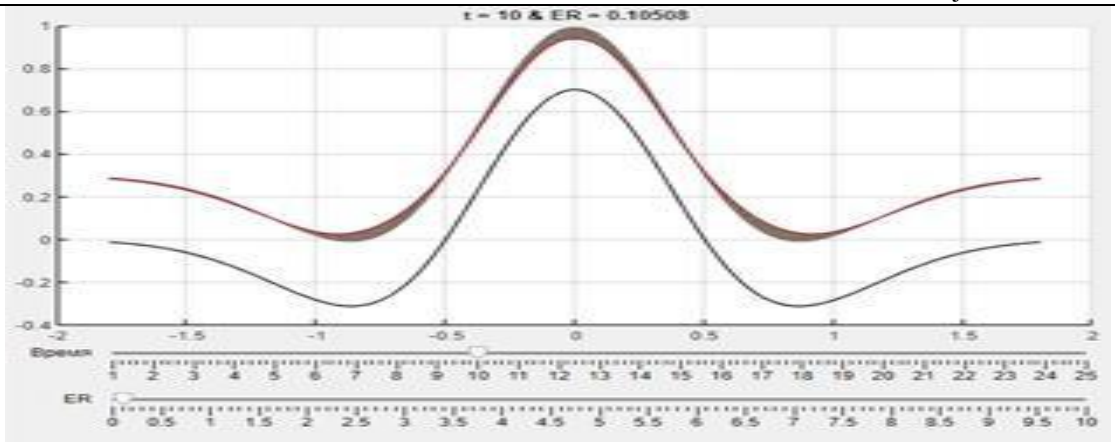


Рис. 2 – Положение вязкого слоя при $t = 10$ для $ER = 0{,}1$.

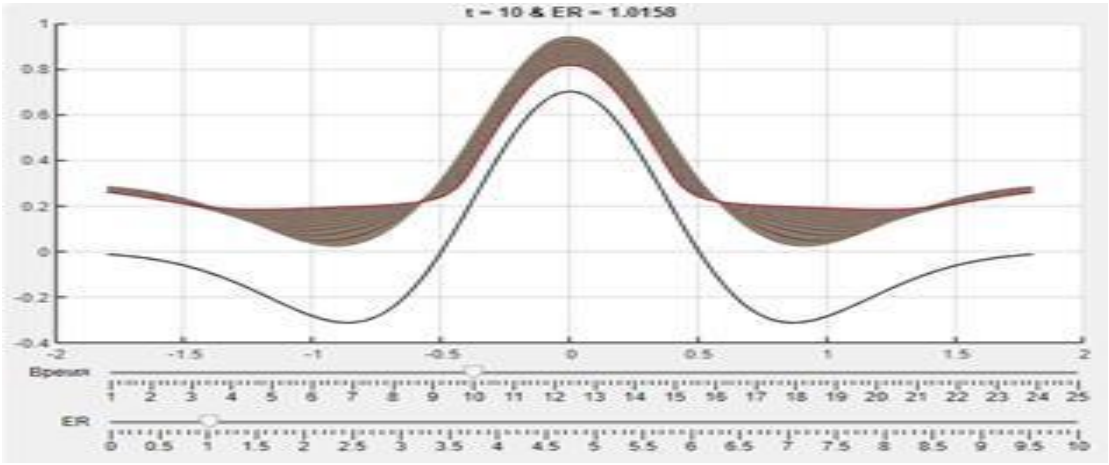


Рис. 3 – Положение вязкого слоя при $t = 10$ для $ER = 1$.

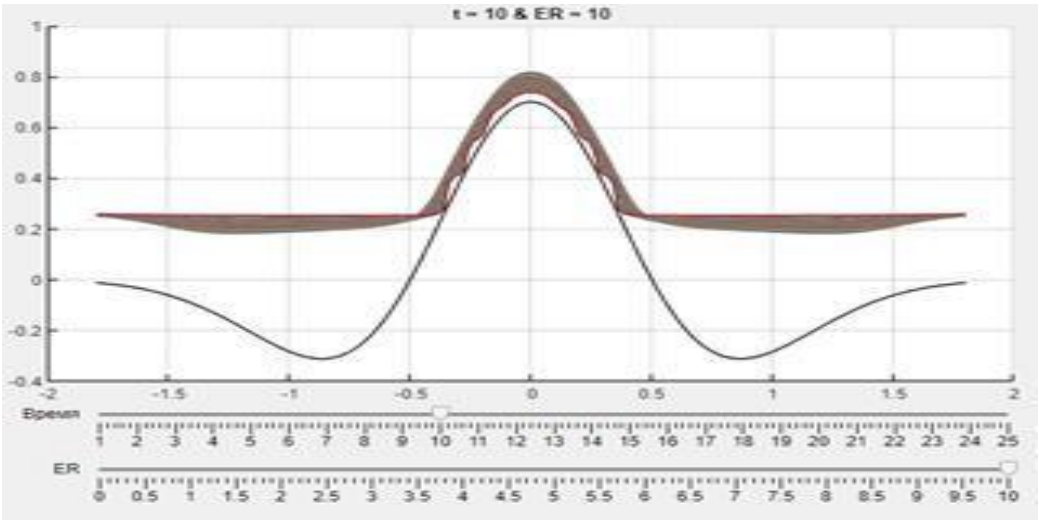


Рис. 4 – Положение вязкого слоя при $t = 10$ для $ER = 10$.

5. Анализ результатов

В связи с тем, что основным параметром, влияющим на рассматриваемый процесс, является изменение значения динамического коэффициента вязкости, изменение этого параметра было учтено в качестве основного фактора при исследовании данного процесса. Следовательно значения параметра *ER*, зависящего обратно пропорционально от динамического коэффициента вязкости, были использованы для численного эксперимента.

Из анализа численных результатов следует, что при достаточно большом значении динамического коэффициента вязкости рассматриваемого слоя (ER □ 0,1 и ER □ 0,01) изменение первоначального состояния слоя будет незначительным. В самом деле, опускание максимальной точки (вершины) внешней поверхности слоя за промежуток времени t □ 10 составляет для случая, когда ER □ 0,1, всего на 6,15% (уменьшение от 1 до 0,9385), а для случая, когда всего на 1.09% (то же самое, от 1 до 0,9891). Для сравнения можно привести дан-

ные для $ER = 1$ и $ER = 10$. В двух последних случаях коэффициент вязкости будет иметь сравнительно небольшие значения. Опускание материалов вязкого слоя при этом будет значительным, опускание вершины слоя составит для случая $ER = 1$ около 18%, а для $ER = 10$ около 20%.

Кроме этого, следует отметить, что из-за опускания материалов слоя происходит утонение верхних частей (Фиг.4), и за счет этого процесса происходит утолщение нижних частей рассматриваемой области, где накапливаются осадочные породы, толщина которых достигает значительных размеров. Утолщение слоя осадочных пород на самом нижнем уровне (на подошве) возвышенности для различных вариантов составляли от 13,6% до 84,2%.

6. Заключение

Следует отметить, что результаты решения данной задачи позволяет теоретическое (математическое) описание механизма возникновения оползней, залегающих на возвышенных местностях. Проведена оценка изменений, происходящих из-за оползней при уменьшении коэффициента вязкости осадочных пород. Полученные результаты исследования позволяют оценить масштабы катастрофических последствий из-за возникновения оползней.

Список литературы

1. Troncone A., Conte E., Donato A. Two and three-dimensional numerical analysis of the progressive failure that occurred in an excavation-induced landslide. Engineering Geology. 2014; 183: 265–275. https://doi.org/10.1016/j.enggeo.2014.08.027

2. Leroueil S. Natural slopes and cuts: movement and failure mechanism. Geotechnique. 2001;51(3):197–243. https://doi. org/10.1680/geot.2001.51.3.197

3. Дьяченко В .В., Туркин В. А., Воробьев А.Е., Кукарцев В. В., Тынченко Я. А. Механизмы формирования оползней повышенной опасности (быстрых и протяженных). -Горная промышленность. - №4, 2024. - стр. 96 - 100. https: //mining-media.ru/ru/article/newtech/18888/

4. Ержанов Ж. С. Механика тектонического развития Земли // Известия АН СССР. – Серия геологическая. –М.: Наука, 1973. – № 5. - С. 35 -45.

5. Bill Bruce G., Gurey Donald R., Marshal Grant A. Viscosity estimates for the crust and upper mantle from patterns of lacustire shoreline deformation in the Eastern Great Basin // Journal of Geophysical Researh. B. – 1994. 99. Vol 11. P. 46 -58.

6. Ержанов Ж. С., Сагинов А.С., Гуменюк Г.Н., Векслер Ю. А., Нестеров Г. А. Ползучесть осадочных горных пород. – Алма-Ата: Наука, 1970. - 208 с.

7. Crosta G.B., Imposimato S., Roddeman D.G. Numerical modelling of large landslides stability and runout. Natural Hazards and Earth System Science. 2003;3(6):523–538. https://doi.org/10.5194/nhess-3-523-2003

8. Абатуров В.Г. Физико-механические свойства горных пород и породоразрушающий буровой инструмент. – Тюмень: Изд-во «Нефтегазовый университет», 2007. -238 с.

9. Остапенко В. В. О применении теории мелкой воды для моделирования волновых течений с гидравлическими борами. // Прикладная механика и техническая физика. - 2018, Том 82, Выпуск 4, С. 444 -458.

REGULARIZATION AND UNIQUENESS OF SOLUTIONS TO A SYSTEM OF VOLTERRA INTEGRAL EQUATIONS OF THE FIRST KIND WITH THREE INDEPENDENT VARIABLES

Zulpukarov Zh.
Candidate of Physical and Mathematical Sciences, Associate Professor of Osh Technological University named after M. M. Adyshev, Kyrgyz Republic
Alieva Zh.
Senior Lecturer of the Osh State Pedagogical University Kyrgyz Republic
DOI: 10.5281/zenodo.15294177

Abstract
In this paper, we prove the uniqueness of the solution and construct regularizing operators M.M. Lavrentiev for solving linear systems of Volterra integral equations of the first kind with three independent variables in the space $C_n(G)$.
Keywords: theorem, lemma, function, system, inequalities, equations, space, small parameter.

Introduction. The result regularizing operators by M.M. Lavrentiev for solving Volterra integral equations of the first kind with one and two independent variables were obtained in [1,2]. The methods of work [1] were further developed in [3,4]. Solutions of Volterra integral equations of the first kind are widely studied in the works of A.N.Tikhonov, M.M. Lavrentiev, V.K. Ivanov, A.L. Buchheim, V.G. Romanov, M.I. Imanaliev, A. Asanov and others.

The system is considered

$$\int_0^t K(t,x,y,s)u(s,x,y)ds + \int_0^t\int_0^x N(t,x,y,s,z)u(s,z,y)dzds +$$

$$+\int_0^t\int_0^x\int_0^y M(t,x,y,s,z,w)u(s,z,w)dwdzds = f(t,x,y),\ (t,x,y)\in G,\ (1)$$

where $K(t,x,y,s)$, $N(t,x,y,s,z)$ and $M(t,x,y,s,z,w)$ - (nxn) are matrices of the function, and $u(t,x,y)$ – the desired and $f(t,x,y)$ – given n-dimensional vector functions on $G=\{(t,x,y):\ 0\le t\le T,\ \ 0\le x\le X,\ \ 0\le y\le Y\}$, $f(0,x,y)=0$ for $x\in[0,X], y\in[0,Y]$.

