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Economic sciences

MODERNIZATION AND GROWTH OF THE ECONOMY OF AZERBAIJAN IN THE POST-SOVIET PERIOD (1990-2023)

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Abstract

The article analyzes structural shifts in the economy of the Republic of Azerbaijan in 1990-2023. The main stages and problems of carrying out economic transformations, modernization and diversification of the economy, the formation of the Azerbaijani model of sustainable socio-economic development are highlighted. It is shown that the formation of the sectoral structure of the economy, investments were largely determined by the export-raw material model of the reproduction of the Azerbaijani economy. The purpose of the study is to study the priority areas of modernization and diversification of the Azerbaijani economy. The research method is systemic, economic analysis, as well as comparative and statistical methods of data processing. The results of the study showed that the desire to modernize the nation, increase its competitiveness, adapt to the growing demands of new history and achieve the future prosperity of Azerbaijan are the main goals of the Azerbaijani state. Taking the position of a country actively developing the oil and gas industry and a reliable supplier of energy resources to the world market, the country is developing new growth points - outside the oil sector, seeking to take a new place on the economic map of the world.

Keywords: *modernization and diversification of the economy, investment, economic development.*

After gaining state independence on October 18, 1991, the people of Azerbaijan were given the opportunity to freely decide their destiny, implement the ideas of independent statehood, and build their independent future. Despite the fact that from time to time our state faced serious challenges and even coup attempts, today the country's transition from one political and economic system to another is on the rise. Having determined our own future, we purposefully moved forward.

The adopted course symbolized not only the direction of the country's transition from one political and economic system to another, but also realized the desire to transform from modern to postmodern, from an industrial society to a postindustrial society. Undoubtedly, much remains to be done to achieve the necessary level of development: improve the development sector, eliminate the economy's dependence on oil exports, move to the formation of an information and digital economy, the basis of which is information and communication technologies (ICT).

Today, Azerbaijan is moving forward, clearly defining the goals of its development. Our world is global. In this globalization, more competitive nations are emerging, investing in the comprehensive development of people and mastering new technologies. That is, human capital and information technology have become the main factors in the development of the state as a whole. The desire to modernize the nation, increase its competitiveness, adapt to the growing demands of new history and achieve the future prosperity of Azerbaijan are the inevitable realities of the time.

The main goal of the Azerbaijani state, which has become a new type of state, is modernized social development, joint strengthening of the interests of society and the state. In this case, the state becomes not only a customer, but also a guarantor of the modernization of social innovations, and as a result, an innovator. Therefore, the state should be governed not by the economy, but by economic development. It is this type of partner state that is more in line with the challenges of the modern global world and has the ability to resolve issues of innovation and modernization.

Taking into account the above, the government of Azerbaijan has identified five main areas of economic modernization [1, pp. 51-52]:

- The first direction is the innovative development of Azerbaijan. This involves the use of modern technologies by Azerbaijani companies, ensuring the production of new products and expanding import markets. Much work has already been done in this direction.

- The second direction is the dynamic strengthening of the institutions of the emerging market and the definition of competition. This direction is one of the important elements of the economy of Azerbaijan in order to develop entrepreneurship and attract new investments to the country's economy.

- The third direction provides for the future diversification of the national economy, the expansion of the production of final products using modern technologies, the rise of the processing industry and the "knowledge economy". At the same time, in order to stimulate innovative development, which is one of the important elements of the modernization policy, work is underway to improve the legal and economic framework for innovative activities.

- The fourth direction is the creation of human capital of a new quality, the education of creatively thinking personnel and their training in accordance with the requirements of the creative economy. To this end, active work is underway to qualitatively update all forms of the education system in the country.

- The fifth direction of economic modernization is the continuation of work on the organization of new sources of economic growth.

And first of all, it should be noted that the development of the national economy of Azerbaijan falls on the period after gaining independence. Thus, after the collapse of the USSR, Azerbaijan was among the post-Soviet countries that found themselves in the deepest economic crisis: compared to 1990, the reduction in real GDP in 1994 was 52.6% [2], since the country lacked the material and technical base of industry and was generally dependent on energy production. 1995-1997 is a period of economic stabilization based on the implementation of appropriate reforms, privatization of state property, liberalization of foreign trade and attraction of foreign investment in the oil and gas sector.

In particular, on September 20, 1994, the "Contract of the Century" was signed, which became an important turning point in the history of the development of the economy of our country. An Agreement on production sharing from the Azeri-Chirag-Guneshli fields was signed with 11 well-known oil companies from seven countries: BP, Statoil, Amoko, TPAO, Itoci, ExxonMobil, Lukoil, Delta, Remko, MacDermot, Hess. Since then, Azerbaijan's oil strategy has become a key component of both domestic and foreign policy. The years of implementing the new oil strategy began – a period of unprecedented development [3]. And it can be said with confidence that the "Contract of the Century" (with a total value of \$28 billion) today ensures Azerbaijan's energy security and economic stability. Moreover, in 1994, the first Production Sharing Agreement (PSA) was signed, which allowed dozens of foreign companies to be attracted to this sector of the Azerbaijani economy. As a result, incoming foreign direct investment increased almost threefold in two years – from 10.8% of GDP in 1995 to 28.1% of GDP in 1997 [4].

One of the important means for involving the country in foreign trade is the customs tariff, the law on which came into force in 1995, and in 1997 the Customs Code (CC) of the AR was adopted, which is an important means of state regulation of the foreign market and protection of the country's economy from the negative impacts of foreign competition [5].

Since 1998, the economy of Azerbaijan has entered a growth trajectory, which has noticeably accelerated since 2004 due to the rapid growth in oil prices: in 1998-2003, the country's GDP increased by 61.1%; over the next 6 years, under conditions of doubling the price of crude oil and increasing oil production by more than 3.3 times, economic growth amounted to 185.3% [6]. In addition, in the period 2003-2008, Azerbaijan very actively and consistently participated in the processes of globalization through the implementation of transport and communications projects of both regional and international significance. For example, in 2006, the Baku-Tbilisi-Ceyhan oil export pipeline was put into operation, opening up great opportunities for solving the problem of energy security.

In 2007, gas exports from the Shah Deniz field began via the Baku-Tbilisi-Erzurum gas pipeline. This pipeline, along with the strategic importance of the project itself, opened up new opportunities for finding new alternative routes for future strategic export gas pipelines to various countries of the world. The Baku-Tbilisi-Erzurum gas pipeline has become an important part of the multi-variant oil and gas export and pipeline policy implemented since 1994. The gas pipeline has further changed the geopolitical and geo-economic situation in the South Caucasus and the Caspian-Black Sea basin in favor of Azerbaijan [7, pp. 189–190].

Moreover, in 2007, an intergovernmental agreement on the construction of a new Baku-Tbilisi-Kars railway was signed between the governments of Azerbaijan, Turkey and Georgia (the construction of which was completed in 2017), etc. Summarizing the above, it can be said that for five years, the

country's GDP growth rate annually exceeded 10%. And in 2005, 2006, 2007 and 2008, the GDP growth rate was the highest in the world - 26.4; 34.5; 25.0 and 10.8%, respectively. The volume of GDP in 2008 amounted to 38.0 billion manat, or 46.2 billion US dollars, and the country's GDP per capita in 2008 was 5403.9 US dollars and, compared to 2003, increased more than 6.0 times [8].

Thus, in 2015, there was a certain structural change in the volume of trade turnover. Due to the decrease in trade volume, the ratio between imports and exports changed in favor of imports, which negatively affected the balance of foreign trade activities of the country. In 2017, the situation improved relatively, the volume of exports increased and the volume of imports decreased. In 2019, the country's foreign trade turnover amounted to \$33.3 billion, including exports of \$19.4 billion and imports of \$13.6 billion. As a result, a positive trade balance of \$5.8 billion was formed. Compared with 2018, foreign trade turnover at actual prices increased by 4.3%, and in real terms - by 3.7%, including imports decreased by 6.5%, and exports - by 2% [9].

Starting from 2020 to 2021, the economy of Azerbaijan, like the entire world economy, faced serious problems. The quarantine measures taken by the government in connection with the pandemic caused certain tangible losses to the economy of Azerbaijan. Thus, compared to 2019, in 2020, the production of gross domestic product (GDP) decreased by 4.3%, including in the non-oil and gas sector - by 2.6%. In the export sector, indicators fell by 30%, including exports in the non-oil sector by 5.2%, and imports into the country decreased by 21.4%. Compared to 2019, in 2020, the nominal income of the population of Azerbaijan decreased by 1.8% [10].

As a result, in April 2020, the President of the Republic of Azerbaijan signed an Action Plan to reduce the negative impact of the coronavirus pandemic (COVID-19) and sharp fluctuations in the global energy and stock markets on the economy of Azerbaijan. This document developed programs to provide state support to various sectors of the economy and entrepreneurship, which includes 10 areas [11].

On May 4, 2020, in his opening speech at the Non-Aligned Movement Summit in the Contact Group format on the topic "We are together against COVID-19", dedicated to the fight against coronavirus, the President of the Republic of Azerbaijan said: "In order to ensure economic stability in Azerbaijan, solve problems related to employment, ensure macroeconomic and financial stability, a socio-economic support package worth more than 3.5 billion manats or 2 billion dollars was adopted.... Until January 1, 2021, taxpayers in the areas of activity directly affected by the pandemic will be provided with tax benefits and tax holidays. All this is only part of the steps taken. In general, citizens highly appreciate the measures taken by the state," noted the President of the Republic [12].

Already at the beginning of the 21st century, Azerbaijan has become one of the dynamically developing countries in the post-Soviet space from an economic point of view. Thus, in the world ranking of global competitiveness, annually compiled by the World Economic Forum (WEF), Azerbaijan in 2019 rose by 11 places, taking 58th place in the ranking among 141 countries [13]. In particular, in the world ranking of global competitiveness, Azerbaijan in 2017-2018 rose in the ranking of 137 countries to 35th place.

Improving positions in the competitiveness ranking has a positive effect on the terms of long-term lending to Azerbaijan by foreign investors. In particular, the total volume of foreign investment in the economy of Azerbaijan in 2023, according to the Central Bank (CB), amounted to \$ 6.6 billion. In 2022, foreign direct investment in the economy of Azerbaijan amounted to \$ 6 billion 275.85 million. Thus, in 2023, FDI increased by 6.1%. In the non-oil and gas sector, the volume of foreign direct investment amounted to \$ 2 billion (an increase of 11.1%), the share is 30.1% (in 2022 - 29%) [14].

Recently, serious steps have been taken in Azerbaijan to improve the business environment in order to attract foreign investment. That is, the formation and development of the national economy of Azerbaijan largely depends on its sustainable development, one of the main factors of which is the investment activity of the economy.

Thanks to this, Azerbaijan twice took leading positions in the Doing Business 2009 and Doing Business 2019 reports (34th place among 190 countries), and was named one of the 10 most reformist countries in the Doing Business 2020 report. Experts agree that the Doing Business report is of exceptional importance in terms of attracting foreign investors to the country [15].

According to the Central Bank of the Republic of Azerbaijan, in 2023, the top five countries in terms of FDI in the economy of Azerbaijan were (fig. 1) [14].

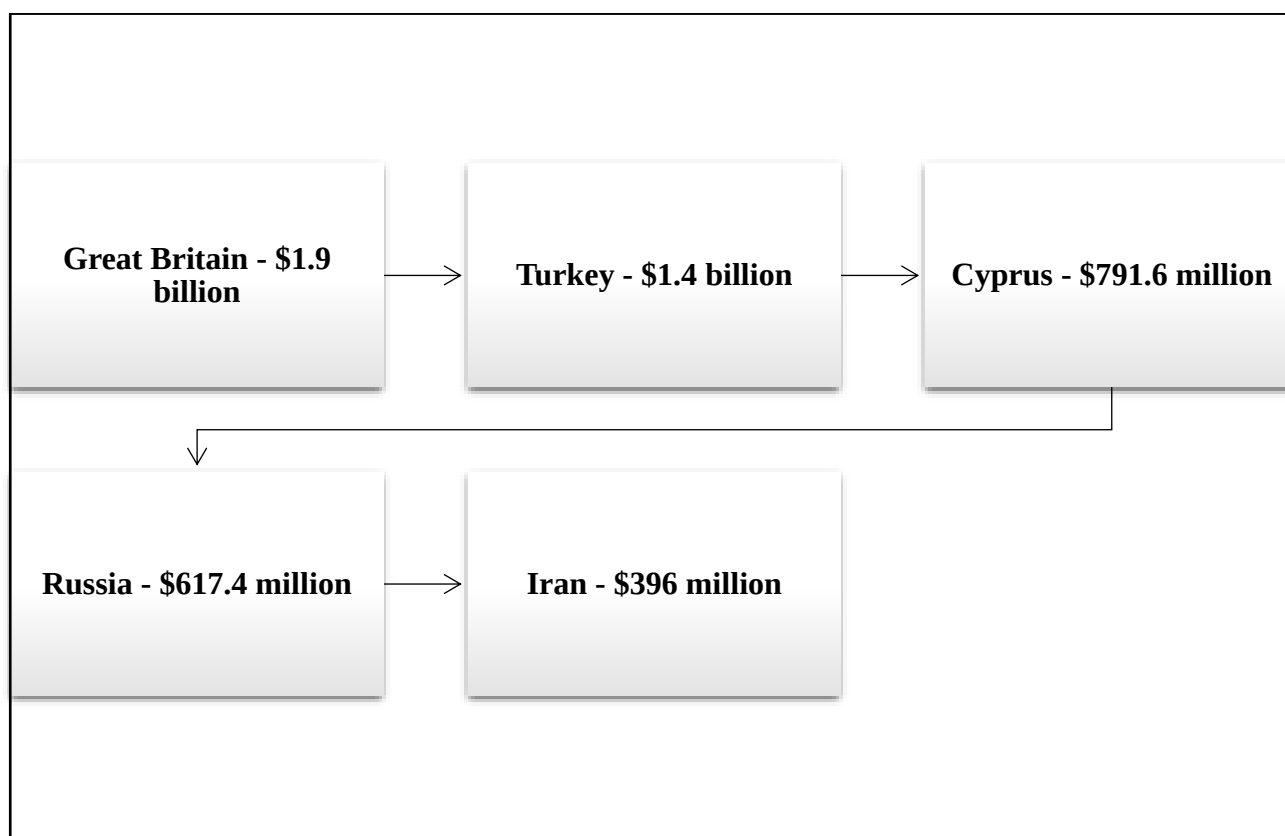


Figure 1. Leading countries in terms of FDI volume in the economy of the Republic of Azerbaijan in 2023.

According to the State Customs Committee (SCC), in 2023, Azerbaijan carried out trade operations with 193 countries. According to the SCC, in 2023, Azerbaijan's foreign trade turnover amounted to \$52 billion (a decline of 2.9% compared to 2022). At the same time, exports amounted to \$33.9 billion (a decline of 11.1%), imports - \$17.3 billion (an increase of 18.9%). In the export structure, the bulk of the volume fell on products of the oil and gas sector (90.12%) (fig. 2) [16].

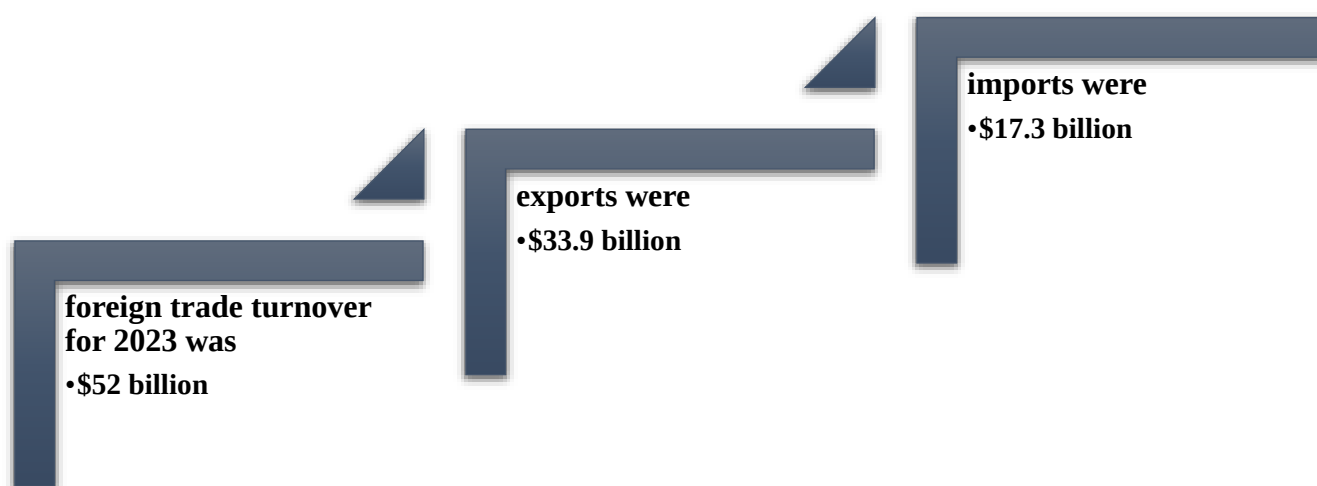


Figure 2. Foreign trade indicators of Azerbaijan for 2023.

In the import structure, food products accounted for 12.5%, tobacco and tobacco products - 0.69%, pharmaceuticals - 3.24%, fertilizers - 0.42%, plastics and plastic products - 3.03%, wood and wood products - 2.25%, clothing and clothing accessories - 2.4%, ferrous metals and ferrous metal products -

6.37%, machines, mechanisms, electrical apparatus, equipment and spare parts for them - 20.04%, vehicles and spare parts - 16.56%, furniture - 0.76%, other - 31.74% [16].

In 2023, Italy again retained the status of Azerbaijan's largest trading partner with a trade turnover of \$ 15.7 billion, or 44.86% of total exports. Today, the priority areas of cooperation between Azerbaijan and Italy include such areas as oil and oil products, transport, tourism, agriculture (especially in the field of viticulture), pharmaceuticals, medicine and the humanitarian sphere.

The top ten trading partners of Azerbaijan for 2023 also include (fig. 3) [16].

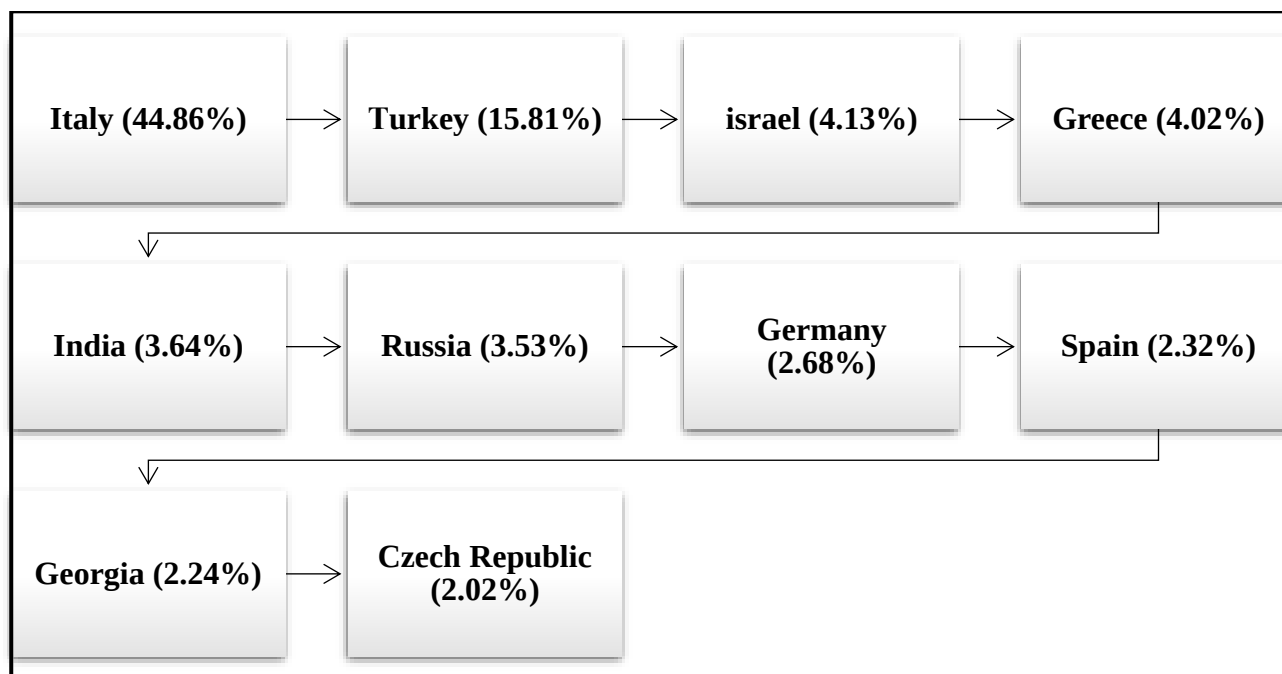


Figure 3. Azerbaijan's leading trading partners in 2023.

And, thanks to the Second Karabakh War, which lasted 44 days (from September 27 to November 10), our lands, through the efforts of our military personnel, were liberated from occupation. The President of the Republic of Azerbaijan, on December 1, 2020, addressing the people, said: "A new era is beginning for our country. A new era of creation, an era of development, an era of restoration of our liberated territories. In general, the economic, agricultural, and tourist potential of all liberated regions is great. We must skillfully use this potential to turn the Karabakh region into one of the most beautiful regions not only in Azerbaijan, but also in the world, and I am confident that we will achieve this. Therefore, our victory is a historical Victory... Now the Nagorno-Karabakh conflict is no more" [17].

Accordingly, the Azerbaijani government has already launched a large-scale campaign to restore the liberated lands, called the "Great Return". For the restoration of the liberated territories, 2.2 billion manats (\$1.29 billion) were allocated from the state budget in 2021, 2.67 billion (\$1.57 million) in 2022, and \$1.8 billion will be allocated from the state budget in 2023 for the restoration, reconstruction and reintegration of the country's liberated territories - Karabakh and Eastern Zangezur [18].

Moreover, on February 2, 2021, the President of Azerbaijan signed an order "Azerbaijan 2030: National Priorities of Socioeconomic Development", which includes 5 main directions: ensuring sustainable growth and competitiveness of the economy; creating a dynamic, inclusive society based on social justice; competitive human capital and modern innovations; great return to the liberated territories; clean environment and a country of "green growth" [19].

Finally, an important milestone for Azerbaijan was the decision to host the 29th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP29), which will be held from 11 to 22 November 2024. This decision, taken at the COP28 plenary session in Dubai in December 2023, underlines the importance of Azerbaijan in the international arena and is evidence of its active role in the fight against climate change and the country's transition to a "green economy". Azerbaijan, striving for sustainable development, is actively promoting initiatives to reduce its carbon footprint and develop renewable energy sources. In accordance with this objective, by the decree of the President of the Republic of Azerbaijan Ilham Aliyev, 2024 was declared the "Year of Solidarity for

a Green World" in Azerbaijan, which underlines the country's commitment to international cooperation in the field of environmental protection and sustainable development.

Thus, being a country with an actively developing oil and gas industry and a reliable supplier of energy resources for the world market, the country is developing new growth areas outside the oil and gas sector and is striving to occupy new positions on the economic map of the world. Among the areas that are currently considered priority in the republic, agriculture, the high-tech sector – ICT, transport, the space industry, tourism and education are in first place.

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ASSESSMENT OF ARMENIAN AQUACULTURE INDUSTRY EXPORT ADVANTAGE IN CIS COUNTRIES**Aram Arakelyan**

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Abstract

This work is devoted to studying the problem of specialization and defining the structure of international trade in the aquaculture sector. An assessment of the comparative advantages of product exports is provided, based on the application of the Balassa index. Aquaculture allows you to define the international trade of the aquaculture sector. In particular, we found that the use of the Balassa Index to examine the expansion of trade in aquaculture products has important implications for a country's economic growth. The results of the study can be applied to determine the expected standard benefits from trade: resources will be reallocated to their most productive uses, and welfare will increase.

Keywords. Aquaculture, export, advantage, comparative, balassa index

Introduction

Rapid growth in aquaculture production is helping to meet the population's demand for protein-rich fish products (FAO. 2022. *The State of World Fisheries and Aquaculture 2022. Towards a Blue Transformation*, Rome, FAO <https://doi.org/10.4060/cc0461en>). Naturally, an increase in the production of aquatic animals should be accompanied by an increase in exports and imports in the world fisheries and aquaculture sector and in particular in the similar sector of the Republic of Armenia. In general, the challenge of ensuring effective fisheries management requires the need to assess the level of comparative advantage of exports to support decision-making for the development of aquaculture production. Solving this problem is especially significant in regions with limited data and weak capacity, and in particular in the Republic of Armenia. To assess the specialization and structure of international trade in products, various approaches and indicators have been developed that can be used to assess a country's comparative advantage in international trade. This paper assesses the specialization and structure of international trade in the aquaculture sector and assesses the comparative advantages of aquaculture exports. Application of the Balassa index to assess the export advantage of Armenian export comparative advantage of Fish and crustaceans, molluscs and other aquatic invertebrates product group is studied.

Indices for assessing the comparative advantage of exports

B. Balassa proposed an index of comparative advantage in international trade [1-5]. He showed that "comparative advantage arises from economic factors and can be measurable or immeasurable." According to Balassa, the following specialization index is proposed, which is called the Balassa index

$$B_{ij} = 100 \times \frac{X_{ji}}{\sum_{j=1}^N X_{ji}} / \frac{\sum_{i=1}^N X_{ji}}{\sum_{j=1}^N \sum_{i=1}^M X_{ji}}, \quad (1)$$

where X_{ji} - export of j -th product group (Service) to i -th country. The Balassa index (1) is bounded below 0 and has no upper bound. If a country specializes in the export of any product or group of goods and the average indicator of this industry is higher than the average indicator of other countries, then the indicator of this industry is more than 100, and if the indicator is less than 100, then the industry of other countries has lower specialization compared to the value. The result obtained from this indicator is used to assess the relative importance of inter-industry specialization and intra-industry trade. It is known [1-5] that the higher the inter-industry specialization, the larger the standard deviation of the resulting index time series. It should be noted that the Balassa Index (1) does not provide a complete picture of a

country's trade since it only takes into account exports. For example, a country has a high comparative advantage in the production of a product, but the volume of imports of this product exceeds its exports. An example of this is the export and import of alcoholic and non-alcoholic drinks in the Republic of Armenia in 2012.

Logarithmic Balassa index. Balassa's index of comparative advantage in international trade (1) is also presented as follows:

$$RCA = \ln \left(\frac{X_i}{M_i} \right) \times \left(\frac{\sum_{i=1}^n X_i}{\sum_{i=1}^n M_i} \right) \times 100, \quad (2)$$

where X and M — assessment of exports of product groups with comparative advantage of RA exports

Assessment of the Armenian export comparative advantage of Fish and crustaceans, molluscs and other aquatic invertebrates product group

For the assessment of Armenian export comparative advantage of Fish and crustaceans, molluscs and other aquatic invertebrates product group we used data given in the www.armstat.am. Data assessing the Armenian export of the Fishery industry considered for the period 2020-2022 and are given in the table 1.

Table 1.

Fish and crustaceans, molluscs and other aquatic invertebrates product group of Armenian export/import

2020				2021			2022		
	Total	Export	Import	Total	Export	Import	Total	Export	import
	53078.8	49692	3386.8	73699.5	63367	9632.4	141073	1E+05	21572
CIS		49272	779.6		63047	1669.9		1E+05	1805.5
Other		419.8	2607.2		320.7	7962.5		524	19766

Source: armstat.am

Based on Table 1, it is possible to estimate the Balassa index for the product group Fish and crustaceans, molluscs and other aquatic invertebrates in the export of which the Republic of Armenia had comparative advantages in different years from 2020 to 2022.

Table 2

Balassa Index for product group Fish and crustaceans, molluscs and other aquatic invertebrates

Year	Balassa index export	Balassa index import
2020	4.307587216	0.010974157
2021	5.739065669	0.006122379
2022	11.89527089	0.00478541

Table 2 shows the Balassa Index for the product group Fish and crustaceans, molluscs and other aquatic invertebrates and therefore from this table it is clear that studied product group has a comparative advantage in 2020-2022 for exports to CIS countries.

To increase the volume of exports of the product group Fish and crustaceans, molluscs and other aquatic invertebrates, which has a comparative advantage, it is advisable to consider mechanisms for protecting the rights of domestic producers used in other countries.

The state seeks to expand the volume of exports of goods produced by domestic producers and is looking for new markets. Thus, organizations producing exported goods may be subject to various taxation mechanisms or export controls. However, this approach cannot last long. In such a situation, the question naturally arises of how to protect the interests of organizations producing export products, and, as a result, support them in order to increase production volumes.

To achieve this goal, the economic features of export incentives were considered, as well as the role of government policy to stimulate exports. The role of the state is especially great in the policy of expanding trade towards exporters. However, in this case, importing countries can appeal the market expansion policy pursued by the Republic of Armenia, since one of the mechanisms for implementing such a policy is based on dumping: exported products are sold at artificially low prices and displace products produced by the Republic of Armenia. importing country. Such a policy will also be in demand by other competing exporting countries, since their exported goods will be displaced by the exported goods of the Republic of Armenia. Thus, the Republic of Armenia, having adopted dumping as the basis of its export policy, will lead to the displacement of both local production and goods imported from other countries to the country importing goods from the Republic of Armenia.

The concepts of dumping and the differences between its types are formulated. The legislation of developed countries distinguishes between the following two types of dumping:

1. Price dumping, which involves selling a product on the export market at a lower price than on its domestic market,

2. Value dumping, which consists of selling exported goods at a price below their cost.

According to the agreement adopted by the EAEU, member states must apply anti-dumping measures throughout the EAEU. The Agreement regulates a clear procedure for the application of anti-dumping measures, where the necessary stages of protective measures are formulated, starting from filing an application with the responsible body of the EAEU, considering the application, making a decision until the results of the decision are drawn up. The concept of dumping, an explanation of the sector of the EAEU economy, and an analysis of the damage caused to the sector of the EAEU economy as a result of dumped imports are formulated in detail. Considering that Russia is a member of the WTO, its obligations to the WTO are mentioned, as well as the compliance of anti-dumping measures applied by the Russian Federation with WTO requirements. The EAEU agreement provided for the punishment of the dumping country as an obligation.