We introduce the norm, for nxn-matrix $A=(a_{aij})$ as follows:

$\|A\|=(\sum_{i=1}^{n}\sum_{j=1}^{n}a_{ij}^2)^{\frac{1}{2}}$ and for n-dimensional vectors $u=(u_1,...,u_n)$ in the form $\|u\|=(\sum_{i=1}^{n}u_i^2)^{\frac{1}{2}}$.

It is allowed that $\det[K(t,x,y,t)]$ a counter value can vanish number of times in area G..

Let $\lambda_i(t,x,y),(i=1,2,...,n)$ be the eigenvalues of the matrix

$\frac{1}{2}[K(t,x,y,t)+K^*(t,x,y,t)]$, where $K^*(t,x,y,t)$ is the conjugate matrix to the matrix $K(t,x,y,t)$. Let's denote

$$\lambda(t,x,y)=\min_i\{\lambda_i(t,x,y)\},(t,x,y)\in G,\ i=1,2,...,n. \qquad (2)$$

We require you to meet the following conditions:

a) $\|K(t,x,y,s)\|\in C(G_1)$, $\|N(t,x,y,s,z)\|\in C(G_2)$, $\|M(t,x,y,s,z,w)\|\in C(G_3)$, $\|K(t,x,y,t)\|\le N_0\lambda_0(t)$ and $\lambda(t,x,y)\ge\lambda_0(t)\ge 0$ for $(t,x,y)\in G$, $0<N_0$-const, $\lambda(t,x,y$–- defined using formula (2), $\lambda_0(t)\in L_1(0,T)$;

b) for $t>\tau$ for any (t,x,y,s), $(\tau,x,y,s)\in G_1=\{(t,x,y,s): 0\le s\le t\le T;\ 0\le x\le X;\ 0\le y\le Y\}$ is valid

$$\|K(t,x,y,s)-K(\tau,x,y,s)\|\le C\int_\tau^t\lambda_0(s)ds,$$

where $0<C$ is a positive scalar.

c) for $t>\tau$ for any (t,x,y,s,z), $(\tau,x,y,s,z)\in G_2=\{(t,x,y,s,z): 0\le s\le t\le T;\ 0\le z\le x\le X;\ 0\le y\le Y\}$ fair enough

$$\|N(t,x,y,s,z)-N(\tau,x,y,s,z)\|\le C_1\int_\tau^t\lambda_0(s)ds,$$

where $0<C_1$ is a certain constant and $N(t, x, y, t, z)\equiv 0$for

$$(t,x,y,z)\in G_4=\{(t,x,y,z): 0\le t\le T;\ 0\le z\le x\le X;\ 0\le y\le Y\};$$

d) for $t>\tau$ for any (t,x,y,s,z,w), $(\tau,x,y,s,z,w)\in G_3=\{(t,x,y,s,z,w): 0\le s\le t\le T;\ 0\le z\le x\le X;\ 0\le w\le y\le Y\}$valid

$$\left\|M(t,x,y,s,z,w)-M(\tau,x,y,s,z,w)\right\|\le C_2\int_{\tau}^{t}\lambda_0(s)ds,$$

where$0<C_2$is a certain constant and $M(t, x, y, t, z, w)\equiv 0$for

$$(t,x,y,z,w)\in G_5=\{(t,x,y,z,w): 0\le t\le T;\ 0\le z\le x\le X;\ 0\le w\le y\le Y\}.$$

Along with the system (1), consider the system

$$\varepsilon u(t,x,y,\varepsilon)+\int_0^t K(t,x,y,s)u(s,x,y,\varepsilon)ds+\int_0^t\int_0^x N(t,x,y,s,z)u(s,z,y,\varepsilon)dzds+$$

$$+\int_0^t\int_0^x\int_0^y M(t,x,y,s,z,w)u(s,z,w,\varepsilon)dwdzds=f(t,x,y),\ (t,x,y)\in G,\ (3)$$

Where $0<\varepsilon$ is a small parameter.

We will look for the solution of system (3) in the form

$$u(t,x,y,\varepsilon)=u(t,x,y)+\xi(t,x,y,\varepsilon),\ (t,x,y)\in G\ .\ (4)$$

Substituting (4) into (3), we obtain

$$\varepsilon\xi(t,x,y,\varepsilon)+\int_0^t K(t,x,y,s)\xi(s,x,y,\varepsilon)ds+\int_0^t\int_0^x N(t,x,y,s,z)\xi(s,z,y,\varepsilon)dzds+$$

$$+\int_0^t\int_0^x\int_0^y M(t,x,y,s,z,w)\xi(s,z,w,\varepsilon)dwdzds+\varepsilon u(t,x,y)=0\ .\ (5)$$

From the latter, we move on to the following system:

$$\xi(t,x,y,\varepsilon)+\frac{1}{\varepsilon}\int_0^t K(s,x,y,s)\xi(s,x,y,\varepsilon)ds=-\frac{1}{\varepsilon}\int_0^t[K(t,x,y,s)-K(s,x,y,s)]\times$$

$$\times\xi(s,x,y,\varepsilon)ds-\frac{1}{\varepsilon}\int_0^t\int_0^x N(t,x,y,s,z)\xi(s,z,y,\varepsilon)dzds-$$

$$-\frac{1}{\varepsilon}\int_0^t\int_0^x\int_0^y M(t,x,y,s,z,w)\xi(s,z,w,\varepsilon)dwdzds-u(t,x,y)\ ,\ (t,x,y)\in G.\qquad(6)$$

The resolvent of the matrix kernel $\left(-\frac{K(s,x,y,s)}{\varepsilon}\right)$has the form

$$R(t,x,y,s,\varepsilon)=-\frac{1}{\varepsilon}X(t,x,y,s,\varepsilon)K(s,x,y,s),\ \varepsilon>0,\qquad(7)$$

where $X(t, x, y, s,\varepsilon)$ is the Cauchy matrix function of the system $\varepsilon X'_t(t,x,y,s)=-K(t,x,y,t)X(t,x,y,s,\varepsilon),\ X(t,x,y,t,\varepsilon)=E_n$, E_n – the identity matrix.

Note the following properties of the matrix function $X(t,x, y, s,\varepsilon)$:

$1^0.\ X(t,x,y,s,\varepsilon)=X(t,x,y,\varepsilon)\cdot X^{-1}(s,x,y,\varepsilon)$, (8)

where $X^{-1}(t, x, y,\varepsilon)$ is the inverse matrix of the matrix $X(t,x,y,\varepsilon)$

$$2^0.\ [X(t,x,y,s,\varepsilon)]'_s=\frac{1}{\varepsilon}X(t,x,y,s,\varepsilon)K(s,x,y,s),\qquad(9)$$

$$[X(t,x,y,s,\varepsilon)]'_t=-\frac{1}{\varepsilon}K(t,x,y,t)X(t,x,y,s,\varepsilon).\qquad(10)$$

3^0. By virtue of the Vazhevsky inequalities [64] and by virtue of condition *a*), the following holds

$$\left\|X(t,x,y,s,\varepsilon)\right\|\le\sqrt{n}\exp\left\{-\frac{1}{\varepsilon}\int_s^t\lambda_0(\tau)d\tau\right\},(t,x,y,s)\in G_1,\qquad(11)$$

Then, using the resolvent $R(t,x,y, s,\varepsilon)$, from (6). Using the Dirichlet formula and taking into account (9), (10), we transform the latter to the following form:

$$\xi(t,x,y,\varepsilon)=\int_0^t H(t,x,y,s,\varepsilon)\xi(s,x,y,\varepsilon)ds+\int_0^t\int_0^x N_1(t,x,y,s,z,\varepsilon)\xi(s,z,y,\varepsilon)dsdz+$$

$$+\int_0^t\int_0^x\int_0^y M_1(t,x,y,s,z,w,\varepsilon)\xi(s,z,w,\varepsilon)dsdzdw+F(t,x,y,\varepsilon),\ (t,x,y)\in G,\ (12)$$

where $H(t,x,y,s,\varepsilon)=-\frac{1}{\varepsilon}X(t,x,y,s,\varepsilon)[K(t,x,y,s)-K(s,x,y,s)]-$

$$-\frac{1}{\varepsilon^2}\int_s^t X(t,x,y,\tau,\varepsilon)K(\tau,x,y,\tau)[K(t,x,y,s)-K(\tau,x,y,s)]d\tau,\ (t,x,y)\in G,\ (13)$$

$$N_1(t,x,y,s,z,\varepsilon)=-\frac{1}{\varepsilon}X(t,x,y,s,\varepsilon)N(t,x,y,s,z)-\frac{1}{\varepsilon^2}\int_s^t X(t,x,y,\tau,\varepsilon)K(\tau,x,y,\tau)\times$$

$$\times[N(t,x,y,s,z)-N(\tau,x,y,s,z)]d\tau,\ (t,x,y)\in G,\qquad(14)$$

$$M_1(t,x,y,s,z,w,\varepsilon)=-\frac{1}{\varepsilon}X(t,x,y,s,\varepsilon)M(t,x,y,s,z,w)-\frac{1}{\varepsilon^2}\int_s^t X(t,x,y,\tau,\varepsilon)\times$$

$$\times K(\tau,x,y,\tau)[M(t,x,y,s,z,w)-N(\tau,x,y,s,z,w)]d\tau,\ (t,x,y)\in G,\qquad(15)$$

$$F(t,x,y,\varepsilon)=-X(t,x,y,0,\varepsilon)u(t,x,y)-\frac{1}{\varepsilon}\int_0^t X(t,x,y,s,\varepsilon)K(s,x,y,s)\times$$

$$\times[u(t,x,y)-u(s,x,y)]ds,\ (t,x,y)\in G.\qquad(16)$$

In the future, we will use the following lemmas.

Lemma 1. Let conditions *a*)-*d*) hold. The matrix functions $H(t, x, y, s,\varepsilon)$, $N1_1(t,x, y, s, z,\varepsilon)$, *and* $_{M1}(t,x, y, s,z, w,\varepsilon)$ are defined, respectively, using formulas (13), (14), and (15). Then the estimates are valid

$$\|H(t,x,y,s,\varepsilon)\|\le C_3,\ (t,x,y,s)\in G_1,\ \varepsilon>0,\qquad(17)$$

$$\|N_1(t,x,y,s,z,\varepsilon)\|\le C_4,\ (t,x,y,s,z)\in G_2,\ \varepsilon>0,\qquad(18)$$

$$\|M_1(t,x,y,s,z,w,\varepsilon)\|\le C_5,\ (t,x,y,s,z,w)\in G_3,\ \varepsilon>0,\qquad(19)$$

where

$$C_3=C\sqrt{n}(e^{-1}+N_0),\ C_4=C_1\sqrt{n}(e^{-1}+N_0),\ C_5=C_2\sqrt{n}(e^{-1}+N_0),\quad N_0>0.$$

Proof. By virtue of conditions *a*) - *b*) from (13), we have

$$\|H(t,x,y,s,\varepsilon)\|\le\frac{1}{\varepsilon}\|X(t,x,y,s)\|C\int_s^t\lambda_0(s)ds+\frac{1}{\varepsilon^2}\int_s^t\|X(t,x,y,\tau,\varepsilon)\|N_0\lambda_0(\tau)\times$$

$\times C\left(\int_\tau^t\lambda_0(s)ds\right)d\tau$. In this case, by virtue of (11) for the first term, we have

$$\frac{1}{\varepsilon}\|X(t,x,y,s)\|C\int_s^t\lambda_0(s)ds=\frac{\sqrt{n}}{\varepsilon}e^{-\frac{1}{\varepsilon}\int_s^t\lambda_0(\tau)d\tau}C\int_s^t\lambda_0(\tau)d\tau=\left|\eta=\frac{1}{\varepsilon}\int_s^t\lambda_0(\tau)d\tau\right|\le C\sqrt{n}e^{-1}.$$

For the second term, the relation holds

$$\frac{1}{\varepsilon^2}\int_s^t\|X(t,x,y,\tau,\varepsilon)\|N_0\lambda_0(\tau)C\left(\int_\tau^t\lambda_0(\tau)d\tau\right)d\tau=\frac{1}{\varepsilon^2}\int_s^t\sqrt{n}e^{-\frac{1}{\varepsilon}\int_\tau^t\lambda_0(\tau)d\tau}N_0\times$$

$$\times\lambda_0(\tau)C\left(\int_\tau^t\lambda_0(s)ds\right)d\tau=\left|\begin{matrix}\eta=\frac{1}{\varepsilon}\int_\tau^t\lambda_0(\tau)d\tau\\ d\eta=-\frac{1}{\varepsilon}\lambda_0(\tau)d\tau\end{matrix}\right|=\le CN_0\sqrt{n}\int_0^\infty\eta e^{-\eta}d\eta\le CN_0\sqrt{n}.$$

Hence, the validity of Lemma 1 follows from this.

Similarly, estimates (18) and (19) can be obtained.

Lemma 2. Let the function $F(t,x,y,\varepsilon)$ be defined by formula (16). If $u(t, x, y)\in$ *With* $_n(G)$; $u(0,x,y)=0$ for $x\in[0,X], y\in[0,Y]$ and $\lambda_0(t)>0$ for $t\in[0,T]$, $\varphi(t)=\int_0^t\lambda_0(s)ds$, $\|K(t,x,y,t)\|\le N_0\lambda_0(t)$; $N_0>0$, then the estimate is valid

$$\|F(t,x,y,\varepsilon)\|\le(2N_0+1)e^{-\frac{1}{\varepsilon^{1-\beta}}}\sqrt{n}\|u(t,x,y)\|_C+(N_0+1)\omega_{\bar u}(\varepsilon^\beta)\sqrt{n}\,, \quad (20)$$

where β– some number from the interval (0,1),

$\omega_{\bar u}(\delta)=\sup\limits_{\substack{|\upsilon-\upsilon_0|<\delta\\(x,y)\in[0,X]\times[0,Y]}}\|u(\varphi^{-1}(\upsilon),x,y)-u(\varphi^{-1}(\upsilon_0),x,y)\|$, $\varphi^{-1}(\upsilon)$ – inverse function to the function $\upsilon=\varphi(t)=\int_0^t\lambda_0(s)ds$, i.e. $\varphi^{-1}(\varphi(t))=t,\ \varphi(\varphi^{-1}(\upsilon))=\upsilon$.

Proof. 1) Let $0\le t\le\varphi^{-1}(\varepsilon^\beta), 0<\beta<1$. Then from (16)

we have

$$\|F(t,x,y,\varepsilon)\|=\|-X(t,x,y,0)u(t,x,y)-\frac{1}{\varepsilon}\int_o^t X(t,x,y,s)K(s,x,y,s)[u(t,x,y)-$$

$$-u(s,x,y)]ds\|\le\omega_{\bar u}(\varepsilon^\beta)\sqrt{n}e^{-\frac{1}{\varepsilon}\varphi(t)}+\omega_{\bar u}(\varepsilon^\beta)\int_o^t\frac{\sqrt{n}}{\varepsilon}N_0e^{-\frac{1}{\varepsilon}[\varphi(t)-\varphi(s)]}\lambda_0(s)ds\le$$

$$\le\omega_{\bar u}(\varepsilon^\beta)\sqrt{n}(1-N_0)e^{-\frac{1}{\varepsilon}\varphi(t)}+\omega_{\bar u}(\varepsilon^\beta)\sqrt{n}N_0\le(1+N_0)\sqrt{n}\omega_{\bar u}(\varepsilon^\beta)\,. \quad (21)$$

2) If $\varphi^{-1}(\varepsilon^\beta)\le t\le T$, then

$$\|X(t,x,y,s,\varepsilon)u(t,x,y)\|\le\|u(t,x,y)\|_C\sqrt{n}e^{-\frac{1}{\varepsilon^{1-\beta}}}, \quad (22)$$

$$\left\|\frac{1}{\varepsilon}\int_0^{\varphi^{-1}(\varphi(t)-\varepsilon^\beta)}X(t,x,y,s,\varepsilon)K(s,x,y,s)[u(t,x,y)-u(s,x,y)]ds+\frac{1}{\varepsilon}\int_{\varphi^{-1}(\varphi(t)-\varepsilon^\beta)}^t X(t,x,y,s,\varepsilon)\times\right.$$

$$\left.\times K(s,x,y,s)[u(t,x,y)-u(s,x,y)]ds\right\|\le2(N_0\|u(t,x,y)\|_Ce^{-\frac{1}{\varepsilon^{1-\beta}}}+N_0\omega_{\bar u}(\varepsilon^\beta))\sqrt{n}. \quad (23)$$

Given (21), (22), and (23), (we obtain (20) from (16). Lemma 2 is proved.

Due to the ocen of approx (17), (18), (19) and (20) from (12) we obtain

$$\|\xi(t,x,y,\varepsilon)\|\le a(t,x,y,\varepsilon)+\int_0^t C_3\|\xi(s,x,y,\varepsilon)\|ds\,,\ (t,x,y)\in G, \quad (24)$$

where

$$a(t,x,y,\varepsilon)=C_0(\varepsilon)+\int_0^t\int_0^x C_4\|\xi(s,z,y,\varepsilon)\|dzds+\int_0^t\int_0^x\int_0^y C_5\|\xi(s,z,w,\varepsilon)\|dwdzds\,. \quad (25)$$

$$C_0(\varepsilon)=(2N_0+1)e^{-\frac{1}{\varepsilon^{1-\beta}}}\sqrt{n}\|u(t,x,y)\|_C+(N_0+1)\omega_{\bar u}(\varepsilon^\beta)\sqrt{n}\,.$$

Based on Lemma 5 [6], we rewrite inequality (24) in the following form:

$$\|\xi(t,x,y,\varepsilon)\|\le a(t,x,y,\varepsilon)+\int_0^t C_3e^{C_3(t-s)}a(s,x,y,\varepsilon)ds\,.$$

Instead $a(t,x,y,\varepsilon)$ of putting the expression (25), we have

$$\|\xi(t,x,y,\varepsilon)\|\le C_0(\varepsilon)+\int_0^t\int_0^x C_4\|\xi(s,z,y,\varepsilon)\|dzds+\int_0^t\int_0^x\int_0^y C_5\|\xi(s,z,w,\varepsilon)\|dwdzds+$$

$$+\int_0^t C_3 e^{C_3(t-s)}\{C_0(\varepsilon)+\int_0^s\int_0^x C_4\|\xi(s_1,z,y,\varepsilon)\|dzds_1+\int_0^s\int_0^x\int_0^y C_5\|\xi(s_1,z,w,\varepsilon)\|dwdzds_1\}ds.$$

We integrate this inequality and apply the Dirichlet formula:

$$\|\xi(t,x,y,\varepsilon)\|\le C_0(\varepsilon)e^{C_3t}+\int_0^t\int_0^x C_4e^{C_3(t-s)}\|\xi(s,z,y,\varepsilon)\|dzds+$$

$$+\int_0^t\int_0^x\int_0^y C_5e^{C_3(t-s)}\|\xi(s,z,w,\varepsilon)\|dwdzds,$$

then, replacing *t* на with T, we write in the following form:

$$\|\xi(t,x,y,\varepsilon)\|\le C_0(\varepsilon)e^{C_3T}+\int_0^t\int_0^x C_4e^{C_3T}\|\xi(s,z,y,\varepsilon)\|dzds+$$

$$+\int_0^t\int_0^x\int_0^y C_5e^{C_3T}\|\xi(s,z,w,\varepsilon)\|dwdzds. \qquad (26)$$

For the last (26), we apply Lemma 6. [6], we have

$$\|\xi(t,x,y,\varepsilon)\|\le C_0(\varepsilon)e^{C_3T}+\int_0^t\int_0^x\int_0^y C_5e^{C_3T}\|\xi(s,z,w,\varepsilon)\|dwdzds+\int_0^t\int_0^x R(t,x,s,z)\times$$

$$\times[C_0(\varepsilon)e^{C_3T}+\int_0^s\int_0^z\int_0^y C_5e^{C_3T}\|\xi(s_1,z_1,w,\varepsilon)\|dwdz_1ds_1]dzds.$$

Hence, applying the Dirichlet formula, we obtain

$$\|\xi(t,x,\varepsilon)\|\le C_0(\varepsilon)e^{C_3T}+\int_0^t\int_0^x C_0(\varepsilon)e^{C_3T}R(t,x,s,z)dzds+\int_0^t\int_0^x\int_0^y[C_5e^{C_3T}+$$

$$+\int_s^t\int_z^x R(t,x,s_1,z_1)C_5e^{C_3T}dz_1ds_1]\|\xi(s,z,w,\varepsilon)\|dwdzds, \qquad (27)$$

where $R(t,x,s,z)=\sum_{n=0}^{\infty}\left(C_4e^{C_3T}\right)^{n+1}\frac{(t-s)^n(x-z)^n}{(n!)^2}$.

Andin (27) we obtain the following inequality

$$\|\xi(t,x,y,\varepsilon)\|\le C_6+\int_0^t\int_0^x\int_0^y C_7\|\xi(s,z,w,\varepsilon)\|dwdzds, \qquad (28)$$

where $C_6=C_0(\varepsilon)e^{C_3T}[1+R(T,X,0,0)TX]$, $C_7=C_5e^{C_3T}[1+R(T,X,0,0)TX]$.

Inequality (28) we apply Lemma 2.1.7 and obtain

$$\|\xi(t,x,y,\varepsilon)\|\le C_6+\int_0^t\int_0^x\int_0^y R_1(t,x,y,s,z,w)C_6dwdzds, \qquad (29)$$

where $R_1(t,x,y,s,z,w)=\sum_{n=0}^{\infty}C_7^{n+1}\frac{(t-s)^n(x-z)^n(y-w)^n}{(n!)^3}$.