The Russian Federation and the Republic of Armenia are members of the WTO, therefore they must take into account the obligations of WTO members and the application of post-national anti-dumping measures provided for by the WTO.

Let us consider the dependence of the exports of product groups with a comparative advantage on their imports. The model will

A significant model was obtained based on regression models for the product group of Fish and crustaceans, molluscs and other aquatic invertebrates

$$GDP_t = 8552506.3 + 81.44779EXP_t + 14.5399FDI_t$$

346820.44	17.058429	14.217728	
	24.65976	4.77462	2.02365

where

a) the values of the first line given under the coefficients of the regression equation represent the standard error, and the values given in the second line are the estimate of the t statistic;

b) $R^2=0,8778$, $F=24,37$:

According to the model presented in (), GDP is primarily dependent on the export of the commodity group crayfish and crustaceans and on foreign direct investment.

Conclusion

Our results show that studying the specialization and structure of international trade in aquaculture products based on indices of a country's comparative advantage in international trade allows us to determine the importance of the aquaculture sector in economic development. We argue that the assessment of the comparative advantage of exports obtained on the basis of the application of the Balassa index made it possible to justify the importance of developing the volume of foreign direct investment and using it to expand aquaculture production.

We also argue that the attractiveness of the aquaculture sector: an increase in exports by one unit increases GDP by 81.447 units, and an increase in foreign direct investment by one unit increases GDP by 14.54 units. Moreover, this efficiency of development of the aquaculture sector has a high level of multiplier and therefore is an important contribution to almost all industries associated with the aquaculture sector. This means that, the aquaculture sector will influence economic growth directly, influencing productivity, it should also increase growth indirectly, influencing the openness of international trade.

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ANALYSIS OF APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES TO SMALL AND MEDIUM ENTERPRISES

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Abstract

Information and communication technologies are widespread in all businesses, regardless of their size, and this process continues. As with many technologies, its adoption is slower in small and medium enterprises than in large enterprises. Sectors of activity are becoming more globalized over time, and even as the dominance of large entrepreneurs continues to grow, new opportunities are emerging for small and medium-sized enterprises, a side industry that helps them expand their activities. Small and medium-sized enterprises face challenges such as competitiveness, productivity, management skills, and technological capabilities during globalization. In order to overcome these difficulties, governments should provide assistance to small and medium-sized enterprises for support such as mastering information and communication, helping with market failures, developing the business environment, and e-business. In the study, the benefits of ICT to small and medium enterprises and the limitations encountered during its use were also investigated. At the same time, the use of information and communication in different sectors is found here. The result of ICT policy having an important role in e-business and internet use for entrepreneurs will be reflected.

The integration of Information and Communication Technologies (ICT) has revolutionized the operations of Small and Medium Enterprises (SMEs), presenting them with numerous growth opportunities. This research investigates the deployment and impact of ICT in SMEs, with a focus on the enhancements in efficiency, market competitiveness, and overall business performance facilitated by these technologies. The study examines various ICT tools such as cloud computing, digital marketing, e-commerce solutions, and customer relationship management systems, evaluating their adoption rates and effectiveness across different SME sectors.

The findings reveal that SMEs that effectively utilize ICT can achieve substantial improvements in productivity, cost reduction, and market expansion. Nonetheless, several barriers, including limited financial resources, insufficient technical expertise, and resistance to technological change, hinder the comprehensive adoption of ICT in SMEs. The research also underscores the importance of government policies and support programs in promoting ICT adoption among SMEs, highlighting the necessity for customized training and financial incentives to address these challenges.

In summary, while ICT applications offer significant advantages for SMEs, a holistic approach involving collaboration among stakeholders, continuous skill development, and adaptable technological infrastructure is essential to fully harness these benefits. Future studies should focus on longitudinal analyses to assess the long-term effects of ICT on SME performance and explore innovative solutions to overcome existing adoption barriers.

Keywords: Small and medium enterprises, information and communication technology, e-commerce, ICT adoption, Business growth

Introduction

ICTs, e-business applications are numerous and helpful in achieving advantages in both inter-company and intra-company business activities. These applications can increase the reliability and speed of both business-to-consumer and business-to-business transactions, reduce transaction costs, and expand internal data management. For improving service quality and external communication, they are an effective channel of use according to customers. If we look at the advantages obtained during the use of ICT, the increase in internet sales and purchases has been realized in recent times, and the use of these tools has been longer. E-commerce has been following a faster growth trend in recent times. We can only give examples of such platforms as Azerbaijan Trendyol, Umico and Temu. E-commerce, despite the use of ICT, is still not at the expected level, so that by 2023, e-commerce will account for approximately 1/5

of international trade, or 19%. These calculations include services and goods performed at the international level. Online sales are mostly business-to-business, while business-to-customer e-commerce has a smaller share. Small and medium-sized enterprises are not able to use the Internet as widely as large firms and they are lagging behind. In order to expand the implementation of e-commerce and e-business policies of this type of entrepreneurship, technical service and investment costs should be covered by the state. The more they stay out of marketing or online information, access to the Internet, the more SMEs will stay away from e-commerce, as a result of which they will not be able to reach large entrepreneurs, and the share mass of traditional trade will always exceed e-commerce. Another reason that hinders electronic commerce is the lack of regulatory and legal regulations between countries, and the lack of trust and confidence.

Research

Even though some time has passed, SMEs in more developed countries are realizing the benefits of internet, e-mail, computer terminals and in short ICT to their business activities. Many small and medium-sized businesses in developed countries and countries that are part of the Economic Cooperation Union have at least one computer and Internet access in micro-enterprises with a small number of employees. Many software solutions can improve the management of knowledge and information within an enterprise, which can lead to effective business processes and increased firm performance. With the help of the Internet and e-mail, local and foreign communication can be established both with other entrepreneurs and with customers. This, in turn, can increase reliability, speed up operations, reduce costs and drive sales.

About 148,000 businesses in the European Union were surveyed in 2021. Less than 3% of those who participated in the survey were large entrepreneurs, and the larger part were small entrepreneurs with an indicator of 83%, and the remaining 14% were medium entrepreneurs.

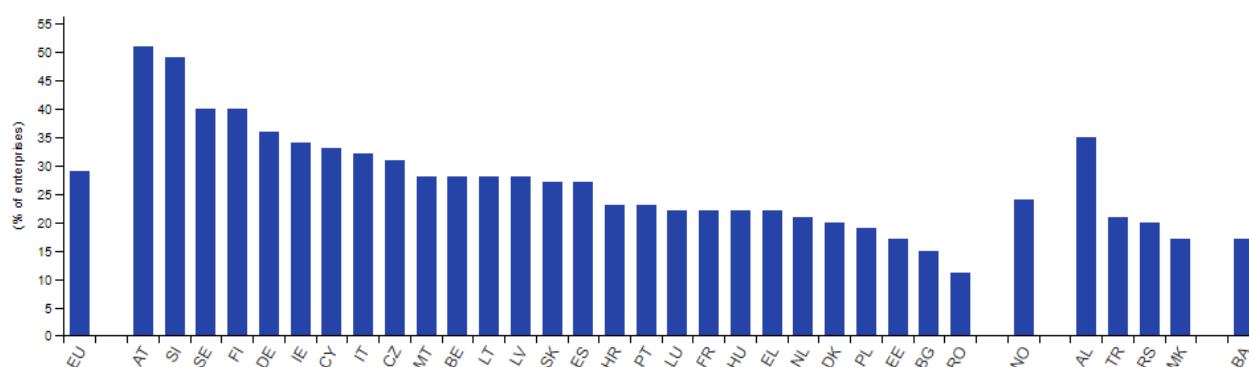


Figure 1: Use of IoT by Entrepreneurs in Europe 2021

Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Use_of_Internet_of_Things_in_enterprises

According to the data shown in Figure 1, the indicator of using IOT in 2021 in the European territory is on average 29% of all entrepreneurs. Austria has the highest rate of IOT usage as a share of total enterprises. Thus, 51% of the total businesses in Austria are using IoT, Slovenia is in second place with 49% of this indicator. In Italy, this indicator is equal to 32%, and in Turkey to 21%. The lowest rate of IOT-using businesses in total businesses is in Bulgaria with 15% and Romania with 11%.

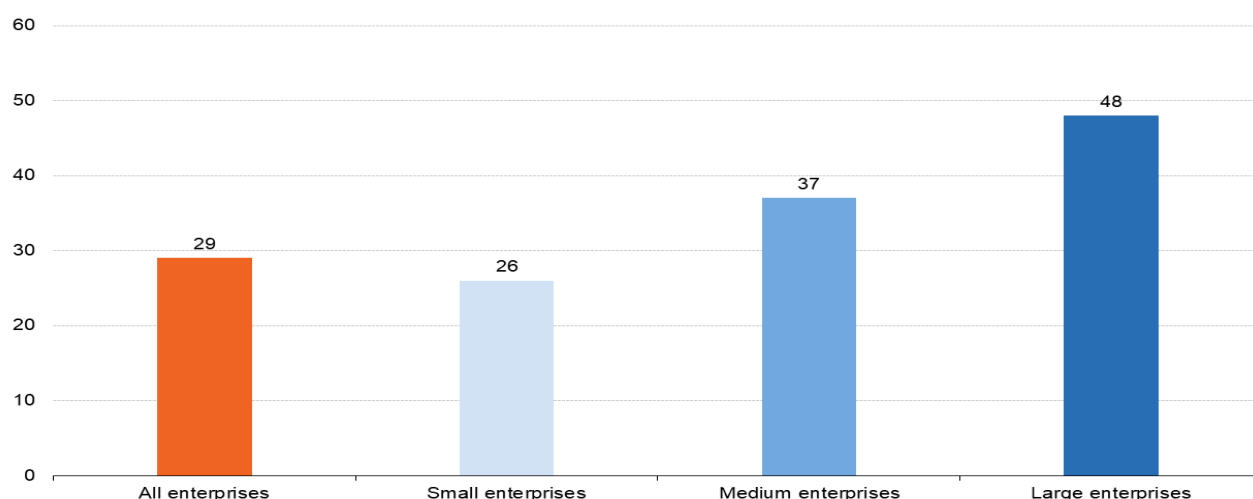


Figure 2: Use of IoT by type of Enterprise in Europe, 2021

Source: https://ec.europa.eu/eurostat/statistics-explained/images/2/22/Enterprises_using_IoT_by_size_class%2C_EU%2C_2021_%28%25_of_enterprises%29.png

Figure 2 shows that in 2021, 29% of businesses in Europe will use more IoT to protect their assets. In 2021, the use of IoT in large enterprises is 48%, and the use of IoT in small enterprises is 26%.

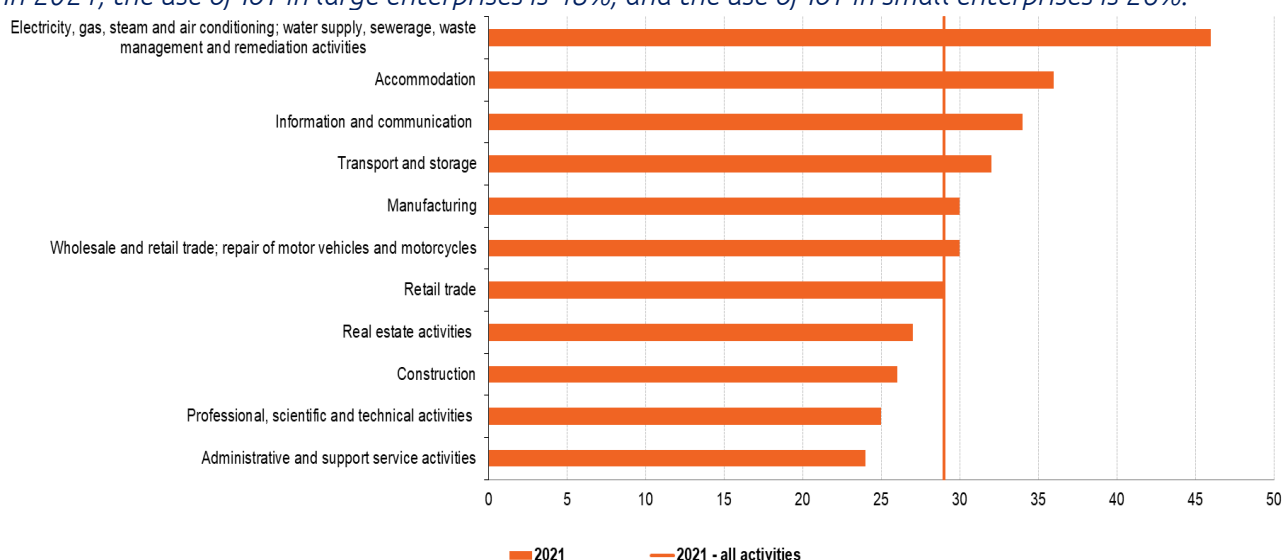


Figure 3: Use of IoT by Businesses in Europe, 2021

Source: https://ec.europa.eu/eurostat/statistics-explained/images/3/38/Enterprises_using_IoT_by_economic_activity%2C_EU%2C_2021_%28%25_of_enterprises%29.png

According to Figure 3, 46% of enterprises operating in the direction of electricity, gas, and water supply, and 34% in areas such as information and communication, and the average figure of 29%, have a large mass in enterprises with IOT users. The lowest IoT use was in support and administrative services with 24% and in scientific professional activities with 25%.

Table 1

Leading online businesses by sales, 2017 to 2023, in billion USD

Characteristic	2017	2018	2019	2020	2021	2022	2023
Amazon.com	177.87	232.89	280.52	386.06	469.82	513.98	574.78
Apple*	229.23	265.6	260.17	274.52	365.82	394.33	383.29
Alphabet	110.86	136.82	161.86	182.53	257.64	282.83	307.39
Alibaba	22.99	56.15	71.99	109.48	134.57	126.49	-
Meta (formerly Facebook Inc.)	40.65	55.84	70.7	85.97	117.93	116.61	134.9
Tencent	21.9	45.56	54.08	73.88	87.85	79.6	-
Netflix	11.69	55.84	20.16	25	26.7	31.62	33.72
PayPal	13.09	15.45	17.77	21.45	25.37	27.52	29.77
Baidu	13.03	14.88	15.43	16.41	19.54	17.93	-
eBay	8.01	8.65	7.43	8.89	10.42	9.8	10.11

Source: https://www.statista.com/statistics/277123/internet-companies-revenue/_of_enterprises%29.png

Based on the information shown in Table 1, we can say how important online activity is in the development of business and sales. Thus, the table shows the leading online sales companies by year, and these indicators also belong to well-known companies. As can be seen from here, the use of ICT is more common in large enterprises than in small and medium-sized enterprises. All the companies in the opposite table are large enterprises. When we look at sales trends by year, more growth is observed.

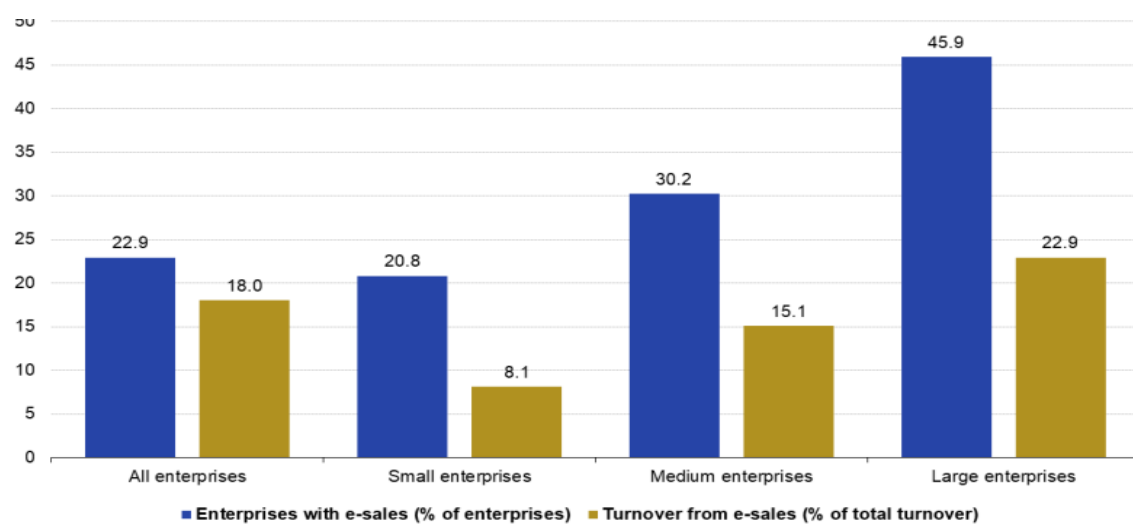


Figure 4: E-sales by business size in Europe and the share of e-sales in business turnover, in percentage, 2022

Source: [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:E-sales_and_turnover_from_e-sales,_by_size_class,_EU,_2022_\(%25_of_enterprises,_%25_of_total_turnover\).png](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:E-sales_and_turnover_from_e-sales,_by_size_class,_EU,_2022_(%25_of_enterprises,_%25_of_total_turnover).png)

According to the information shown in Figure 4, e-sales in Europe in 2022 for all businesses cover 22.9% of all businesses. The turnover from e-sales has a share of 18% in all businesses. If we look at small and medium-sized enterprises, we will notice that the share of e-sales in large enterprises, as well as the turnover of e-sales in the entire turnover, is greater.

In addition to providing companies with an electronic customer base, the use of ICT is also an effective option for data collection, providing employees and managers with faster and more accurate information about customers. By means of this, all personnel can easily access the company's database at the same time, either from the office or from another place, and they can use the data and add new data.

ICTs can be more useful in SMEs than in large enterprises if they are used properly and more widely. SMEs in the regional and local markets have difficulties in finding a new customer base and expanding the customer base in the global environment due to the lack of marketing and informational features. If SMEs can use ICT properly, they can get more qualified staff from outside or inside the country as employees through their website, and at the same time, they can attract local or foreign potential investors during investment. In order to attract them, they can use ICT to provide detailed information about their financial situation, technology, and business plans. Because when choosing a company, investors and personnel pay attention to their future situations and potential.

Although many of the conducted studies have shown that the use of ICT has a positive effect on the business of the entrepreneur, some of them have not reported that the use of the computer is beneficial in the expansion of business activities. According to the studies conducted by the Economic Cooperation Organization, the effect of e-business and ICT use on the enterprise's activity is generally positive. Projects related to these areas were implemented in 11 different countries, and 220 businesses successfully exited these projects. In this study, even if the company's turnover and profitability increase, the trend of employment growth is less. According to surveys conducted in 13 countries, the use of ICT has been useful in meeting customer needs, increasing product range, and increasing market share. At the same time, its use ensured a more efficient use of labor and capital. Despite these, investing in innovations in the use of ICT is one of the main points for improving the company's performance.

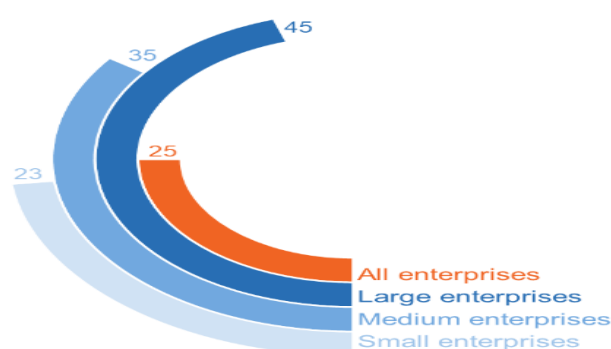


Figure 5: ICT security incident insurance by business size in Europe, by percentage, 2022

Source: [https://ec.europa.eu/eurostat/statistics-](https://ec.europa.eu/eurostat/statistics-explained/images/3/34/Enterprises_having_insurance_against_ICT_security_incidents%2C_by_size%2C_EU%2C_2022_%28%25_enterprises%29.png)

[explained/images/3/34/Enterprises_having_insurance_against_ICT_security_incidents%2C_by_size%2C_EU%2C_2022_%28%25_enterprises%29.png](https://ec.europa.eu/eurostat/statistics-explained/images/3/34/Enterprises_having_insurance_against_ICT_security_incidents%2C_by_size%2C_EU%2C_2022_%28%25_enterprises%29.png)

As well as the benefits of using ICT for entrepreneurs, there are also some disadvantages. The most significant of these negative aspects may be the transfer of information to other persons or the transfer of management to the hands of other persons other than the entrepreneur, against which measures should be taken and care should be taken as much as possible. Businesses should take many security measures and try to keep their data confidential as much as possible. In the study of entrepreneurs in Europe, the distribution of the share of entrepreneurs insured against ICT incidents according to the study in 2022 is reflected in Figure 5. This indicator is still not at the desired level for all businesses. Thus, the insurance for all enterprises is equal to 25% of the total enterprises. Based on the data shown in Figure 5, we can say that this indicator of SMEs, like many other indicators, lags behind large enterprises. So, if the security insurance in large enterprises was 45% of the total large enterprises, this indicator is equal to 35% in medium enterprises, and 23% in small enterprises.

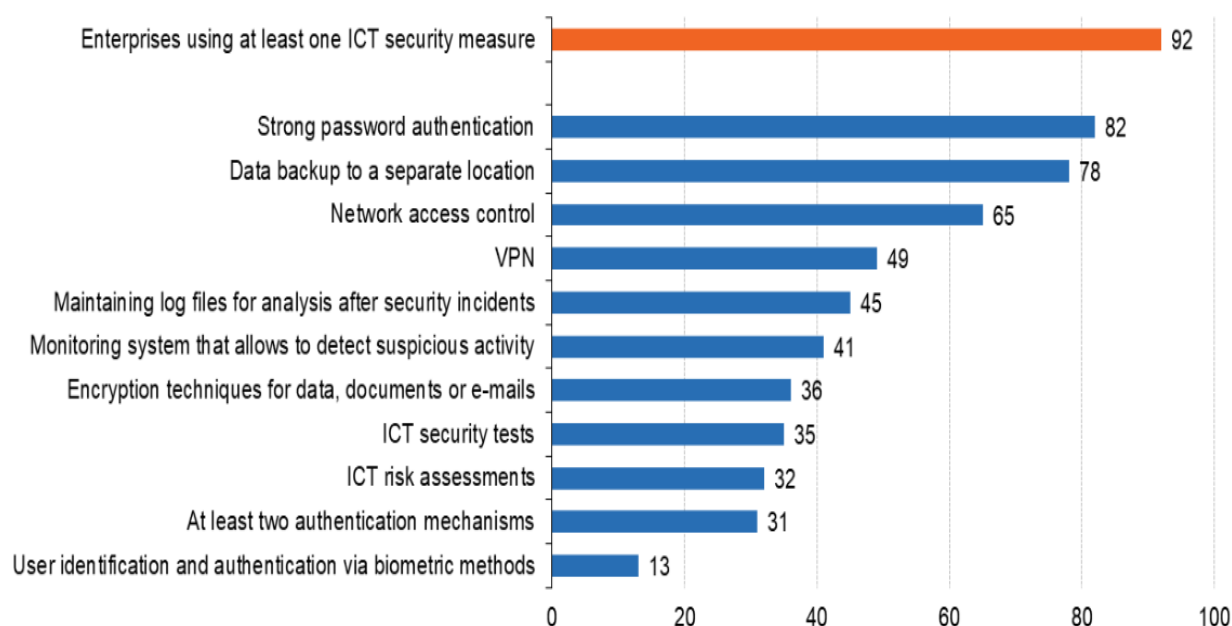


Figure 6: ICT security measures of businesses in Europe, by percentage, 2022

Source: https://ec.europa.eu/eurostat/statistics-explained/images/d/d6/ICT_security_measures_used_by_enterprises%2C_EU%2C_2022_%28%25_enterprises%29.png

Entrepreneurs implement some security measures related to the use of ICT. Based on the research conducted in Europe, some conclusions have been reached in this regard. The rate of entrepreneurs implementing at least 1 security measure is quite high. Thus, 92% of all entrepreneurs implement at least 1 security measure. The most commonly used measures are the implementation of strong passwords and the backup of data in separate locations. Accordingly, these indicators cover 82% and 78% of entrepreneurs. The least used security measures are the implementation of at least 2 authentication mechanisms and the use of biometric user login. The indicators of these measures are equal to 31% and 13% of total entrepreneurs, respectively.

Result

Although there are many potential benefits of ICTs and e-commerce, there are many opinions regarding the impact of their use on firm performance. Their use requires additional investment in many cases, and although attracting investment brings benefits, it is inevitable to bring additional costs and risks with it. Although numerous studies have shown the benefit of market expansion for SMEs, larger enterprises may also want to enter activities where SMEs are more numerous and capture the revenue. Additionally, it should be noted that managing and running an online business for SMEs is not an easy task, as it requires additional training costs, software or hardware costs. For this, it is necessary to attract investment, which also means a potential additional business partner.

Some entrepreneurs, especially early adopters of e-commerce, make the transition to e-business through ICT. After these uses, they started to use sophisticated technologies and more useful ICTs to improve their processes. These types of businesses are the main part of B2B and B2C e-business. The e-business strategy included functions such as supply management, after-sales service, delivery, logistics, and marketing.

A large number of SMEs are at the stage of understanding e-commerce or creating web bugs. Small businesses have less incentive than large businesses to adapt to complex processes. For these reasons, the use of ICTs by SMEs, the use of e-business requires more time. Despite this, it is inevitable that SMEs in B2B and B2C e-commerce will be a key component in business processes using ICT. Because their activity is very important for business activity.

In order for SMEs to use ICT and adapt to market conditions, e-government should pay more attention to these processes. If there is tight integration between B2G, B2C and B2B, e-business will be a more attractive future for SMEs. It is very important that the e-government stimulates the activity of SMEs online, but it is necessary to try to realize this stimulation as much as possible.

The use of electronic commerce and ICT to create wide opportunities for the activities of entrepreneurs has been revealed in this study. The use of ICT makes information exchange fast and efficient. With the help of networked computers, it makes the use of files on a shared network accessible to everyone. At the same time, nature is also benefited by means of ICTs, and information is stored in electronic devices rather than paper carriers. Storing information through ICTs also brings great advantages to entrepreneurs. For example, with the help of stored data, banks can make the right loan sales to their customers, or saving customer correspondence can ensure more effective and operative responses by employees in the next request of the customer. Another benefit of data sharing is that experienced employees can share their experience with other employees through this shared data sharing tool.

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Jurisprudence

THE IMPACT OF INTERDISCIPLINARY RESEARCH ON THE DEVELOPMENT OF THE CONCEPT OF JUSTICE IN THE CONTEXT OF DIGITAL TECHNOLOGIES AND CHANGES IN SOCIAL NORMS

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The scientific and technological revolution 4.0 has created a huge window of opportunity for a host of modern digital technologies. At the same time, it has given rise to the emergence and development of modern social relations using information and communication technologies. In fact, today all the prerequisites have been created for the beginning of the scientific, technical and social revolutions 5.0, which simultaneously and radically change the role of a person in the social structure, while changing the social structure itself, creating new social groups, institutions, social relations [1].

Modern social relations in the context of digital technologies are also undergoing dramatic changes [2], becoming multi-vector and can be divided by the type of objects, subjects and characteristics of relations between them, namely, the subjective and objective basis for identifying social relations. Thus, the subjective basis for identifying social relations is social communities of people, and the objective basis is information and communication technologies and their products [3]. Legal science is a social science, since it performs epistemological and heuristic functions that determine the directions of scientific research and scientific predictions, and studies the relations that develop between people, groups of people, people and state institutions. The results of the research are practical improvement of legislation on a scientific basis, development of draft legal acts, scientific expertise, etc.

However, current practice shows that modern laws are created very slowly, without the necessary and sufficient detail of terms and basic concepts.

The correctness, accuracy and consistency of definitions of legal terms with the current legislation cannot be overemphasized. Unfortunately, we must state that today the legislation is not able to promptly regulate social relations that are rapidly developing with the use of digital technologies [4].

Most legal systems have existing legal acts that are not formulated with a view to the possible emergence of modern information and communication systems and do not consider the issues of their regulatory regulation, as well as improperly apply outdated legal norms to many new social relations related to the use of modern technologies. For example, existing legal acts may regulate certain issues related to the use of information technologies, but their scope is often unclear or ambiguous, which creates a situation of legal uncertainty. Traditional social relations are well regulated by legal norms, institutions and branches of law. At the same time, there are social relations that are only being formed, and they objectively need to be distinguished as separate areas, branches or institutes of law, with a complex structure, to create relatively stable regulation [5].

In fact, the regulation of social relations with the use of digital technologies should be created based on related analogue institutions and branches of law to streamline functional and subject-matter regulatory inter-sectoral relations.

The legal regulation of social relations in the context of digital technologies is complex and combines the norms of international, information, administrative, civil, criminal, labor, property, intellectual property, personal data protection and other branches and institutions of law, as well as institutions for ensuring the general, information and cyber security of the state. The legal regime of regulation and methods of these branches and institutions differ, but in order to ensure a unified and comprehensive legal regulation of social relations, it is necessary to implement a specific combination of these methods and regimes.

The solution to this problem is possible through comprehensive and large-scale interdisciplinary research to regulate social relations and form new branches of law [6].

Interdisciplinary research plays a key role in the development of the concept of both law in general and justice specifically in the context of digital technologies and changing social norms. This research

allows for the integration of knowledge from different fields, which provides a deeper and more comprehensive understanding of the complex interrelationships between digital innovations and social processes, as well as their impact on the justice system.