From (29) we have

$$\|\xi(t,x,y,\varepsilon)\|\le C_0(\varepsilon)C_8,\ (t,x,y)\in G, \qquad (30)$$

where $C_0(\varepsilon)=(2N_0+1)e^{-\frac{1}{\varepsilon^{1-\beta}}}\sqrt{n}\|u(t,x,y)\|_C+(N_0+1)\omega_{\bar{u}}(\varepsilon^{\beta})\sqrt{n}$,

$C_8=e^{C_3T}[1+R(T,X,0,0)TX][1+R_1(T,X,Y,0,0,0)TXY]$. The following is proved

Theorem 1. Let conditions *a*)-*d*) hold and system (1) has a solution $u(t,x,y)\in C_n(G)$, $u(0,x,y)=0$ for $x\in[0,X], y\in[0,Y]$ and $\lambda_0(t)>0$ .Then the solution $u(t,x,y,\varepsilon)$ of system (3)

at $\varepsilon\to 0$ converges to a continuous solution $u(t,x,y)$ of the system (1) in the domain *G* and the estimate (30) is valid.

Lemma 3. Let

$$F(t,x,y,\varepsilon)=\frac{1}{\varepsilon}f(t,x,y)-\frac{1}{\varepsilon^2}\int_0^t X(t,x,y,s,\varepsilon)K(s,x,y,s)f(s,x,y)ds, \quad (31)$$

where *X(t,x, y, s,ε)* is a matrix function. Also, let $\lambda(t,x,y)\ge\lambda_0(t)>0$,

$\lambda_0(t)\in L_1(0,T)$ and $\lambda_0(t)>0$ for almost all $t\in[0,T]$ and $\left\|K(t,x,y,t)\right\|\le N_0\lambda_0(t)$, $N_0>0$, then in the domain *G* the bound is valid

$$\left\|F_1(t,x,y,\varepsilon)\right\|_C\le\frac{\left\|f(t,x,y)\right\|_C}{\varepsilon}(1+\sqrt{n}N_0), \quad (32)$$

Proof. Given (11) from (31), we have

$$\left\|F_1(t,x,y,\varepsilon)\right\|_C\le\frac{\left\|f(t,x,y)\right\|_C}{\varepsilon}+\frac{1}{\varepsilon^2}N_0\sqrt{n}\left\|f(t,x,y)\right\|_C\int_o^t e^{-\frac{1}{\varepsilon}\int_s^t\lambda_0(\tau)d\tau}\lambda_0(s)ds\le$$

$$\le(1+N_0\sqrt{n})\cdot\frac{\left\|f(t,x,y)\right\|_C}{\varepsilon}.$$ Lemma 3 is proved.

Theorem 2. Let the conditions *a*)-*d*) $\lambda_0(t)>0$ hold for all $t\in[0,T]$. Then the solution of system (1) is unique in the space *with* $_n(G)$.

Proof. Let be a homogeneous system

$$\int_0^t K(t,x,y,s)\vartheta(s,x,y)ds+\int_0^t\int_0^x N(t,x,y,s,z)\vartheta(s,z,y)dsdz+$$

$$+\int_0^t\int_0^x\int_0^y M(t,x,y,s,z,w)\vartheta(s,z,w)dwdzds=0,\ (t,x,y)\in G,$$

that is, the system (1) at $f(t,x,y)\equiv 0$ admits a nonzero solution $\vartheta(t,x,y)$. We will rewrite the last system in the following form:

$$\int_0^t K(s,x,y,s)ds\vartheta(0,x,y)+\int_0^t K(s,x,y,s)[\vartheta(s,x,y)-\vartheta(0,x,y)]ds+\int_0^t[K(t,x,y,s)-$$

$$-K(s,x,y,s)]\vartheta(s,x,y)ds+\int_0^t\int_0^x[N(t,x,y,s,z)-N(s,x,y,s,z)]\vartheta(s,z,y)dzds+$$

$$+\int_0^t\int_0^x\int_0^y[M(t,x,y,s,z,w)-M(s,x,y,s,z,w)]\vartheta(s,z,w)dwdzds=0. \quad (30)$$

Both parts of the system (30) are scalar multiplied by a vector $\vartheta(0,x,y)$. We denote the dot product by the symbol ⟨·,·⟩. We multiply from the right and from the left we have

$$\left\langle\int_0^t K(s,x,y,s)ds\vartheta(0,x,y),\vartheta(0,x,y)\right\rangle+\left\langle\int_0^t K(s,x,y,s)[\vartheta(s,x,y)-\vartheta(0,x,y)]ds,\right.$$

$$\left.\vartheta(0,x,y)\right\rangle+\left\langle\int_0^t[K(t,x,y,s)-K(s,x,y,s)]\vartheta(s,x,y)ds,\vartheta(0,x,y)\right\rangle+$$

$$+\left\langle\int_0^t\int_0^x[N(t,x,y,s,z)-N(s,x,y,s,z)]\vartheta(s,z,y)dzds,\vartheta(0,x,y)\right\rangle+$$

$$+\left\langle\int_0^t\int_0^x\int_0^y[M(t,x,y,s,z,w)-M(s,x,y,s,z,w)]\vartheta(s,z,w)dwdzds,\vartheta(0,x,y)\right\rangle=0. \quad (31)$$

Now multiply from the left

$$\left\langle \vartheta(0,x,y),\int_0^t K(s,x,y,s)ds\,\vartheta(0.x.y)\right\rangle+\left\langle \vartheta(0,x,y),\int_0^t K(s,x,y,s)[\vartheta(s,x,y)-\right.$$

$$-\vartheta(0,x,y)]ds\Big\rangle+\left\langle \vartheta(0,x,y),\int_0^t[K(t,x,y,s)-K(s,x,y,s)]\vartheta(s,x,y)ds\right\rangle+$$

$$+\left\langle \vartheta(0,x,y),\int_0^t\int_0^x[N(t,x,y,s,z)-N(t,x,y,s,z)]\vartheta(s,z,y)dzds\right\rangle+\left\langle \vartheta(0,x,y),\right.$$

$$\left.,\int_0^t\int_0^x\int_0^y[M(t,x,y,s,z,w)-M(s,x,y,s,z,w)]\vartheta(s,z,w)dwdzds\right\rangle=0\,,\quad(32)$$

Adding up subtly (31) and (32), we obtain

$$\left\langle\int_0^t[K(s,x,y,s)+K^*(s,x,y,s)]ds\,\vartheta(0,x,y),\vartheta(0,x,y)\right\rangle+\left\langle\int_0^t[K(s,x,y,s)\times\right.$$

$$\times[\vartheta(s,x,y)-\vartheta(0,x,y)]ds,\vartheta(0,x,y)\Big\rangle+\left\langle\int_0^t[K(t,x,y,s)-K(s,x,y,s)]\times\right.$$

$$\times\vartheta(s,x,y)ds,\vartheta(0,x,y)\Big\rangle+\left\langle\int_0^t\int_0^x[N(t,x,y,s,z)-N(s,x,y,s,z)]\vartheta(s,x,y)dzds,\right.$$

$$\vartheta(0,x,y)\Big\rangle+\left\langle\int_0^t\int_0^x\int_0^y[M(t,x,y,s,z,w)-M(s,x,y,s,z,w)]\vartheta(s,x,y)dwdzds,\right.$$

$$\vartheta(0,x,y)\Big\rangle+\left\langle\vartheta(0,x,y),\int_0^t K(s,x,y,s)[\vartheta(s,x,y)-\vartheta(0,x,y)]ds\right\rangle+$$

$$+\left\langle\vartheta(0,x,y),\int_0^t[K(s,x,y,s)-K(s,x,y)]\vartheta(s,x,y)ds\right\rangle+$$

$$+\left\langle\vartheta(0,x,y),\int_0^t\int_0^x[N(t,x,y,s,z)-N(s,x,y,s,z)]\vartheta(s,z,y)dzds\right\rangle+$$

$$+\left\langle\vartheta(0,x,y),\int_0^t\int_0^x\int_0^y[M(t,x,y,s,z,w)-N(s,x,y,s,z,w)]\vartheta(s,z,w)dwdzds\right\rangle=0\,.$$

By virtue of the scalar product property, we obtain

$$\int_0^t\lambda_0(s)ds\|\vartheta(0,x,y)\|\le 2N_0\int_0^t\lambda_0(s)ds\sup_{(s,x,y)\in G_t}\|\vartheta(s,x,y)-\vartheta(0,x,y)\|ds+$$

$$+2\int_0^t\|K(t,x,y,s)-K(s,x,y,s)\|\|\vartheta(s,x,y)\|ds+2\int_0^t\int_0^x\|N(t,x,y,s,z)-N(s,x,y,s,z)\|\times$$

$$\times\|\vartheta(s,z,y)\|dzds+2\int_0^t\int_0^x\int_0^y\|M(t,x,y,s,z,w)-M(s,x,y,s,z,w)\|\cdot\|\vartheta(s,z,w)\|dwdzds$$

where $G_t=\{(t,x,y,s)$: $0\le s\le t;\ 0\le x\le X;\ 0\le y\le Y\}$.By virtue of the conditions of the theorem, we have

$$\int_0^t\lambda_0(s)ds\|\vartheta(0,x,y)\|\le 2N_0\int_0^t\lambda_0(s)\sup_{(s,x,y)\in G_t}\|\vartheta(s,x,y)-\vartheta(0,x,y)\|ds+$$

$$+2C\int_0^t\int_s^t\lambda_0(\tau)d\tau\cdot\|v(s,x,y)\|ds+2C_1\int_0^t\int_0^x\int_s^t\lambda_0(\tau)d\tau\|\vartheta(s,z,y)\|dzds+$$

$$+ 2C_2 \int_0^t \int_0^x \int_0^y \int_s^t \lambda_0(\tau) d\tau \cdot \|\vartheta(s,z,w)\| dw dz ds .$$

Next, we apply the Dirichlet formula and the mean and theorem, dividing both parts received on $\int_0^t \lambda_0(s) ds$ get

$$\|\vartheta(0,x,y)\| \le 2N_0 \sup_{(s,x,y)\in G_t} \|\vartheta(s,x,y) - \vartheta(0,x,y)\| + [2Ct + 2C_1 tx + C_2 txy] \|\vartheta(t,x,y)\|$$

.

From here, going to the limit at $t \to 0$, we get

$$\vartheta(0,x,y) = 0 \text{ by } x \in [0,X], y \in [0,Y]. \quad (33)$$

From (3) for $f(t,x,y) = 0$, we have $u(t,x,y,\varepsilon) = 0$, ε>0. Then by virtue of the theorem

$$\|u(t,x,y)\|_C = \|u(t,x,y,\varepsilon) - u(t,x,y)\|_C \le [(2N_0 + 1)e^{-\frac{1}{\varepsilon^{1-\beta}}} + (N_0 + 1)\omega_{\bar{u}}(\varepsilon^\beta)]\sqrt{n} e^{C_2 T} \to 0$$

by $\varepsilon \to 0$.

Thus $\|u(t,x,y)\|_C = 0$. From here $u(t,x,y) = 0$. Theorem 2 is proved.

Conclusion

Regularizing operators are constructed and theorems are proved uniqueness solution of linear Volterraintegral equations of the first kind with three independent variables in space $C_n(G)$. The results of this work can be applied in applied problems where nonlinear ill-posed integral equations of the first kind are degenerated.

References

1. Sergeev, V. O. Regularization of Volterra equations of the first kind. ACADEMY OF SCIENCES OF THE USSR, 1971, vol. 197, no. 3, pp. 531-534.

2. Arsenin V.Ya. On the application of the regularization method to integral equations of the first kind of convolution type // Journal of Computational Mathematics and Mathematical Physicists. 1969. Vol. 9, No. 6. pp. 204-210.