First, digital technologies are significantly changing the way justice is delivered. The introduction of e-courts, automated case distribution systems, the use of artificial intelligence to analyse legal documents and predict the outcome of trials - all of this requires new approaches to legal regulation and the organization of the judicial system. Interdisciplinary research allows us to consider the technical aspects of implementing these technologies, their impact on the efficiency of justice and potential risks related to data privacy and possible biases in algorithms.

Second, digital technologies are changing social norms and perceptions of justice. They contribute to the formation of new social networks that can influence public opinion and attitudes towards legal issues. An interdisciplinary approach allows us to analyse how changes in communication technologies and social networks affect legal culture, trust in the legal system and citizen participation in the legal process. This is important for developing new strategies for legal education and public awareness.

Thirdly, interdisciplinary research contributes to the development of new concepts of justice that consider the challenges of globalization and digitalization. For example, cybercrime, intellectual property protection in the digital environment, digital identity and privacy issues all require the integration of knowledge from different disciplines to develop effective legal mechanisms. This also includes considering international law and practices of different countries, which is made possible by interdisciplinary research.

Finally, interdisciplinary research contributes to the development of ethical standards and principles in the field of justice that meet the challenges of the digital age. The use of artificial intelligence and the storage and processing of large amounts of data require the development of new ethical frameworks that will ensure justice, equality and the protection of human rights. An interdisciplinary approach allows us to engage experts in ethics, philosophy, law, and technical sciences to create such standards.

Moreover, interdisciplinary research has a critical impact on the development of justice in the context of digital technologies and changing social norms. Integration of knowledge from different fields allows for a deeper understanding of the relationships between digital innovations and social processes, affecting the legal system. Digital technologies are changing the way justice is administered through e-courts and automated systems, requiring new approaches to legal regulation.

Social norms and perceptions of fairness and quality of justice are changing due to new communication technologies and social media. This requires an analysis of the impact on legal culture and trust in the legal system, which contributes to the development of new strategies for legal education, while the use of artificial intelligence and the processing of large amounts of data require a new ethical framework to ensure the creation of new standards for their use.

In addition, interdisciplinary research contributes to the development of new concepts of justice that consider the challenges of globalization and digitalization. For example, the problems of cybercrime, protection of intellectual property in the digital environment, digital identity and privacy require the integration of knowledge from different disciplines to create effective legal mechanisms. This also includes considering international law and practices of different countries, which is made possible by interdisciplinary research.

Finally, the development of ethical standards and principles in the field of justice is an integral part of interdisciplinary research. The use of artificial intelligence and the storage and processing of large amounts of data require new ethical frameworks that will ensure justice, equality and the protection of human rights in the digital age. The involvement of experts in ethics, legal philosophy and technical sciences is critical to the creation of such standards.

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HOUSE ARREST IN THE CRIMINAL PROCESS OF KAZAKHSTAN: PROBLEMS OF IMPLEMENTATION

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ДОМАШНИЙ АРЕСТ В УГОЛОВНОМ ПРОЦЕССЕ КАЗАХСТАНА: ПРОБЛЕМЫ РЕАЛИЗАЦИИ

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Abstract

The use of preventive measures in the criminal procedural law of the Republic of Kazakhstan is one of the most complex aspects in the theory and practice of criminal proceedings. House arrest as a type of preventive measure was first introduced into criminal procedural legislation in 1923. With the development of social relations in the newly adopted in 1959 CPC of the KazSSR house arrest was already absent. This approach of the legislator was uniform throughout the USSR and presupposed compliance with the principle of conformity of the codes of criminal procedure of all fifteen union republics with the Fundamentals of Criminal Procedure of the Union of Soviet Socialist Republics and Union Republics (1958). The processes of sovereignty of the Soviet republics in the period 1991-1993 are characterised by increased attention in the field of legal policy of the new states - the issues of humanisation of repressive branches of law. In the CPC RK of 1997, house arrest was again included in the system of preventive measures. At the same time, the problems of implementation of this type of preventive measures have remained relevant and have not found their resolution in the current CPC RK (2014).

Аннотация

Применение мер пресечения в уголовно-процессуальном праве Республики Казахстан – один из наиболее сложных аспектов в теории и практике уголовного судопроизводства. Домашний арест как вид мер пресечения был впервые введен в уголовно-процессуальное законодательство в 1923 году. По мере развития общественных отношений во вновь принятом в 1959 году УПК КазССР домашний арест уже отсутствовал. Такой подход законодателя был единым на всей территории СССР и предполагал соблюдение принципа соответствия уголовно-процессуальных кодексов всех пятнадцати союзных республики Основам уголовного судопроизводства Союза ССР и союзных республик (1958 г.). Процессы суверенизации советских республик в период 1991-1993 гг. характеризуются повышенным вниманием в области правовой политики новых государств – вопросам гуманизации репрессивных отраслей права. В УПК РК 1997 года в систему мер пресечения вновь был включен домашний арест. Наряду с этим, проблемы реализации данного вида мер пресечения сохранили свою актуальность и не нашли своего разрешения в действующем УПК РК (2014 г.).

Keywords: *measures of criminal procedural restraint, house arrest, restrictions, rights, freedoms and legitimate interests of a person and a citizen, calculation of time limits.*

Ключевые слова: *меры уголовно-процессуального пресечения, домашний арест, ограничения, права, свободы и законные интересы человека и гражданина, исчисление сроков.*

Введение

Актуальность исследования проблем применения и исполнения домашнего ареста обусловлена прежде всего приоритетами, сформулированными в Концепции правовой политики Республики Казахстан до 2030 года (далее – Концепция), в области уголовно-процессуальных правоотношений. В частности, в пункте 4.11. названной Концепции в качестве важнейшей

задачи указывается «совершенствование порядка применения в уголовном процессе мер государственного принуждения и мер пресечения» [1, с. 13]. Данный приоритет, рассматриваемый в контексте основного приоритета, состоящего в выработке механизмов, направленных на обеспечение стабильности уголовного и уголовно-процессуального законодательства [1, с. 12]. Говорить о стабильности уголовного и уголовно-процессуального законодательства весьма сложно с учетом того, что начиная с 2014 года, то есть с момента принятия действующих УК РК и УПК РК, в них было внесено более 1200 изменений и дополнений, о чем упоминал Глава государства К.-Ж. К. Токаев в своих ежегодных посланиях народу Казахстана. В современных условиях теории и практики все чаще обнаруживают в предписаниях этих кодексов наличие противоречий и явных пробелов. Регламентация домашнего ареста не является исключением.

В ходе исследования были применены традиционные в юридической науке методы: диалектический, сравнительно-правовой, статистический, логико-аналитический, исторический, а также отдельные частные методы.

Домашний арест известен со времени принятия в 1864 году Устава уголовного судопроизводства Российской Империи (далее – УУС) [2]. В целом в УУС арест как мера принуждения представлен достаточно широко. К разновидностям ареста относились: содержание по домашним арестом, в тюрьме, на гауптвахтах, в других помещениях. Как отмечал П. И. Люблинский, домашний арест отличался от содержания под стражей только тем, что местом заключения являлась квартира обвиняемого. Применялась эта мера крайне редко – в случаях тяжелой болезни обвиняемого или его исключительного положения. В 1899 году, например, домашний арест не применялся ни разу. Тогда как в 1898 году из 146 753 обвиняемых содержались под стражей 23 727, то есть 16,2% [3, с. 372-374].

В соответствии со ст. 416 УУС были установлены следующие виды мер пресечения:

- 1) отобрание вида на жительство или обязательство их подпиской о явке к следствию и неотлучке с места жительства;
- 2) отдача под особый надзор полиции;
- 3) взятие залога;
- 4) домашний арест;
- 5) взятие под стражу.

Характеризуя домашний арест, И. Я. Фойницкий писал: «Домашний арест есть мера, по строгости своей стоящая между залогом и личным задержанием; она состоит в том, что обвиняемый оставляется в своей квартире, но к нему приставляется стража для воспрепятствования побегу и предупреждения сношений с другими лицами. На практике ввиду затруднительности ее осуществления она применяется только к лицам видного общественного положения или к больным.» [4, с. 334]. Непосредственно в нормах УУС каких-либо пояснений относительно домашнего ареста, позволяющих четко разграничивать его от взятия под стражу, не содержится. Тактика умолчания в данной части имеет место также в УПК РСФСР 1923 года, УПК РК 1997 и 2014 года. В УПК КазССР 1959 года домашнего ареста как меры пресечения не содержится. В пределах ст. 63 УПК КазССР в качестве мер пресечения предусмотрены: подписка о невыезде; личное поручительство или поручительство общественных организаций, наблюдение командования воинской части; заключение под стражу [5].

В современных условиях процесс возрождения домашнего ареста не сопровождался более детальной регламентацией поводов и оснований, условий и порядка его применения. Трудности применения домашнего ареста в практической деятельности не преодолены современным законодательством так же, как и во времена И. Я. Фойницкого.

В советский период развития права, когда Казахская Автономная Советская

Социалистическая Республика входила в состав РСФСР, в УПК РСФСР 1923 года домашний арест предусматривался в ст. 144 и 157 [6]. Виды мер пресечения в этот период практически совпадали с мерами, предусмотренными в УУС 1864 года, и включали в себя: 1) подписку о невыезде; 2) поручительство, личное, имущественное; 3) залог; 4) домашний арест; 5) заключение под стражу. Согласно ст. 157 УПК РСФСР 1923 года, домашний арест заключался в «лишении обвиняемого свободы в виде изоляции его на дому, с назначением стражи или без таковой». Каких-либо иных разъяснений о домашнем аресте в данном УПК РСФСР не содержалось.

В 1958 году были приняты Основы уголовного судопроизводства Союз ССР и союзных республик (далее – Основы). В ст. 33 названного акта устанавливались следующие меры пресечения: 1) подписка о невыезде; 2) личное поручительство или поручительство общественной организации; 3) заключение под стражу и иные меры пресечения, которые могут быть определены законодательством союзных республик [7]. С учетом того, что система и структура законодательств союзных республик должны были соответствовать Конституции СССР и общесоюзному законодательству, то вполне объясним отказ союзных республик от домашнего ареста, который не был предусмотрен нормами Основ, в период правовой реформы 1958-1961 гг.

Для сравнения в УПК РК 1997 года (ст. 140) и 2014 года (ст. 137) предусмотрены виды мер пресечения:

- 1) подписка о невыезде;
- 2) личное поручительство;
- 3) передача военнослужащего под наблюдение командования воинской части;
- 4) отдача несовершеннолетнего под присмотр
- 5) залог;
- 6) домашний арест;
- 7) арест/содержание под стражей.

Отличие УПК РК 1997 года от УПК РК 2014 года состоит в замене термина «арест» на термин «содержание под стражей». Домашний арест сохранил свое терминологическое обозначение без изменений начиная с 1864 года.

Основная часть

Регламентация домашнего ареста по действующему УПК РК сводится к следующему:

- предусмотрение единых оснований для всех видов мер пресечения: наличие признаков, указывающих на то, что подозреваемый, обвиняемый скроется от органов уголовного преследования или суда либо воспрепятствует объективному расследованию дела или разбирательству в суде, либо будет продолжать заниматься преступной деятельностью, а также для обеспечения исполнения приговора (ч. 1 ст. 136 УПК РК);

- единые для всех видов мер пресечения условия избрания меры пресечения: обязательный учет обстоятельств: 1) тяжесть совершенного преступления; 2) личность подозреваемого, обвиняемого, его возраст; 3) состояние здоровья; 4) семейное положение, наличие в семье иждивенцев; 5) прочность социальных связей подозреваемого, обвиняемого; 6) репутация подозреваемого, обвиняемого; 7) род занятий; 8) наличие у подозреваемого, обвиняемого постоянного места работы или учебы; 9) имущественное положение; 10) наличие постоянного места жительства и другие обстоятельства (ст. 138 УПК РК);

- возможность применения электронных средств слежения во всех случаях, за исключением наблюдения командования воинской части и содержания под стражей (ч. 2 ст. 137 УПК РК);

- основная цель применения домашнего ареста – изоляция подозреваемого, обвиняемого от общества (ч. 1 ст. 146 УПК РК);

- возможность одновременного применения одного и более ограничений при избрании домашнего ареста, предусмотренных ч. 2 ст. 146 УПК РК: 1) запрет выхода из жилища полностью или в определенное время; 2) запрет на ведение телефонных переговоров, отправление корреспонденции и использование средств связи, за исключением случаев, когда на подозреваемого, обвиняемого возложена обязанность отвечать на контрольные телефонные звонки или иные сигналы контроля, звонить по телефону или лично являться в определенное время в орган дознания или другой орган, осуществляющий надзор за поведением подозреваемого, обвиняемого или подсудимого; 3) запрет на общение с определенными лицами и принятие кого бы то ни было у себя; 4) применение электронных средств контроля и возложение обязанности носить при себе эти средства; 5) установление наблюдения за подозреваемым, обвиняемым или их жилищем, а также охрана их жилища или отведенного им помещения в качестве жилища; 6) другие меры, обеспечивающие надлежащее поведение и изоляцию подозреваемого, обвиняемого от общества. При необходимости за поведением подозреваемого, обвиняемого может быть установлен надзор.

В качестве проблемных аспектов нами усматриваются следующие положения:

- 1) правомерность комплекса ограничений, налагаемых на лицо, находящееся под домашним арестом;
- 2) что необходимо понимать под «жилищем» в уголовно-процессуальном смысле;

- 3) кто должен обеспечивать охрану жилища подозреваемого, обвиняемого;
- 4) каковы критерии оценки обстоятельств, учитываемых при избрании меры пресечения в виде домашнего ареста.

Анализ правовых источников, публикаций по кругу исследуемых проблем, практика свидетельствуют о том, что уровень и охват их разрешения самых различных.

Так, в своих исследованиях Ю. В. Царева обращает внимание на снижение случаев применения домашнего ареста органами уголовного преследования и судом ввиду сложности его практической реализации. Ею приведены отдельные статистически данные по наиболее суровым видам мер пресечения: в субъектах РФ в 2019 году применены содержание под стражей – в 94 632 случаях, домашний арест – 6 038 случаях, залог – в 77 случаях; в 2022 году: 44 496 – 3 746 – 53 случаях соответственно [8, с.63]. Таким образом, снижение частоты применения содержания под стражей составило 2,13 раза, домашнего ареста – в 1,61 раза, залога – 1,45 раза. Динамика свидетельствует о том, что значительное снижение применения содержания под стражей не повлекло роста применения домашнего ареста. Соотношение содержания под стражей и домашнего ареста по отношению к залого складывается следующим образом: в 2019 году на 1 залог приходилось 577 домашних арестов, 1 229 случаев содержания под стражей; в 2022 году на один залог приходилось 70,6 домашних арестов и 113,9 содержаний под стражей.

Применительно к казахстанской практике применения содержания под стражей, домашнего ареста и залога, то здесь также складывается очень похожая ситуация. Проблемы те же: недостаточная правовая регламентация оснований и условий применения домашнего ареста, сложность его практической реализации.

Проблема первая: правомерность комплекса ограничений, налагаемых на лицо, находящееся под домашним арестом.

Показательно нормативное постановление Конституционного Суда Республики Казахстан «О рассмотрении на соответствие Конституции Республики Казахстан отдельных положений части второй статьи 146 Уголовно-процессуального кодекса Республики Казахстан от 4 июля 2014 года» от 11 апреля 2023 года № 9 [9]. Поводом для вынесения нормативного постановления послужило обращение адвоката Утебекова Д. Н. в интересах гражданина Молдагалиева К. Д. с просьбой признать не соответствующим Конституции положение части 2 статьи 146 УПК РК об ограничении лицу, находящемуся под домашним арестом, на выход из жилища, ведение телефонных переговоров, получение корреспонденции и использование средств связи. Конституционный суд считает, что оснований для удовлетворения обращения адвоката Утебекова Д. Н. нет.

Наряду с этим, на наш взгляд, существуют отдельные спорные моменты, для уяснения которых полагаем целесообразным представить сравнительную таблицу прав, предусмотренных для подозреваемого, обвиняемого при применении содержания под стражей, и ограничений в отношении подозреваемого, обвиняемого, находящегося под домашним арестом (таб. 1):

Таблица 1.

Сравнительная таблица прав лиц, находящихся под стражей в порядке ст. 147 УПК РК, и ограничения в отношении лиц, находящихся под домашним арестом в порядке ст. 146 УПК РК

№	Права лиц, содержащихся под стражей (ст. 147 УПК РК):	Ограничения в отношении лиц, находящихся под домашним арестом (ст. 146 УПК РК):
1.	- получать свидания с защитником, количество и продолжительность которых не ограничена	Регламентация отсутствует
2.	- получать свидания с родственниками и другими лицами	- запрет на общение с определенными лицами и принятие кого бы то ни было у себя
3.	- вести переписку и пользоваться письменными принадлежностями	- запрет на отправку корреспонденции и пользование средствами связи
4.	- выходить на ежедневную прогулку продолжительностью не менее одного часа	-запрет выхода из жилища полностью или в определенное время

5.	- получать посылки и передачи	Регламентация отсутствует
6.	- участвовать в семейно-правовых отношениях	Регламентация отсутствует
7.	- участвовать в гражданско-правовых сделках	Регламентация отсутствует

Показанные в таблице отдельные виды прав подозреваемого, обвиняемого, содержащегося под стражей в порядке ст. 147 УПК РК, приведены из ст. 9-2 Закона РК «О порядке и условиях содержания лиц в специальных учреждениях, специальных помещениях, обеспечивающих временную изоляцию от общества», принятого 30 марта 1999 года № 353-І [10]. Пилотажный анализ приведенных прав при содержании лица под стражей и запретов в отношении лица, находящегося под домашним арестом, свидетельствует о том, домашний арест в определенном смысле представляется более строгим, чем содержание под стражей. Мы усматриваем отдельные пробелы в регламентации порядка содержания лица под домашним арестом. Изучение Правил исполнения меры пресечения в виде домашнего ареста, утвержденных совместным приказом Министра внутренних дел РК от 29 августа 2014 года № 564, Генерального Прокурора РК от 2 сентября 2014 года № 86, Председателя Комитета национальной безопасности РК от 4 сентября 2014 года № 290, Министра финансов РК от 11 сентября 2014 года № 394 и Председателя Агентства РК по делам государственной службы и противодействия коррупции от 12 сентября 2014 года № 4 [11], показало, что в этих Правилах нет никаких разъяснений относительно права подозреваемого, обвиняемого, находящихся под домашним арестом, иметь свидание с избранным или назначенным защитником наедине и конфиденциально (п.5) ч. 9 ст. 64 УПК РК). Значимость этого права особенно велика на фоне права лица, содержащегося под стражей, на конфиденциальные свидания с защитником без ограничения их количества и продолжительности.

На наш взгляд, ограничения, предусмотренные в отношении лица, находящегося под домашним арестом, находятся в определенном противоречии с п. 2 ст. 29 Всеобщей декларации прав человека, которая гласит: «При осуществлении своих прав и свобод каждый человек должен подвергаться только таким ограничениям, какие установлены законом исключительно с целью обеспечения должного признания и уважения прав и свобод других и удовлетворения требований морали, общественного порядка и общего благосостояния» [12]. Действительно, рассматриваемые ограничения предусмотрены нормами закона, но не всякий закон безупречен.

Проблема вторая: что необходимо понимать под «жилищем» в уголовно-процессуальном смысле.

Для уяснения вопроса о том, что необходимо понимать под термином «жилище», полагаем целесообразным сравнить соответствующее определение по УПК РК и Закону РК «О жилищных отношениях» [13] (табл. 2).

Таблица 2.

**Сравнительная таблица редакций определений понятия
«жилище» по УПК РК и ЗРК «О жилищных отношениях»**

Редакция п. 49) ст. 7 УПК РК	Редакция п. 28 ст. 2 ЗРК «О жилищных отношениях»
Жилище – помещение или строение для временного или постоянного проживания одного или нескольких человек, в том числе: собственные или арендуемые квартира, дом, садовый дом, гостиничный номер, каюта, купе; непосредственно к ним примыкающие веранды, террасы, галереи, балконы, мансардные строения, подвал и чердак жилого строения, кроме многоквартирного жилого дома, а также речное или морское судно и другие	Жилище – отдельная жилая единица (индивидуальный жилой дом, квартира, комната в общежитии, модульный (мобильный) жилой дом), предназначенная и используемая для постоянного проживания, отвечающая установленным строительным, санитарным, экологическим, противопожарным и другим обязательным нормам и правилам

Примечательно, что существует еще один вариант толкования понятия «жилище» или места, где может быть реализован домашний арест. Оно носит расширительный характер. Так, в п. 4 Правил исполнения меры пресечения в виде домашнего ареста указывается: Место

содержания под домашним арестом определяется органом, ведущим уголовный процесс. Это может быть жилище, больница, клиника, пансионат, иные места и арендованные помещения» [11].

При отсутствии жилища реализация домашнего ареста теряет практический смысл. Отсюда, определение понятия «жилище» - одно из ключевых для оценки имеющихся жилищных условий, позволяющих применить меру пресечения в виде домашнего ареста. Необходимо признать, что уголовно-процессуальная интерпретация определения, закрепленного в п.29) ст. 2 ЗРК «О жилищных отношениях», не самая удачная в контексте условий применения домашнего ареста. Наряду с этим, уголовно-процессуальная интерпретация понятия «жилище» как нельзя лучше отвечает целям и задачам процессуального задержания подозреваемого, осмотра места происшествия, производству выемки и обыска, производству негласных следственных и иных процессуальных действий.

Использование каюты какого-либо судна, непосредственно речного или морского судна, купе в железнодорожном вагоне в качестве жилища возможно в условиях, когда орган дознания представлен капитаном морского судна, находящегося в дальнем плавании, или руководителем геолого-разведочной партии, руководителем других государственных организаций и их подразделений, удаленных от органов дознания, в период отсутствия транспортного сообщения (ч. 3 ст. 61 УПК РК). Необходимо отметить, что для использования купе в качестве жилища в ст. 61 УПК РК нет никакого упоминания о руководителе бригады, обслуживающей поезд, который мог выполнять полномочия органа дознания во время выполнения железнодорожного рейса. Кроме того, очевидно, что решение вопроса об использовании веранд, мансард, чердаков, подвалов и балконов для размещения подозреваемого, обвиняемого, подвергнутого домашнему аресту, зависит от уполномоченного лица, который будет исходить из конкретных обстоятельств, предусмотренных ст. 138 УПК РК.

Комната в общежитии относится к жилищу. Однако реализация домашнего ареста в условиях общежития не представляется возможной: ни одно из предусмотренных законом ограничений невозможно применить в условиях высокой степени мобильности жителей общежитий.

Если выбор помещения для реализации домашнего ареста решаемый вопрос, то проблема остается в части, связанной с необходимостью в обязательном порядке получения санкции следственного судьи на применение данной меры пресечения (п. 2) ч. 1 ст. 55 УПК РК). В условиях дальнего плавания или полевых работ, в которых находится капитан судна или руководитель геолого-разведочной партии, не всегда есть возможность получения судебной санкции на домашний арест в дистанционном режиме. При этом, если истекает срок задержания, то дальнейшее удерживание подозреваемого, обвиняемого под домашним арестом без судебной санкции невозможно. А просто так запереть лицо в каюте или ином переносном жилище запрещено законом.

Таким образом, реализация домашнего ареста в контексте понятия «жилище» затруднена в силу изложенных выше и иных особенностей каждого вида жилища, включенных в это понятие нормой уголовно-процессуального закона, а также необходимостью соблюдения требования о его судебном санкционировании.

Проблема третья: кто должен обеспечивать охрану жилища подозреваемого, обвиняемого, подвергнутого домашнему аресту.

Если исходить из содержания п. 6) ч. 2 ст. 146 УПК РК, то охрана жилища наряду с надзором и наблюдением за поведением подозреваемого, обвиняемого, входит в обязанность органа, ведущего уголовный процесс, то есть органа уголовного преследования и суда. Если надзор и наблюдение регламентированы в УПК РК и разделе 3 (Применение домашнего ареста) Правил исполнения меры пресечения в виде домашнего ареста [11], то относительно охраны жилища лиц, находящихся под домашним арестом, в УПК РК кроме упоминания такой обязанности никаких предписаний не содержится. В названных Правилах указывается, что осуществление надзора за исполнением домашнего ареста не может быть поручено лицу, производящему досудебное расследование (п. 8). Надзор и наблюдение за подозреваемым, обвиняемым решением начальника органа дознания, командира воинской части поручаются структурному подразделению того органа, который по своему территориальному расположению находится ближе всего к соответствующему жилищу. Положений об охране жилища в Правилах нет. Есть основания полагать, что в рассматриваемой части наблюдается пробел, состоящий в отсутствии указаний на субъектов, обязанных осуществлять охрану жилища, а также правил

обеспечения охраны. Необходимость восполнения указанного пробела связана с тем, что надзор и наблюдение за подозреваемым, обвиняемым не означают еще и охрану жилища. Охране подлежит не сам подозреваемый, обвиняемый, а его жилище.

Проблема четвертая: каковы критерии оценки обстоятельств, учитываемых при избрании меры пресечения в виде домашнего ареста.

В соответствии со ст. 138 УПК РК орган, ведущий уголовный процесс, при избрании меры пресечения, помимо оснований, указанных в ст. 136 УПК РК, должен учитывать следующие обстоятельства:

- 1) тяжесть совершенного преступления;
- 2) личность подозреваемого, обвиняемого, его возраст;
- 3) состояние здоровья;
- 4) семейное положение, наличие в семье иждивенцев;
- 5) прочность социальных связей подозреваемого, обвиняемого;
- 6) репутация подозреваемого, обвиняемого;
- 7) род занятий;
- 8) наличие у подозреваемого, обвиняемого постоянного места работы или учебы;
- 9) имущественное положение;
- 10) наличие постоянного места жительства и другие обстоятельства.

Перечень указанных обстоятельств не является исчерпывающим. При всем многообразии обстоятельств, влияющих на процессуальное решение уполномоченного лица, применение домашнего ареста должно быть отрегулировано более четко, чем это имеет место быть в нормах УПК РК. Основной аргумент для более подробной регламентации условий применения домашнего ареста мы усматриваем в том, что в соответствии с ч. 4 ст. 62 УК РК время содержания под домашним арестом до вступления приговора в законную силу засчитывается в срок наказания в виде лишения свободы, ареста, ограничения свободы из расчета два дня за один день, в виде привлечения к общественным работам – из расчета один день содержания под домашним арестом за два часа общественных работ. Домашний арест не является заменой содержания лица под стражей. Условия применения домашнего ареста и содержания под стражей имеют свои особенности. Названные меры пресечения объединяет результат их применения – изоляция подозреваемого, обвиняемого от общества. Способы достижения результата разные. Наряду с этим, существуют иные представления о сущности домашнего ареста. Так, О. В. Качалова считает, что домашний арест может применяться как альтернатива заключению под стражу в отношении престарелых, инвалидов и иных лиц, чье состояние здоровья делает невозможным либо нецелесообразным заключение их под стражу, одиноких матерей и многодетных родителей, лиц, ухаживающих за больными членами семьи, беременных женщин и женщин, имеющих малолетних детей, и т. п. [14, с. 265].

В данном контексте сохраняет практический интерес нормативное постановление Верховного Суда РК «О судебном обжаловании санкции прокурора на арест, домашний арест подозреваемого, обвиняемого или продление срока ареста, домашнего ареста» от 20 марта 2003 года № 1 (утратил силу) [15] о том, что арест (содержание под стражей) и домашний арест являются самыми строгими мерами пресечения и применяются лишь в отношении лиц, совершивших преступления, за которые законом предусмотрено наказание в виде лишения свободы на срок свыше двух лет. Это означает, что подход уполномоченного лица к избранию домашнего ареста должен быть таким же строгим, как и при избрании содержания под стражей.

Важное значение для уяснения критериев оценки обстоятельств, влияющих на избрание домашнего ареста, имеет нормативное постановление Верховного Суда РК «О некоторых вопросах санкционирования мер пресечения» от 24 января 2020 года № 1, в п. 19 которого указывается: «При санкционировании домашнего ареста судам следует учитывать, что ограничение свободы передвижения подозреваемого, обвиняемого и запреты, предусмотренные частью второй статьи 146 УПК, должны применяться в разумных пределах.

Ограничения не должны препятствовать лицу контактам с членами семьи, общению со своим защитником, осуществлению жизненно необходимых действий, например, получение медицинской помощи и т. п.» [16]. Таким образом, экстраполируя приведенное положение на область критериев оценки известных обстоятельств, можно утверждать, что интерпретация обстоятельств, учитываемых при избрании домашнего ареста, также должна осуществляться в разумных пределах.

В данном аспекте мы поддерживаем точку зрения С. Б. Россинского, который утверждает, что для избрания меры пресечения в виде домашнего ареста важно установление такого свойства учитываемых обстоятельств, которые носят смягчающий характер [17, с. 263].

Каждое из приведенных обстоятельств, указанных в ст. 136 УПК РК, применительно к каждому виду мер пресечения, должны быть оценены с точки зрения целесообразности приложения к избираемой мере пресечения, вероятности получения ожидаемого эффекта. Например, такое обстоятельство, как тяжесть совершенного преступления, предполагает: с одной стороны - невозможность применения меры пресечения в отношении лиц, совершивших уголовный проступок; с другой стороны – согласно ч. 4 ст. 62 УК РК, домашний арест может быть применен в отношении лиц, совершивших уголовный проступок, так как предусматривается зачет срока домашнего ареста применительно к отбыванию ареста и общественных работ. Арест и привлечение к общественным работам – виды наказаний, применяемых в отношении лиц, совершивших уголовный проступок (ст. 10 и 40 УК РК). Это означает, что домашний арест не ограничен тяжестью совершенного деяния, тем более – преступления. В данном случае усматривается явное противоречие между установками уголовного и уголовно-процессуального законов.