3.ZulpukarovZh.A., Alieva Zh.A. Linear integral Volterra equation of the first kind with three independent variables // Proceedings of the XVII International Scientific Conference "Society: scientific and educational potential of development (ideas, resources, solutions)" Cheboksary, Russia [Electronic resource] https://www.elibrary.ru/item.asp?id=48210776 February 28, 2022 –pp. 15-22.

4. Zulpukarov Zh.A., Alieva Zh.A**.** Construction of regularization of the solution for the Volterra equation of the first kind//International Journal of Applied and Fundamental Research. – Moscow, 2023, no.5. pp. 52-60. 10.17513/mjpfi. 13543**.**

SOCIAL SCIENCES

GENDER PROJECTS AS A FACTOR IN PROMOTING GENDER EQUALITY IN UKRAINE

Akbash K.
PhD in Physic & Mathematics, Associate Professor,
Volodymyr Vynnychenko Central Ukrainian State University
Pasichnyk N.
DSc in History, Professor,
Volodymyr Vynnychenko Central Ukrainian State University
Rizhniak R.
DSc in History, Professor,
Volodymyr Vynnychenko Central Ukrainian State University
DOI: 10.5281/zenodo.15294181

Abstract

The article examines the key areas and results of national and international projects in Ukraine aimed at achieving gender equality. Particular attention is paid to the initiatives of Ukrainian organizations working to form a gender-sensitive society through educational activities and overcoming stereotypes. Effective practices implemented within the framework of such projects as the platform "Women are 50% of Ukraine's success", the activities of the Institute of Mass Information, public organizations "Business Development Center" and "Youth for Human Rights" are analyzed. It is determined that the integration of international experience, active public participation and the development of institutional mechanisms contribute to the strengthening of gender policy. The need for further improvement of mechanisms for implementing gender projects is emphasized, in particular in terms of monitoring, financing and adaptation to the Ukrainian context. The results of the study can become the basis for the formation of an effective toolkit for implementing gender equality at the regional and institutional levels.

Keywords: gender equality, gender policy, gender projects, gender stereotypes, inclusive society, social equity.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Relevance. Ensuring gender equality is a relevant strategic goal of today, both at the level of the global economy as a whole and at the national level in particular. Overcoming gender disparities not only contributes to social equity, stimulates economic development, expands opportunities for individuals and Ukrainian society, but also serves as a priority in the context of Ukraine's integration into the EU, where gender standards are an integral part of social policy. The implementation of national and international projects on gender issues plays a significant role in the transformation of Ukrainian society, the formation of inclusive policies and increasing the level of social equity. The analysis of such projects allows us to assess the effectiveness of implemented initiatives, identify best practices and adapt them to specific regional or institutional needs. At the same time, international projects become an important source of knowledge and resources for improving national approaches to addressing gender issues; their analysis not only expands the scientific understanding of the effectiveness of various approaches to gender policy, but also provides practical tools for implementing changes in society.

At the same time, regional adaptation of complex gender indices and indicators remains a challenge. This requires a systematic analysis of projects implemented at different levels to determine their relevance and usefulness in specific conditions. Consideration of national initiatives in combination with international experience allows us to identify synergies between local and global approaches to solving gender problems. Therefore, the purpose of this article is to study the main directions and results of national and international projects in Ukraine on gender issues, assess their effectiveness and opportunities for adaptation to the regional and institutional levels. Such analysis will contribute to the development of tools for the further implementation of complex gender indices in practice and ensuring greater effectiveness of gender policy.

Analysis of recent research and publications. Research on gender equality is multidimensional and covers social, economic, political and legal aspects. Amartya Sen in his work "Development as Freedom" [6] considers the issue of gender equality in the context of the concept of human development. Nussbaum Martha C. in her work "Women and Human Development: The Capabilities Approach" [14] develops the capability approach theory pioneered by Amartya Sen, complementing it with social and cultural factors that influence women's capabilities. Mieke Verloo in the work "Varieties of Gender Equality: Stretching the Agenda" [13] analyzes approaches to gender equality in various political and social contexts and considers the implementation of international gender initiatives. Grimshaw Damian & Rubery Jill in their study "The Adjusted Gender Pay Gap: a Critical Appraisal of Standard Decomposition Techniques" [9] analyze the main factors influencing gender inequality in employment, as well as the effectiveness of policies aimed at overcoming

this phenomenon. Ukrainian research by Kateryna Levchenko and Tamara Martsenyuk is devoted to gender initiatives in the fields of education, medicine and the labor market, noting both positive trends and the presence of structural barriers. Levchenko K. in her monograph “Gender policy in Ukraine: definition, formation, management” [11] analyzes the current state of gender equality in Ukraine and assesses the effectiveness of state and international initiatives aimed at achieving it. The work of T. Martsenyuk, “Women in Ukrainian Politics: Challenges and Prospects for Change” [12] is a thorough study of the role of women in the political life of Ukraine, which analyzes the dynamics of gender equality in the political sphere, the main barriers to women's participation in elected bodies of government, and opportunities for improving their representation. The authors of the article in previous publications also considered various aspects of gender issues: theoretical and applied foundations of gender research [5]; gender projects in Ukraine, initiated by state structures, state and public organizations, foreign partners (in the form of grants from state structures of Europe, the USA, Canada and other countries, foundations, civil society organizations) [4; 8]; possibilities of adapting Gender Development Index [2], Global Gender Gap Index [3] and Gender Inequality Index [1] to the regional level.

Thus, even a brief review of the literature indicates significant scientific interest in gender equality issues and the need for further analysis of the impact of gender initiatives on the implementation of gender equality in Ukraine.

Presentation of the main material of the study. Many national and international gender projects aimed at achieving equality between men and women in various spheres have been implemented in Ukraine. Analysis of their areas of activity and organizational features made it possible to classify these projects into the following six main groups: 1) national gender projects; 2) international gender projects of official institutions; 3) gender projects of European organizations and institutions; 4) gender projects of Ukrainian organizations and institutions; 5) gender educational projects of Ukrainian and international organizations and institutions; 6) research into international experience of best practices used in international gender projects.

All of the above types of gender projects were analyzed and detailed in the monograph “Gender Dimensions of Ukraine: Adaptation of Gender Indices to the Subnational Level” [4, pp. 45–172], therefore, in this publication we consider it appropriate to focus specifically on gender projects of Ukrainian organizations and institutions aimed at gender education and changing stereotypes. Ukrainian organizations and institutions are actively implementing projects aimed at raising public awareness of gender issues, changing public perceptions of the roles of women and men, and building a culture of equality. Such initiatives reach a wide target audience, including youth, educators, employers, civil servants, and the general public. The main goals of such projects are: a) forming a public consciousness that supports the principles of gender equality; b) overcoming traditional stereotypes about the roles of men and women in the family, at work and in society; c) expanding access to knowledge on gender issues through educational programs, trainings and information campaigns; d) creating a gender-sensitive educational environment and media space. Let us give examples of individual effective projects in this area.

The platform "Women are 50% of Ukraine's success" [15] is a social project aimed at activating and supporting women in public and political life, balancing the representation of women and men in key positions in order to accelerate the creation of a truly European model of society. On the platform's website, you can find a selection of 12 projects - online courses for self-education on the topic of gender equality: "Women and Men: Gender for All" (the goal of the course is to help educators and all interested parties understand gender issues; learn to professionally analyze events and social phenomena from a gender perspective, avoid discrimination, better understand their rights and ways to protect them, actively and effectively use the acquired knowledge in public discussions and everyday life), "Implementation of the principles of gender equality in the provision of administrative and social services" (the online course is recommended for representatives of government bodies and local governments, specialists/staff in the field of providing social and administrative services, members/staff of public organizations and all those interested in this topic) and others.

Institute of Mass Information (IMI) [10] is a Ukrainian media public organization that defends the rights of journalists, analyzes the media sphere, covers media-related events, counteracts propaganda and disinformation, and provides media with protective equipment for trips to the combat zone during the Russian-Ukrainian war since 2014. It has representatives in 20 regions of Ukraine and a network of hubs called “Mediabase”. The Institute of Mass Information participates in the development of draft laws and media reforms, as well as orders and other documents that regulate the activities of the media and the information space in Ukraine; promotes the investigation of crimes against journalists; actively works in working groups with law enforcement officers. Since 2013, IMI has been systematically monitoring the observance of gender balance by Ukrainian national online media. It records the representation of women experts in key topics, the presence of women as heroines, stereotypes, sexism, discriminatory vocabulary, ageism. Among the most famous IMI projects are “Gender Equality After 134 Years. How Ukrainian Online Media Affirm Sexism in the Media Space”, “Gender Imbalance in Propaganda Media. Monitoring Study”, “Housewife, Nurse, Sorrowful Mother and Sexy Kitty: One Third of Media Continues to Use Stereotypes and Sexism” and others [7]. IMI was the first to conduct gender monitoring in Ukraine, the goal of which is to show the media mistakes in achieving gender balance, which will contribute to improving the visibility and representation of Ukrainian women.

The public organization "Business Development Center" implemented the project "Gender-Sensitive Business" during 2019–2020. The project is aimed at integrating the principles of gender equality into the

corporate culture of enterprises. The main activities of the project were conducting seminars and consultations for company managers, developing gender-sensitive policies for business, and implementing mechanisms for equal pay for women and men.

The project "Gender Stereotypes and Youth" of the public organization "Youth for Human Rights" (2018-2021) aimed to overcome widespread gender stereotypes among young people and to promote the formation of a new culture of gender equality. The project implemented educational, informational and awareness-raising activities that included both direct work with young people and involvement of the general public through modern communication platforms. The main goals of the project were to raise youth awareness of gender equality and related rights, to debunk gender stereotypes that limit the opportunities of young women and men, to encourage youth to actively participate in solving social and gender problems, and to popularize the ideas of equal opportunities for everyone in society, regardless of gender. During the project implementation, educational classes were held (interactive lessons, seminars and trainings in schools and higher education institutions), information campaigns (on social networks using videos, infographics and posters, launching flash mobs and challenges with hashtags that drew attention to the problems of gender stereotypes, involving youth leaders and bloggers in disseminating information about the project), media products were used (short videos demonstrating the harmful effects of gender stereotypes, thematic booklets and posters for youth centers, schools and public organizations), competitions and public events were held.

The implementation of these and similar projects resulted in the following achievements: a) expanding access to knowledge on gender issues among youth, educators, and the general public; reducing the number of gender stereotypes in the media, educational programs, and corporate culture; c) creating new educational materials that meet the principles of gender equality; d) forming gender-sensitive communities through educational campaigns.

Overall, gender projects aimed at educating and changing stereotypes play a key role in transforming public consciousness in Ukraine. Thanks to these initiatives, public awareness of gender issues is increasing, which contributes to the creation of an inclusive society where equal opportunities are provided for women and men in all spheres of life.

Conclusions. The synergy effect that arises from combining project efforts allows for achieving larger and more sustainable results. Interaction between global and regional initiatives contributes to the exchange of best practices, harmonization of standards and increased institutional capacity. In particular, joint actions ensure more efficient use of resources, elimination of duplication of efforts and alignment of strategic goals across regions. The analysis of the projects showed their comprehensive approach, which includes awareness-raising campaigns, creation of new institutional mechanisms, integration of gender aspects into policies and programs, as well as active participation of civil society. As a result, the following results were achieved:

- increased public awareness of women's rights and gender equality;
- specialized institutions have been created to support victims of violence;
- interaction between government agencies, public organizations, and international partners has been strengthened.