Учет обстоятельства «состояние здоровья» предполагает, что подозреваемый, обвиняемый нуждается в медицинском наблюдении, проведении медицинских процедур для обеспечения стабильного положительного состояния здоровья, официально признан инвалидом и т. п. Все это требует размещения такого подозреваемого, обвиняемого в больницу, клинику, либо создания надлежащих условий для амбулаторного лечения на дому и др. Очевидно, что избрание домашнего ареста по данному обстоятельству должно сопровождаться соответствующим медицинским заключением, что в свою очередь нуждается в адекватной законодательной оговорке.

Таким образом, в ст. 146 УПК РК должны быть оговорены те обстоятельства, наличие которых влечет избрание домашнего ареста: 1) в обязательном порядке (например, в отношении кормящей матери, лица, которому диагностировано неизлечимое заболевание в критической стадии); 2) в порядке альтернативы содержанию под стражей. Подобный подход к разграничению ограничений на «обязательные» и «возможные» применил А. П. Рыжаков. Независимо от того, что у А. П. Рыжакова речь идет об ограничениях, примененный им метод целесообразен и в отношении обстоятельств, учитываемых при избрании домашнего ареста [18, с. 181].

Как представляется, изложенные недостатки требуют своего дальнейшего исследования с целью выработки конкретных мер, направленных на усовершенствование казахстанского законодательства в вопросах разумной регламентации меры пресечения в виде домашнего ареста.

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Mathematical sciences

У Д К 0 0 4

ANALYSIS OF MODES OPERATION OF EQUALLY DISTRIBUTED SYSTEMS

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Abstract

In the article, taking into account the limited number of copies of a structured software resource, a comparative analysis of mathematical relationships is carried out to calculate the total execution time of a set of equally distributed competing processes in asynchronous and two synchronous modes in the case of unlimited and limited parallelism by the number of processors of a multiprocessor system.

Keywords: *distributed computing system, process, software resource, structuring, limited parallelism, unlimited parallelism, asynchronous mode, synchronous mode, heterogeneous system, homogeneous system, equally distributed system.*

1. Introduction

Increasing the performance of computing systems has always been and remains a pressing problem. But no computing system can compare in power to the total resources that are concentrated in local and global computer networks. The rapid development of information, communication and network technologies has led to the intensive use of geographically distributed computing resources, and the creation on their basis of dynamically scalable high-performance distributed computing systems (DCS).

There is no canonical definition in the literature of what a "distributed computing system" is. For example, Professor Andrew Stuart Tanenbaum defines a distributed system as "a collection of independent computers that appear to their users as a single unified system" [1]. The book [2] says that "by a distributed system we mean any computing system in which several computers or processors, one way or another, interact". We can also consider that a distributed system is a system whose components are located on different networked computers that exchange data and coordinate their actions by passing messages to each other [3]. A distributed system model can also be a set of software tools, which is a set of interconnected processes running on the same computing device [4].

From the above definitions, important specific features of RCS follow: the absence of shared memory and the need to exchange messages between software components for their interaction and synchronization; lack of a single time that characterizes the territorial distribution of system components; geographical remoteness of system components, which is a distinctive feature of distribution; autonomy and heterogeneity of system nodes allows the system to easily scale; the presence of parallel processes, often sharing system resources; the presence of a connecting or intermediate software layer (middleware) that combines computing resources into a single integrated system.

Today, there are various types of distributed computing systems - these are computing clusters, symmetric multiprocessors (SMP), distributed shared memory (DSM) systems, massively parallel systems (MPP) and multicomputers [5,6].

When creating a DCS, the tasks of constructing and studying mathematical models for organizing the interaction of processes competing for a software resource become especially relevant. In this regard, problems of distributed computing related to obtaining mathematical relationships, which can be both direct and inverse, are of interest. When setting direct problems, the conditions are the values of the parameters of the distributed computing system, and the solution is the minimum total time for implementing the given volumes of calculations. The formulation of inverse problems comes down to calculating the characteristics of distributed systems, searching for criteria for the efficiency and optimality of organizing the execution of many distributed competing interacting processes. In addition, the principles of distributed organization of processes are not only one of the universal ways to achieve high performance and reliability of computing tools, but also have a fairly general nature and are

inherent in processes of various natures, primarily they are characteristic of control systems, operating systems, computer-aided design systems, distributed energy systems, etc. [7,8]. When constructing and studying mathematical models and problems of optimal organization of distributed processes, the apparatus of graph theory, linear Gantt charts, scheduling theory, combinatorial optimization, matrix algebra, etc. are widely used. [9-11].

The case when there is one copy of a software resource (SR) in the shared memory of a RCS was studied from various points of view in [12-17]. But, unfortunately, there are no works on mathematical modeling of the functioning of distributed systems in which there is not one, but several copies of a software resource in shared memory. Therefore, the study of problems related to the optimal organization of distributed parallel computing becomes particularly relevant in the case when a limited number of copies of a software resource can be simultaneously placed in the shared memory of a DCS. This generalization is of a fundamental nature in view of the fact that it reflects the main features of multi-pipeline processing, and also allows us to compare the effectiveness of pipeline and parallel processing.

In the article, taking into account the limited number of copies of a structured software resource, a comparative analysis of mathematical relationships is carried out to calculate the total execution time of a set of homogeneous distributed competing processes in asynchronous and two synchronous modes in the case of unlimited and limited parallelism by the number of processors of a multiprocessor system.

2. Mathematical model of distributed computing

Constructive elements for building mathematical models that implement distributed computing methods are the concepts of process and software resource. We will consider a process as a sequence of sets of commands (procedures, blocks, subroutines) $I_s = (1, 2, \dots, s)$. Processes that affect each other's behaviour by exchanging information are called cooperative processes. A programme or its part repeatedly executed in a multiprocessor system will be called a software resource, and a set of corresponding processes will be called competing processes.

By solving the problem of software resource allocation between processes, as a consequence, the problems of efficient use of the main computing resources - processors, RAM, I/O channels, etc. - are implicitly solved. From this point of view, a software resource is an integrated means of requesting computational resources. On the other hand, effectively solving the problem of software resource allocation we solve the problem of reducing the time of realisation of given volumes of calculations.

The mathematical model of a distributed processing system of competing cooperative processes under a limited number of copies of a software resource includes:

- $p \geq 2$, processors of a multiprocessor system that have access to shared memory;
- $n \geq 2$, distributed competing processes;
- $s \geq 2$, blocks of a software resource structured into blocks;
- matrix $T = [t_{ij}]$, $i = \overline{1, n}$, $j = \overline{1, s}$, execution times of the software resource blocks by distributed cooperating competing processes;
- $2 \leq c \leq p$, the number of copies of the software resource structured into blocks that can be simultaneously located in the RAM available for all processors;
- $\theta > 0$ – is a parameter characterising the time of additional system costs associated with the organisation of the conveyor mode of using blocks of a structured software resource by a set of interacting competing processes during distributed processing.

We will also assume that the number of processes is a multiple of the number of copies of the structured software resource, i. e. $n = mc$, where $m = n/c \geq 2$, and that the interaction of processes, processors and software resource blocks is subject to the following conditions:

- 1) no processor can process more than one block at a time;
- 2) processes are executed in parallel-conveyor mode in groups, i.e. simultaneous (parallel) execution c of copies of each block in combination with pipelining of a group c of copies of the Q_j -th block by processes and processors, where $j = \overline{1, s}$;
- 3) processing of each block of the software resource is carried out without interruptions;

4) in the case when the number of software resource blocks $s \leq \left\lceil \frac{p}{c} \right\rceil$, where $\lceil x \rceil$ is the integer

part of the number, for each i -th process, where $i = c(l-1) + q$, $l = \overline{1, m}$, $q = \overline{1, c}$, the distribution of software resource blocks among processors is carried out according to the rule: the block with number j is distributed to the processor with number $c(j-1) + q$.

Let us introduce the following basic modes of pipeline implementation of the interaction of processes, processors and blocks, taking into account the presence c of copies of a structured software resource.

The asynchronous mode of interaction between processes, processors and blocks of a structured software resource implies that the beginning of execution of a copy of the next block Q_j , $j = \overline{1, s}$, is determined by the presence c of processors and the readiness of the block copy for execution, while a software block is considered ready for execution if it is not executed on any of the processors

Fig. 1 is a linear Gantt chart illustrating the asynchronous mode of execution $n = 4$ of distributed competing processes using $c = 2$ copies of a software resource structured into $s = 3$ blocks in a multiprocessor system with $p = 7$ processors and a given matrix of block execution times taking into account additional system costs $T^\theta = [t_{ij}^\theta]_{4 \times 3} = [t_{ij} + \theta]_{4 \times 3}$.

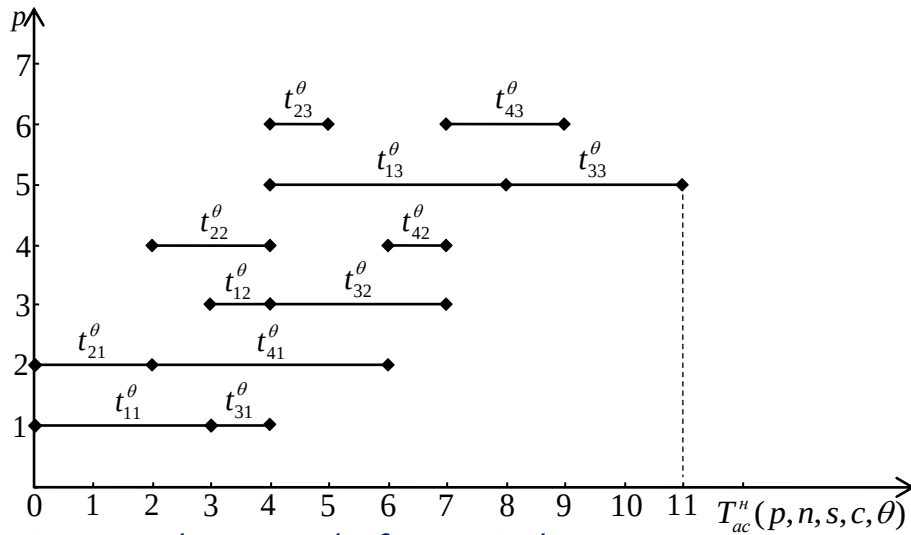


Fig. 1 Asynchronous mode of interaction between processes, processors and blocks of a software resource

The first synchronous mode ensures a linear order of execution of blocks of a software resource within each of the processes without delays, i.e. in the case when $2 \leq s \leq \left\lceil \frac{p}{c} \right\rceil$, the moment of completion of the execution of the Q_j -th block, $j = \overline{1, s-1}$, by the process with number $i = (l-1)c + q$, $l = \overline{1, m}$, $q = \overline{1, c}$, on the $((j-1)c + q)$ -th processor, coincides with the moment of the start of execution of the next Q_{j+1} -th block on the processor with number $(jc + q)$ (Fig. 2).

In the second synchronous mode, in the case when $2 \leq s \leq \left\lceil \frac{p}{c} \right\rceil$, the moment of completion of execution by the i -th process, where $i = (l-1)c + q$, $l = \overline{1, m-1}$, $q = \overline{1, c}$, of the j -th block, $j = \overline{1, s}$, on the $((j-1)c + q)$ -th processor coincides with the moment of the start of execution of the j -th block by process number $(i+c)$ on the same processor, i.e. continuous execution of each block by all processes is ensured (Fig. 3).

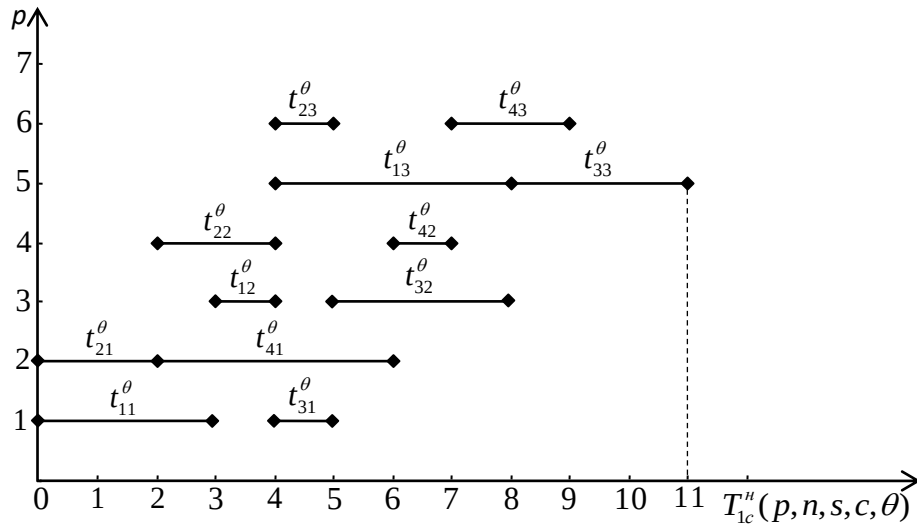


Fig. 2 First synchronous interaction mode processes, processors and blocks

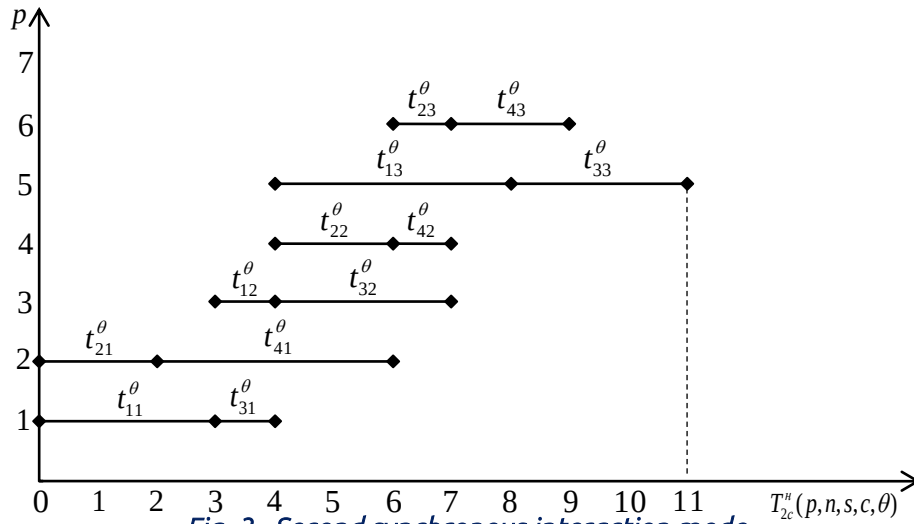


Fig. 3 Second synchronous interaction mode processes, processors and blocks

Definition 1. A system n of distributed competing processes is called heterogeneous if the execution times of software resource blocks $Q_1, Q_2, \dots, Q_s$ depend on the volumes of processed data and/or their structure, i. e. different for different processes.

Definition 2. We will call a system of distributed competing processes homogeneous if the execution times of the Q_j -th block by each of the i processes are equal, i. e. $t_{ij}^{\theta} = t_j^{\theta}$, $i = \overline{1, n}$, $j = \overline{1, s}$.