Importantly, many of these initiatives were long-term in nature and had a sustainable impact, creating conditions for further positive change. At the same time, the analysis revealed the need for further improvement of project implementation mechanisms, especially in terms of monitoring effectiveness, securing funding, and adapting international experience to Ukrainian realities.

References

1. Akbash, K. S., Pasichnyk, N. O., & Rizhniak, R. Ya. (2024). Statystychnyi analiz indeksu hendernoi nerivnosti za rehionamy Ukrainy [Statistical Analysis of the Gender Inequality Index by the Regions of Ukraine]. Statystyka Ukrainy – Statistics of Ukraine, 1, 32–46. Doi: 10.31767/su.1(104)2024.01.04 [in Ukrainian].

2. Akbash, K. S., Pasichnyk, N. O., & Rizhniak, R. Ya. (2019). Statystychnyi analiz hendernoho rozvytku rehioniv Ukrainy [Statistical Analysis of Gender Development of Ukrainian Regions]. Statystyka Ukrainy – Statistics of Ukraine, 3, 90–99. Doi: 10.31767/su. 3(86)2019.03.10 [in Ukrainian].

3. Akbash, K. S., Pasichnyk, N. O., & Rizhniak, R. Ya. (2023). Rehionalnyi indeks hendernoho rozryvu dlia Ukrainy u 2020 rotsi: Analitychnyi zvit [Regional Gender Gap Index for Ukraine in 2020: Analytical Report]. Kropyvnytskyi: Volodymyr Vynnychenko Central Ukrainian State UniversityThe, Interdisciplinary Scientific Center for Applied Research. URL: http://dspace.kspu.kr.ua/jspui/handle/123456789/4932 [in Ukrainian].

4. Akbash, K. S., Pasichnyk, N. O., & Rizhniak, R. Ya. (2025). Henderni vymiry Ukrainy: adaptatsiia hendernykh indeksiv na subnatsionalnyi riven: monohrafiia [Gender Dimensions of Ukraine: Adaptation of Gender Indexes at the Subnational Level: Monograph]. Kropyvnytskyi: KOD. 306 p. [in Ukrainian]. URL: https://dspace.cusu.edu.ua/items/086eaa72-b890-4eff-9f27-a0ec81e669a1

5. Akbash, K.S., Pasichnyk, N.O., Rizhniak, R.Ya. (2019) Teoretyko-prykladni osnovy hendernykh doslidzhen. Navchalnyi posibnyk. [Theoretical and applied foundations of gender studies. Study guide]. Kropyvnytskyi. [in Ukrainian]. URL: https://dspace.cusu.edu.ua/items/beca4af8-55e0-4d19-94e5-9489d8e5a06d

6. Amartya Sen. (1999) Development as Freedom. New York, Alfred A. Knopf. 366 pp.

7. Gender Balance Monitoring. URL: https://imi.org.ua/en/monitorings/hendernyj-balans

8. Gender studies programs in Ukrainian universities. Under the editorship O.L. Zinyuk DVNZ "Prykarpattia National University named after V. Stefanyka". Ivano-Frankivsk: State Educational Institution

"Prycarpathian National University named after V. Stefanyka", 2019. 788 p. [in Ukrainian].

9. Grimshaw Damian, Rubery Jill. (2002) The Adjusted Gender Pay Gap: a Critical Appraisal of Standard Decomposition Techniques. Manchester, Manchester School of Management. 38 pp.

10. Institute of Mass Information. URL: https://imi.org.ua/

11. Levchenko, K.B. (2003), Genderna polityka v Ukraini: vyznachennia, formuvannia, upravlinnia [Gender Policy in Ukraine: the defnition, development, management], National University of Internal Affairs, Kharkiv, Ukraine.

12. Martseniuk, T. (2015). Zhinky v ukrainskii polititysi: vyklyky i perspektyvy zmin [Women in Ukrainian Politics: Challenges and Prospects for Change]. Kyiv: Tsentr politychnykh ta pravovykh doslidzhen. [in Ukrainian].

13. Mieke Verloo. (2019) Varieties of Opposition to Gender Equality in Europe. *Sage Journals*. Volume 18, Issue 2. URL: https://doi.org/10.1177/1478929918824005

14. Nussbaum Martha C. (2000) Women and Human Development: The Capabilities Approach. Cambridge, Cambridge University Press, 336 pp.

15. Platform "Women are 50% of Ukraine's success." URL: https://50vidsotkiv.org.ua/about/

"THE CONSOLIDATION OF THE CONCEPT OF PRESS FREEDOM WITHIN THE MONGOLIAN MEDIA SYSTEM"

Bayarmaa B.
Senior Lecturer of the Department of Journalism and Mass communication (PhD.) National University of Mongolia
Tuvshintur B.
Lecturer of the Department of Journalism and Mass communication (MSc.), National University of Mongolia
Ariunzaya N.
Associate Professor of the Department of Journalism and Mass communication (PhD.) National University of Mongolia
Enkhtushig L.
Lecturer of the Department of Psychology (MA.) National University of Mongolia
Mandaa U.
Doctoral student of the Department of Journalism and Mass communication (MA), National University of Mongolia
DOI: 10.5281/zenodo.15294185

Abstract

This article explores the early intellectual roots of press freedom in Mongolia by analyzing *Ulsyn Erkh* (*The Power of the State*), a 1914 treatise by Jamsrangiin Tseveen-one of Mongolia's earliest public intellectuals and legal thinkers. Through qualitative documentary analysis, the study identifies core liberal principles embedded in Tseveen's work, including the rights to free speech, publication, and public discourse. The findings reveal that these ideas anticipated Mongolia's later constitutional guarantees of press freedom and challenge the dominant narrative that such concepts were only introduced after the 1990 democratic revolution. The research situates Tseveen's text within the broader context of early 20th-century Mongolian political awakening and national sovereignty, highlighting the development of an indigenous legal consciousness. By revisiting this foundational work, the study contributes to a more nuanced understanding of the historical development of press freedom in Mongolia and affirms the enduring relevance of Tseveen's ideas in contemporary legal and journalistic discourse.

Keywords: J. Tseveen, Ulsyn Erkh, press freedom, Mongolian legal history, freedom of expression, media law, democratic transition.

Introduction

Freedom of the press is widely recognized as a foundational element of democratic governance and an essential component of human rights (McQuail, 2010). In the case of Mongolia, the legal recognition of press freedom is enshrined in the 1992 Constitution and reinforced by the 1998 Law on Freedom of the Press. However, the intellectual origins of this principle in the Mongolian context can be traced further back in history. A pivotal yet underexplored figure in this regard is Jamsrangiin Tseveen (J. Tseveen), whose 1914 treatise *Ulsyn Erkh* (*The Power of the State*) laid out early articulations of the right to free expression and publication.

Tseveen's work emerged during a critical period of national revival and political reform in early 20th-century Mongolia. His emphasis on individual rights—including the freedom to express opinions, disseminate information, and engage in public discourse—anticipated key concepts that would later become formalized in Mongolia's democratic legal framework. Notably, *Ulsyn Erkh* addresses not only the liberties of the individual but also the responsibility of the state to protect such rights while maintaining public order—echoing principles found in Western liberal constitutionalism (Habermas, 1996).

This paper examines *Ulsyn Erkh* as a seminal text in the development of Mongolian legal thought and journalistic philosophy. It situates the work within the historical context of Mongolia's early encounters with modern statehood and legal reform and assesses its influence on subsequent constitutional and legal articulations of press freedom. By revisiting this early 20th-century work, the study highlights the foundational role that historical intellectual discourse plays in shaping contemporary understandings of democratic rights and the institutionalization of press freedom in Mongolia.

Literature Review

The study of press freedom in Mongolia has centered on developments following the democratic revolution of 1990 and the adoption of the 1992 Constitution. Scholars such as Namsrai (2005) and Erdenebat (2012) have examined the legal reforms that institutionalized freedom of expression, emphasizing the impact of international human rights standards and Mongolia's transition from a one-party socialist regime to a pluralistic democracy. These studies typically highlight the enactment of the 1998 Law on Freedom of the Press as a watershed moment, codifying principles of media independence, governmental transparency, and public accountability.

However, the historical and philosophical roots of press freedom in Mongolia remain an underdeveloped area of research. While global literature on press freedom, such as works by McQuail (2010), Habermas (1996), and Siebert et al. (1956), provide theoretical frameworks—ranging from the liberal to the authoritarian models of media—these models have only recently

begun to be applied in the Mongolian context. Scholars like Naranjargal (2014) have attempted to bridge this gap by exploring the intersection of legal development and journalistic practice, though they primarily focus on post-1990 media systems.

The contributions of early Mongolian thinkers to press freedom discourse are seldom addressed in scholarly literature. J. Tseveen, regarded as one of the founding figures of modern Mongolian intellectual and journalistic thought, has been noted for his efforts in education, law, and cultural preservation (Luvsandendev, 1998). Yet, his seminal 1914 work *Ulsyn Erkh* (*The Power of the State*) has not received sufficient analytical attention in terms of its influence on the evolution of free expression and press freedom. Tseveen's arguments for individual liberties, including the right to speak, publish, and critique state actions, bear notable resemblance to classical liberal doctrines as outlined by Western philosophers such as John Stuart Mill (1859/2001).

Recent attempts to historicize Mongolian legal consciousness, such as the work of Byambadorj (2021), have begun to address the role of indigenous legal and philosophical traditions. These works support the notion that concepts like press freedom did not arrive solely via Western influence in the 1990s but were in fact seeded in earlier intellectual endeavors, including those by Tseveen. As such, there is a growing scholarly imperative to reinterpret the intellectual history of Mongolia with greater nuance and to acknowledge figures like Tseveen as foundational contributors to the country's legal and democratic development.

This literature review thus identifies a significant research gap at the intersection of legal history, press freedom, and intellectual thought in Mongolia. The present study aims to address this gap by analyzing *Ulsyn Erkh* not only as a political text but as an early articulation of principles that resonate with modern concepts of press freedom and democratic discourse.

Method

This study employs a qualitative historical-documentary analysis to explore the early conceptual foundations of press freedom in Mongolia, with a particular focus on J. Tseveen's 1914 treatise *Ulsyn Erkh* (*The Power of the State*). The research is grounded in the interpretivist paradigm, which emphasizes understanding the meanings embedded in historical texts and their broader sociopolitical contexts (Creswell, 2013).

Primary Source Analysis

The core of the analysis is centered on *Ulsyn Erkh*, treated as a primary historical source. The text was examined using thematic content analysis, with particular attention paid to the sections addressing individual rights—specifically the rights to freedom of expression, publication, and public assembly. Each of these themes was coded and categorized in relation to both the liberal democratic tradition and the historical-political context of early 20th-century Mongolia.

Secondary Source Review

To contextualize and interpret the primary text, the study also incorporates a review of secondary scholarly sources, including works on Mongolian legal history, the development of journalism in Mongolia, and theoretical frameworks on press freedom. These sources were used to triangulate the interpretations drawn from *Ulsyn Erkh* and to assess its influence on later legal instruments, such as the 1924 Constitution, the 1992 Constitution, and the 1998 Law on Freedom of the Press.

Analytical Framework

The analysis is informed by classical liberal theory, particularly the writings of John Stuart Mill (1859/2001), and supported by media freedom models articulated by Siebert, Peterson, and Schramm (1956). This framework allows for a comparative interpretation between Tseveen's ideas and global press freedom paradigms, assessing how early Mongolian thought both converged with and diverged from Western liberal norms.

Limitations

While this study provides an in-depth analysis of a foundational text, its scope is limited to the intellectual and historical significance of *Ulsyn Erkh*. It does not include empirical surveys or media content analysis from contemporary sources. Future research could expand this inquiry by examining the extent to which Tseveen's ideas continue to influence modern Mongolian journalism and legal discourse.

Findings

The analysis of *Ulsyn Erkh* revealed several key themes that position the text as an early and significant articulation of press freedom and liberal rights in Mongolian legal and journalistic thought. The findings are organized under the following major themes:

1. Recognition of Fundamental Individual Rights

J. Tseveen's work articulates a clear and explicit acknowledgment of individual rights, including the freedom of thought, speech, and publication. His assertion that "every person has the right to express their thoughts aloud and to communicate by writing" (Tseveen, 1914/2024, p. X) aligns closely with foundational liberal democratic values. This recognition predates the formal codification of such rights in the 1924 and 1992 Constitutions of Mongolia, illustrating the progressive nature of Tseveen's thinking for his time.

2. Early Legal Limits and Responsibilities of the Press

Tseveen also emphasized that rights are not absolute and should be subject to certain moral and legal boundaries. He warned against the dissemination of "harmful or treasonous" content but insisted that such limitations must be justified by law and not imposed arbitrarily. This mirrors modern liberal thought, where freedom of the press is protected but bounded by public interest and national security considerations (Mill, 1859/2001).

3. Anticipation of Constitutional Guarantees

The thematic analysis demonstrates that several ideas introduced in *Ulsyn Erkh* later became embedded in Mongolia's constitutional framework. For instance, the 1924 Constitution, though limited in practice, acknowledged the public's right to critique state affairs—an idea directly traceable to Tseveen's proposals. Similarly, the 1992 democratic Constitution guarantees freedom of speech and publication, effectively institutionalizing the rights Tseveen advocated nearly a century earlier.

4. Intellectual Independence from Western Liberalism

While Tseveen's ideas parallel Western liberal traditions, the study found that his arguments were grounded in indigenous values, experiences under foreign domination, and the desire for national sovereignty. His writing reflects a uniquely Mongolian perspective on freedom—one that integrates national identity, political independence, and civic dignity. This highlights a homegrown evolution of democratic thought rather than a purely imported model.

5. Press Freedom as a Catalyst for Legal Reform

The findings also suggest that Tseveen's work played a catalytic role in shaping Mongolian legal consciousness. His influence extended beyond journalism to broader legal reform debates, as evidenced by his involvement in commenting on the 1924 Constitution. Through this, *Ulsyn Erkh* served not only as a philosophical treatise but also as a blueprint for early legislative thought on civil liberties.

Discussion

The findings of this study underscore J. Tseveen's *Ulsyn Erkh* as a pivotal text in the intellectual and legal history of Mongolia, particularly concerning the conceptualization of press freedom. Far from being a peripheral or purely academic treatise, the work presents a coherent framework for understanding freedom of expression, publication, and public discourse—principles that were radically forward-thinking in early 20th-century Mongolia.

Reframing the Origins of Press Freedom in Mongolia

While much of the contemporary scholarship situates the origins of Mongolian press freedom within the post-1990 democratic transition (Erdenebat, 2012; Naranjargal, 2014), this study suggests a deeper historical lineage rooted in native intellectual discourse. By doing so, it reframes the narrative that liberal democratic ideals in Mongolia were solely imported from Western institutions in the 1990s. Instead, *Ulsyn Erkh* demonstrates that foundational values such as freedom of expression and civil liberties had been articulated and promoted by Mongolian thinkers long before external democratic reforms took hold.

Indigenous Liberalism and Legal Modernity

Tseveen's work reveals a form of *indigenous liberalism*—a philosophy of individual rights and civic responsibility that emerged in response to Mongolia's historical subjugation under foreign rule and its aspirations for national sovereignty. His arguments are not mere reflections of European liberalism but are tailored to the social and political context of his time. This distinction is significant, as it challenges assumptions that legal modernity in non-Western societies necessarily depends on external models (Chanock, 2001). In Mongolia's case, thinkers like Tseveen provided the theoretical foundation for a uniquely Mongolian legal consciousness.

Continuity and Discontinuity in Legal Development

The study also reveals both continuity and discontinuity in the legal institutionalization of press freedom. While Tseveen's ideas informed early constitutional drafting, including elements of the 1924 Constitution, they were largely suppressed during the socialist period, when press and speech were subordinated to state ideology. The democratic reforms of the 1990s revived many of these earlier liberal principles, culminating in the 1992 Constitution and the 1998 Law on Freedom of the Press. However, the resurgence of restrictive legislation—such as Article 13.14 of the Criminal Code—raises questions about the stability and consistency of press freedom in contemporary Mongolia (RSF, 2024).

Contemporary Relevance and Legacy

Tseveen's legacy remains relevant today as Mongolia navigates tensions between media freedom, political accountability, and state oversight. His insistence that the press serves both truth and public enlightenment resonates with ongoing debates about journalistic ethics, disinformation, and governmental censorship. Revisiting *Ulsyn Erkh* may thus serve not only as an academic exercise but also as a reminder of the enduring importance of protecting fundamental rights in fragile or transitioning democracies.

In conclusion, this discussion affirms that *Ulsyn Erkh* is more than a historical document; it is a living text with philosophical and legal relevance for present-day Mongolia. It offers a foundational perspective for evaluating the trajectory of press freedom and challenges scholars to reconsider the sources and scope of democratic thought in non-Western contexts.

Conclusion

This study examined *Ulsyn Erkh* by J. Tseveen as a foundational text in the development of press freedom in Mongolia, revealing its significance as an early articulation of liberal democratic values within the context of Mongolian legal and journalistic thought. Through qualitative analysis, the research demonstrated that Tseveen not only recognized core rights such as freedom of expression, publication, and assembly but also proposed a normative framework that foreshadowed the legal protections enshrined in Mongolia's modern constitutional system.

The findings challenge prevailing narratives that trace Mongolia's press freedom exclusively to the post-socialist democratization of the 1990s. Instead, they highlight a more nuanced intellectual genealogy in which indigenous legal and philosophical ideas—rooted in national experience and articulated by Mongolian thinkers—played a critical role in shaping the country's democratic principles. By framing individual rights within both civic responsibility and national interest, *Ulsyn Erkh* bridged traditional Mongolian values with emerging global liberal norms.

In contemporary Mongolia, where press freedom faces ongoing challenges such as state interference, legal restrictions, and political pressure, revisiting early texts like *Ulsyn Erkh* is essential. They serve as both a reminder of Mongolia's historical commitment to civil liberties and a guidepost for safeguarding these rights in the future. J. Tseveen's legacy affirms that the foundation of democratic media and free expression in Mongolia was not imported but cultivated through intellectual self-determination and legal imagination.

This study contributes to a broader understanding of how press freedom develops within specific historical and cultural contexts and invites further scholarly engagement with Mongolia's rich tradition of legal and political thought.

References

1. Byambadorj, D. (2021). *Legal consciousness and media reform in post-socialist Mongolia*. Ulaanbaatar University Press.

2. Chanock, M. (2001). *Law, custom, and social order: The colonial experience in Malawi and Zambia*. Heinemann.

3. Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). SAGE Publications.

4. Erdenebat, B. (2012). *Mongolian media law and freedom of expression: A transition in progress*. Journal of Asian Law, 17(2), 45–68.

5. Habermas, J. (1996). *Between facts and norms: Contributions to a discourse theory of law and democracy* (W. Rehg, Trans.). MIT Press.

6. Luvsandendev, A. (1998). *J. Tseveen and the roots of Mongolian intellectual tradition*. Mongolian Journal of History and Philosophy, 4(1), 33–47.

7. McQuail, D. (2010). *McQuail's mass communication theory* (6th ed.). SAGE Publications.

8. Mill, J. S. (2001). *On liberty*. Batoche Books. (Original work published 1859)

9. Naranjargal, K. (2014). *Media independence and democratic transition in Mongolia*. Asian Media Review, 9(3), 78–94.

10. Namsrai, T. (2005). *The evolution of Mongolian constitutional rights*. Legal Studies Quarterly, 8(2), 21–39.

11. RSF. (2024). *World Press Freedom Index 2024*. Reporters Without Borders. https://rsf.org

12. Siebert, F. S., Peterson, T., & Schramm, W. (1956). *Four theories of the press*. University of Illinois Press.

13. Tseveen, J. (2024). *The power of the state* (*Ulsyn Erkh*). (Original work published 1914).

TECHNICAL SCIENCES

THE FUTURE OF CLOUD COMPUTING, LIKE TRENDS IN HYBRID AND MULTI-CLOUD STRATEGIES

Imashev A.
Barry University
DOI: 10.5281/zenodo.15294190

Abstract

As digital transformation accelerates across industries, cloud computing continues to evolve, shaping the future of IT infrastructure and service delivery. This article explores emerging trends in hybrid and multi-cloud strategies, which are becoming increasingly essential for businesses seeking flexibility, scalability, and resilience. Hybrid cloud integrates on-premises systems with public and private clouds, while multi-cloud leverages services from multiple cloud providers to avoid vendor lock-in and optimize performance. The study highlights key drivers behind these strategies, including data sovereignty, regulatory compliance, and the need for customized architectures. It also examines challenges such as integration complexity, cost management, and security. By analyzing current use cases and industry forecasts, the article provides insights into how hybrid and multi-cloud approaches are redefining enterprise IT and paving the way for a more agile and interoperable cloud ecosystem.

Keywords: cloud computing, hybrid cloud, digital transformation, IT infrastructure, vendor lock-in.

Introduction

Cloud computing has revolutionized the way businesses, governments, and individuals store, access, and manage data. It has moved from a novel concept to a foundational component of modern IT infrastructure. As organizations strive for agility, scalability, and cost efficiency, cloud computing continues to evolve, ushering in new technologies and innovative architectures.

Cloud computing originated as a means to provide on-demand access to computing resources over the internet. Initially focused on storage and processing power, early cloud models offered Infrastructure as a Service (IaaS), followed by Platform as a Service (PaaS) and Software as a Service (SaaS). Providers such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform have dominated this landscape, enabling users to scale resources without heavy investment in physical infrastructure.

Over the past decade, cloud services have matured beyond basic hosting and storage. Today, cloud platforms offer integrated services for big data, artificial intelligence (AI), Internet of Things (IoT), and DevOps. The shift from traditional monolithic systems to cloud-native architectures, such as microservices and containers, has been a key driver of this evolution (Marinescu, 2017).

Emerging Technologies Shaping the Cloud's Future

One of the most promising innovations in the cloud domain is edge computing. This paradigm shifts data processing closer to the source of data generation—such as IoT devices, sensors, or smartphones—rather than relying solely on centralized cloud data centers. Edge computing minimizes latency, enhances real-time decision-making, and reduces bandwidth costs.

According to Gartner (2021), by 2025, 75% of enterprise-generated data will be created and processed outside traditional centralized data centers or clouds. This trend reflects the growing demand for faster data processing in areas like autonomous vehicles, industrial automation, and smart cities.

Another groundbreaking innovation is serverless computing, which allows developers to build and run applications without managing the underlying infrastructure. Platforms like AWS Lambda and Google Cloud Functions automatically scale based on demand and only charge for the compute time consumed.

Serverless architectures promote faster development cycles, reduce operational overhead, and support event-driven models. This makes them ideal for microservices-based applications and real-time analytics, significantly increasing productivity and resource efficiency (Roberts, 2019).

Cloud computing and artificial intelligence (AI) are increasingly intertwined. Cloud platforms now offer pre-built AI models, machine learning (ML) tools, and frameworks that allow businesses to develop intelligent applications with ease. Services like Azure AI, AWS SageMaker, and Google AI Platform enable users to integrate natural language processing, computer vision, and predictive analytics into their operations.

AI in cloud computing is also used to optimize resource allocation, improve security through threat detection, and automate IT operations through AIOps (Artificial Intelligence for IT Operations). The synergy between AI and cloud computing accelerates innovation, particularly in sectors like healthcare, finance, and customer service (Dastjerdi & Buyya, 2016).

The cloud computing market is expected to grow exponentially. According to Statista (2023), global spending on public cloud services is projected to reach $679 billion by 2027, up from $490 billion in 2022. This growth is fueled by increased demand for flexible IT solutions, remote work trends, and digital transformation initiatives.

Hybrid and multi-cloud strategies are also gaining momentum, as organizations seek to avoid vendor lock-in and leverage the strengths of multiple providers. Additionally, the rise of sovereign cloud solutions—clouds that meet specific legal and regulatory requirements—shows that localized infrastructure is becoming a key focus, especially in regions with strict data protection laws.

The rise of green cloud computing is another trend, emphasizing sustainable data center practices. Cloud providers are increasingly investing in renewable energy and energy-efficient infrastructure to reduce their environmental impact and meet corporate social responsibility goals.

Across industries, cloud computing serves as the backbone of digital transformation. Businesses use cloud platforms to modernize legacy systems, deploy scalable digital services, and innovate faster. For instance:

- In healthcare, cloud platforms enable telemedicine, electronic health records, and AI-based diagnostics.

- In finance, cloud services facilitate real-time fraud detection, mobile banking apps, and regulatory compliance.

- In education, cloud tools support online learning platforms, virtual classrooms, and global collaboration.

COVID-19 further accelerated cloud adoption, highlighting the need for agility and remote accessibility. A survey by Flexera (2022) revealed that 94% of enterprises now use some form of cloud service, with 80% adopting hybrid or multi-cloud models.

Cloud computing also enhances business continuity by offering disaster recovery solutions and data backup with minimal downtime. Furthermore, the cloud fosters innovation by reducing the cost of experimentation—developers can prototype new services without heavy upfront investment.

The future of cloud computing is shaped by continuous innovation and the growing need for flexible, intelligent, and scalable solutions. Emerging technologies such as edge computing, serverless architecture, and AI integration are redefining how cloud services are built and consumed. As forecasts indicate robust global growth, cloud computing will remain a cornerstone of digital transformation across all sectors. To fully realize its potential, organizations must strategically align cloud adoption with their goals, invest in skills and infrastructure, and navigate challenges related to security, cost, and governance. With its ability to drive innovation, improve efficiency, and empower businesses, cloud computing will undoubtedly play a critical role in shaping the future of the digital economy.

In an era where agility, scalability, and digital transformation are top priorities, organizations are rethinking their approach to cloud adoption. While public cloud services have dominated early cloud strategies, businesses are increasingly adopting hybrid and multi-cloud architectures to meet more complex operational, regulatory, and strategic needs. These advanced cloud models provide the flexibility to balance workloads, optimize performance, and mitigate risks such as vendor lock-in.

Hybrid cloud refers to a computing environment that combines on-premises infrastructure (or private cloud) with public cloud services. The two environments are integrated, allowing data and applications to move seamlessly between them. This model is particularly useful for organizations with legacy systems or sensitive data that must remain on-premises for regulatory or security reasons. On the other hand, a multi-cloud strategy involves the use of two or more public cloud providers (e.g., AWS, Azure, Google Cloud) without necessarily integrating them into a single environment. This approach is often used to leverage the unique strengths of each cloud provider, enhance redundancy, and avoid dependence on a single vendor.

While the two models are sometimes used interchangeably, the key distinction lies in integration. Hybrid cloud focuses on interoperability between private and public clouds, whereas multi-cloud emphasizes diversification across multiple public clouds (Velte, 2019).

The shift toward hybrid and multi-cloud architectures is driven by several strategic and operational factors:

1. Digital Transformation Needs: As companies modernize their IT infrastructure, they seek environments that can support both traditional and cloud-native applications.

2. Regulatory Compliance: Industries such as healthcare and finance often face strict data residency and privacy regulations that require certain data to be stored locally, making hybrid cloud a suitable option.

3. Business Continuity and Risk Mitigation: Multi-cloud provides redundancy. If one cloud provider suffers an outage, workloads can be shifted to another, ensuring high availability.

4. Vendor Independence: Relying on a single cloud vendor can lead to high switching costs and dependency. A multi-cloud approach avoids lock-in and fosters better pricing negotiations.

According to a 2023 report by Flexera, 87% of organizations have adopted a multi-cloud strategy, and 72% use a hybrid cloud model. This highlights the growing importance of flexible and resilient cloud architectures in the modern enterprise (Flexera, 2023).

Key Benefits of Hybrid and Multi-Cloud Strategies

Flexibility and Agility**.** Both models offer unmatched flexibility. Hybrid cloud enables businesses to run critical workloads in private environments while leveraging public cloud resources for scalability. Multi-cloud environments allow organizations to choose the best services and pricing models for specific workloads, enabling rapid deployment and innovation.

Avoidance of Vendor Lock-in**.** Multi-cloud adoption is a strategic defense against being tied to a single provider. Vendor lock-in can limit innovation, increase costs, and reduce negotiating power. By using multiple cloud platforms, organizations retain control and ensure that they can migrate or integrate systems as needed.

Data Control and Compliance**.** Hybrid cloud is ideal for organizations that need to maintain strict control over sensitive data due to industry regulations. Companies can store sensitive information on-premises while using the public cloud for less sensitive operations, thus achieving compliance without sacrificing innovation.

Cost Optimization**.** Using multiple providers allows businesses to compare costs, negotiate better terms, and select services that offer the best value. They

can also use different pricing models (e.g., reserved instances vs. pay-as-you-go) across providers to manage budgets more effectively (Marinescu, 2017).

Despite their benefits, these strategies also come with challenges:

Integration Complexity. Managing multiple cloud platforms and ensuring seamless integration between on-premises and cloud environments can be technically complex. This often requires skilled personnel, standardized APIs, and robust middleware solutions.

Security and Governance. Maintaining consistent security policies across multiple environments is challenging. Data transfers between clouds must be encrypted, identity management needs to be unified, and compliance must be monitored continuously (Zhang et al., 2010).

Cost Management. While multi-cloud can reduce costs through competition, it can also lead to cost sprawl if not managed properly. Without centralized visibility and governance, organizations may overspend or fail to optimize resource usage.

Skills and Training. Adopting a multi-platform environment demands a diverse skill set from IT teams. They must be proficient in the tools and ecosystems of various providers, which can increase training and hiring costs.

Several global enterprises have successfully adopted hybrid and multi-cloud strategies:

- BMW Group uses both Amazon Web Services and Microsoft Azure to build and deploy applications, optimizing workloads based on regional requirements and functionality.

- HSBC, one of the world's largest banking and financial services organizations, has embraced a hybrid cloud model to comply with strict financial regulations while innovating with cloud-native services (Microsoft News, 2021).

- Netflix, while predominantly on AWS, uses a multi-cloud backup strategy to ensure redundancy and protect against downtime.

These real-world examples show that hybrid and multi-cloud strategies are not just technical choices but core components of business continuity, compliance, and innovation planning.

Conclusion

Hybrid and multi-cloud strategies represent the next frontier in cloud computing. They offer businesses the flexibility, control, and resilience required to operate in an increasingly digital and interconnected world. By enabling tailored architectures that balance security, performance, and cost, these models empower organizations to innovate while managing risks effectively. However, realizing the full potential of these strategies requires careful planning, skilled execution, and robust governance. As the cloud landscape continues to evolve, businesses that embrace hybrid and multi-cloud models will be better positioned to thrive in a dynamic and competitive environment.

References

1. Dastjerdi, A. V., & Buyya, R. (2016). Fog computing: Helping the Internet of Things realize its potential. Computer, 49(8), 112-116

2. Flexera. (2023). State of the Cloud Report. Retrieved from https://www.flexera.com

3. Gartner. (2021). Smarter with Gartner: What Edge Computing Means for Infrastructure and Operations Leaders. Retrieved from https://www.gartner.com

4. Marinescu, D. C. (2017). Cloud Computing: Theory and Practice. Elsevier

5. Microsoft News. (2021). HSBC and Microsoft expand strategic partnership to drive digital transformation. Retrieved from https://news.microsoft.com

6. Roberts, M. (2019). Serverless Architectures on AWS. Manning Publications

7. Statista. (2023). Public cloud services market size worldwide from 2017 to 2027. Retrieved from https://www.statista.com

8. Velte, T. (2019). Cloud Computing: A Practical Approach. McGraw-Hill Education

9. Zhang, Q., Cheng, L., & Boutaba, R. (2010). Cloud computing: state-of-the-art and research challenges. Journal of Internet Services and Applications, 1(1), 7–18

VOL.1

№101/2025

Znanstvena misel journal

The journal is registered and published in Slovenia.

ISSN 3124-1123

The frequency of publication – 12 times per year.

Journal is published in Slovenian, English, Polish, Russian, Ukrainian.

The format of the journal is A4, coated paper, matte laminated cover.

All articles are reviewed

Edition of journal does not carry responsibility for the materials published in a journal.

Sending the article to the editorial the author confirms it's uniqueness and takes full responsibility for possible consequences for breaking copyright laws

Free access to the electronic version of journal

Chief Editor – Christoph Machek

The executive secretary - Damian Gerbec

Dragan Tsallaev — PhD, senior researcher, professor

Dorothea Sabash — PhD, senior researcher

Vatsdav Blažek — candidate of philological sciences

Philip Matoušek — doctor of pedagogical sciences, professor

Alicja Antczak — Doctor of Physical and Mathematical Sciences, Professor

Katarzyna Brzozowski — PhD, associate professor

Roman Guryev — MD, Professor

Stepan Filippov — Doctor of Social Sciences, Associate Professor

Dmytro Teliga — Senior Lecturer, Department of Humanitarian and Economic Sciences

Anastasia Plahtiy — Doctor of Economics, professor

Znanstvena misel journal

Slovenska cesta 8, 1000 Ljubljana, Slovenia

Email: info@znanstvena-journal.com

Website: www.znanstvena-journal.com