Definition 3. We will call a system of distributed competing processes identically distributed if the execution times of all blocks of a software resource by each of the processes coincide and are equal t_i^{θ} , i. e. $t_{i1}^{\theta} = t_{i2}^{\theta} = \dots = t_{is}^{\theta} = t_i^{\theta}$, the chain of equalities is valid for all $i = \overline{1, n}$.

3. Analysis of the operating modes of identically distributed systems of competing processes

The works [18–20] studied in detail the basic asynchronous and two synchronous modes of interaction of distributed processes in conditions of competition for a limited number of copies of a software resource. Within the framework of the outlined modes, various mathematical relationships have been obtained to calculate the total execution time of a set of heterogeneous, homogeneous and identically distributed processes, taking into account the presence $2 \leq c \leq p$ of copies of the SR. The problems of comparative analysis of the obtained relationships are of certain theoretical and practical interest. Let us carry out such an analysis for a class of identically distributed systems, taking into account the parameter $\theta > 0$ characterizing the time of additional system costs associated with the organization

of a pipeline mode for the use of blocks of a structured software resource by many competing processes during distributed processing.

Let's consider an identically distributed system of competing processes; this is when the execution times of all blocks of a structured software resource by each of the processes coincide, i.e., the chain of equalities $t_{i1}^\theta = t_{i2}^\theta = \dots = t_{is}^\theta = t_i^\theta$ is valid for all $i = \overline{1, n}$ (Def. 3).

To carry out a comparative analysis, we divide the set n of processes into c subsets of processes in each. Each q -th subset, $q = \overline{1, c}$, will include processes with numbers $i = c(l-1) + q$, $l = \overline{1, m}$, whose blocks will be executed on $(c(j-1) + q)$ -th processors, $j = \overline{1, s}$. Let $T_q^\theta = \sum_{i=1}^m t_{c(i-1)+q}^\theta$ us denote the total execution time of the q -th subset of processes, and $t_{\max}^{q+} = \max_{1 \leq i \leq m} t_{c(i-1)+q}^\theta$ denote the maximum execution time of a block from this subset, $q = \overline{1, c}$.

Definition 4. The characteristic set of an identically distributed system will be called a set of parameters of the form $(t_q^\theta, t_{c+q}^\theta, t_{2c+q}^\theta, \dots, t_{c(m-1)+q}^\theta, T_q^\theta)$, $q = \overline{1, c}$.

Let $\beta = \left\{ (t_q^\theta, t_{c+q}^\theta, \dots, t_{c(m-1)+q}^\theta, T_q^\theta) \mid T_q^\theta = \sum_{i=1}^m t_{c(i-1)+q}^\theta, q = \overline{1, c} \right\}$ – the set of all admissible

characteristic sets of a system of identically distributed processes. Let us select from the set a subset of characteristic sets of the form:

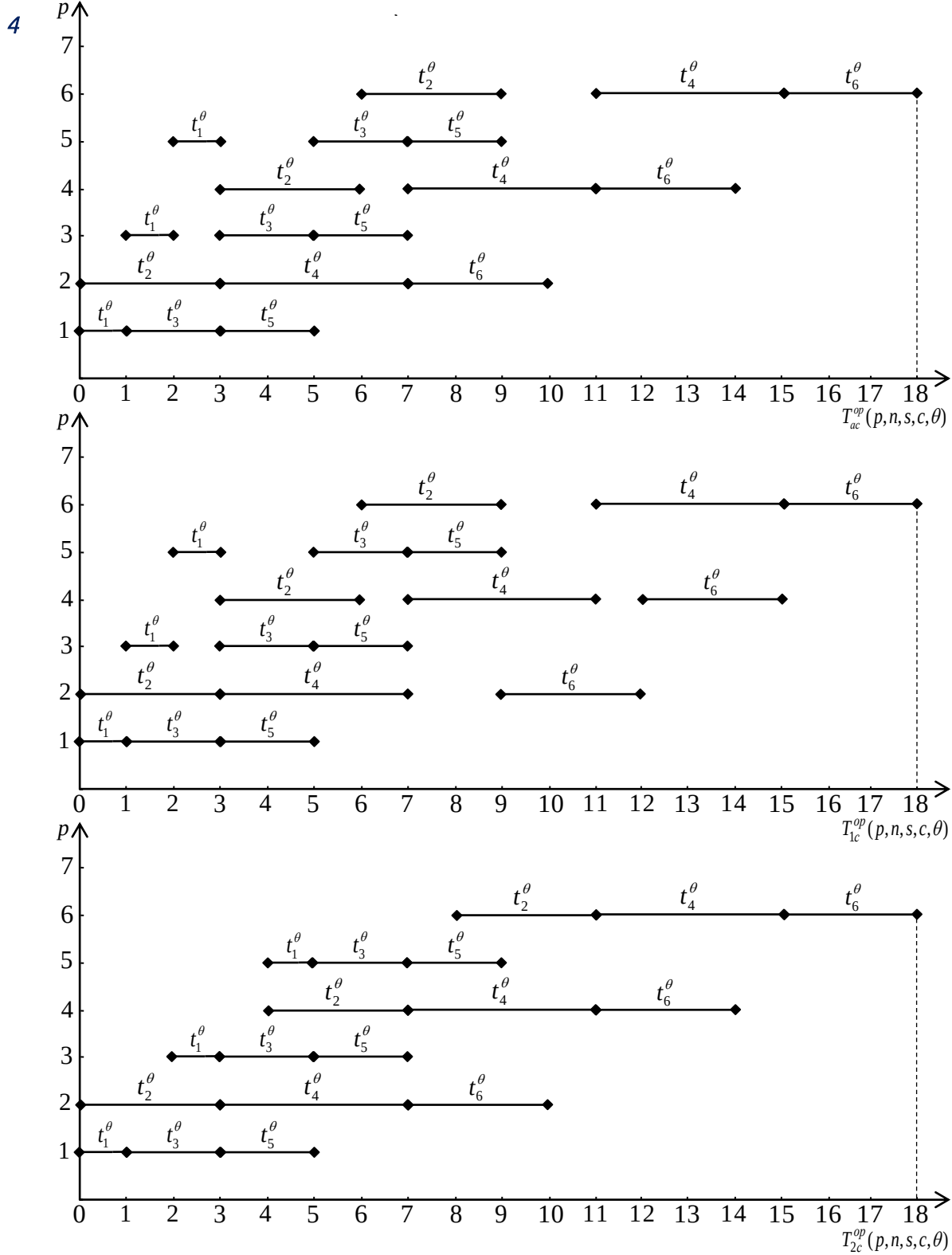
$$S(\beta) = \left\{ (t_q^\theta, t_{c+q}^\theta, t_{2c+q}^\theta, \dots, t_{c(m-1)+q}^\theta, T_q^\theta) \in \beta, \text{ where } \begin{cases} t_q^\theta \leq t_{c+q}^\theta \leq t_{2c+q}^\theta \leq \dots \leq t_{c(k-1)+q}^\theta \geq t_{ck+q}^\theta \geq \dots \geq t_{c(m-1)+q}^\theta, \\ k = \overline{1, m}, q = \overline{1, c} \end{cases} \right\}.$$

For a selected subset of characteristic sets $S(\beta)$, the following theorem holds.

Theorem 1. In the case of a sufficient number of processors, the minimum total execution times of a set of identically distributed competing processes in a multiprocessor system with parameters $p \geq 2$, $n \geq 2$, $s \geq 2$, $2 \leq c \leq p$, $\theta > 0$ in asynchronous and two synchronous modes coincide (Fig. 4), i.e.

$$T_{as}^{ed}(p, n, s, c, \theta) = T_{1s}^{ed}(p, n, s, c, \theta) = T_{2s}^{ed}(p, n, s, c, \theta).$$

Fig.



Execution modes for identically distributed processes when

$$T_{as}^{ed}(p, n, s, c, \theta) = T_{1s}^{ed}(p, n, s, c, \theta) = T_{2s}^{ed}(p, n, s, c, \theta)$$

Proof. For any characteristic set of an identically distributed system, in the case of unlimited parallelism for the asynchronous mode and a second synchronous mode ensuring the continuous execution of each block by all processes, the minimum total execution time of n identically distributed processes competing for c the use of copies of s a block-structured software resource in a

multiprocessor system with p processors with taking into account the parameter $\theta > 0$, including for any characteristic set $\mu \in S(\beta)$, is calculated using the formula:

$$T_{as}^{ed}(p, n, s, c, \theta) = T_{2s}^{ed}(p, n, s, c, \theta) = \max_{1 \leq q \leq c} (T_q^\theta + (s-1)t_{\max}^{q+}). \quad (1)$$

If the interaction of processes, processors and blocks of structured SR is carried out in the first synchronous mode, in which the execution of software resource blocks within each of the processes is ensured without delays, then for any characteristic set of β when $2 \leq s \leq \left\lfloor \frac{p}{c} \right\rfloor$ an equality of the form is satisfied:

$$T_{1s}^{ed}(p, n, s, c, \theta) = \max_{1 \leq q \leq c} \left(T_q^\theta + (s-1) \left[t_{c(m-1)+q}^\theta + \sum_{i=2}^m \max(t_{c(i-2)+q}^\theta - t_{c(i-1)+q}^\theta, 0) \right] \right). \quad (2)$$

Let's show that $t_{c(m-1)+q}^\theta + \sum_{i=2}^m \max(t_{c(i-2)+q}^\theta - t_{c(i-1)+q}^\theta, 0) = t_{\max}^{q+}$. Because $t_{\max}^{q+} = \max_{1 \leq i \leq m} t_{c(i-1)+q}^\theta$,

$q = \overline{1, c}$, then for all numbers $1 \leq i \leq k \leq m$ we have $\sum_{i=2}^k \max(t_{c(i-2)+q}^\theta - t_{c(i-1)+q}^\theta, 0) = 0$, and for

$1 \leq k \leq i \leq m$ there is equality $\sum_{i=k+1}^m \max(t_{c(i-2)+q}^\theta - t_{c(i-1)+q}^\theta, 0) = t_{c(k-1)+q}^\theta - t_{c(m-1)+q}^\theta$. Hence,

$$t_{c(m-1)+q}^\theta + \sum_{i=2}^m \max(t_{c(i-2)+q}^\theta - t_{c(i-1)+q}^\theta, 0) = t_{c(k-1)+q}^\theta = t_{\max}^{q+}.$$

The theorem has been proven.

Theorem 2. If the admissible characteristic set of an identically distributed system with parameters $p \geq 2$, $n \geq 2$, $s \geq 2$, $2 \leq c \leq p$, $\theta > 0$, does not belong to the subset $S(\beta)$, then in the case of unlimited parallelism in the number of processors of a multiprocessor system

$$T_{1s}^{ed}(p, n, s, c, \theta) > T_{as}^{ed}(p, n, s, c, \theta) = T_{2s}^{ed}(p, n, s, c, \theta) \quad (\text{Fig. 5}).$$

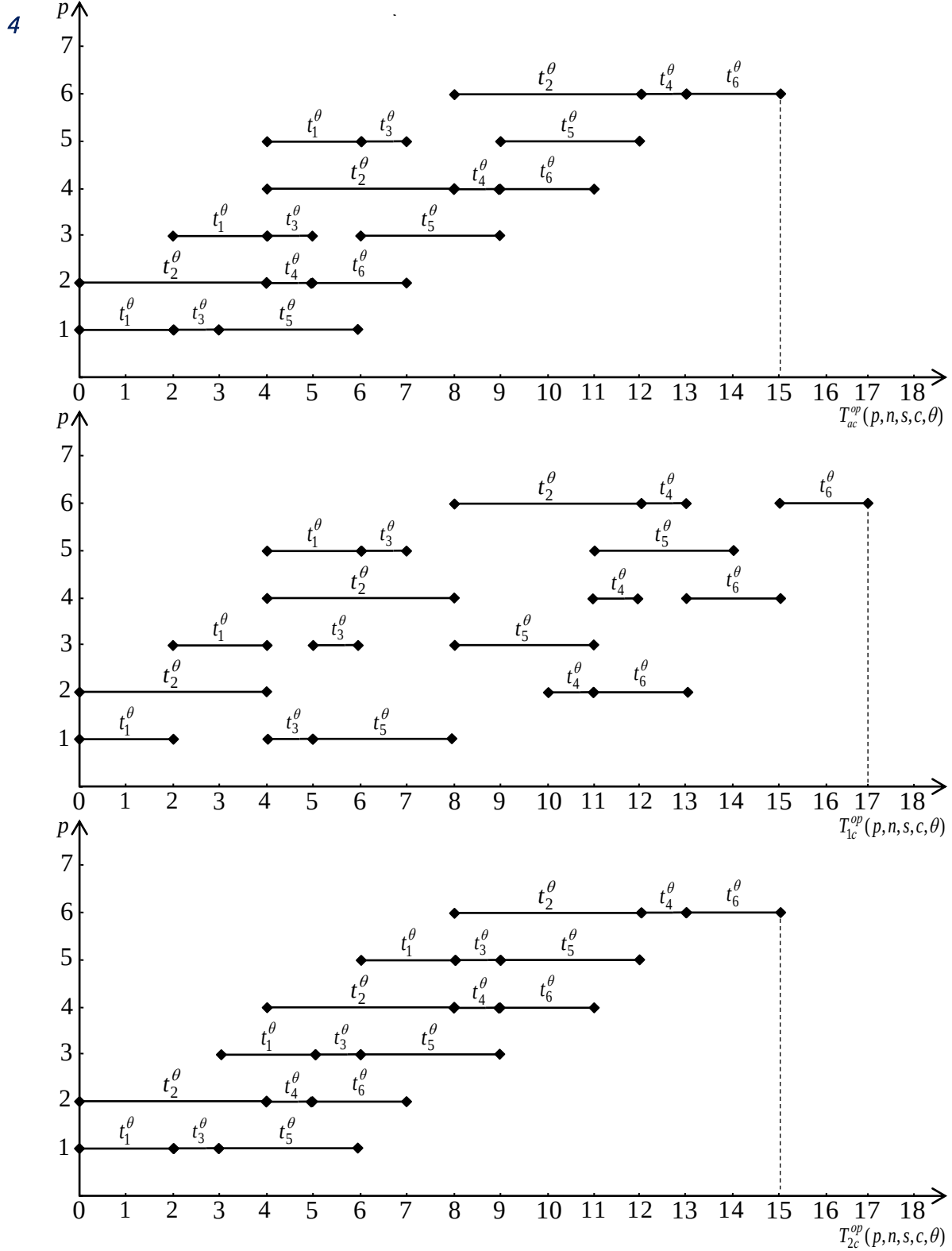
Proof. Since for the asynchronous and second synchronous modes the minimum total execution times of identically distributed competing processes, taking into account the limited number of copies of the software resource, are equal and are determined by formula (1), and for the first synchronous mode by formula (2), then the proof of the inequality $T_{1s}^{ed}(p, n, s, c, \theta) > T_{as}^{ed}(p, n, s, c, \theta)$ will be the proof of the theorem.

Proof of inequality

$$t_{c(m-1)+q}^\theta + \sum_{i=2}^m \max(t_{c(i-2)+q}^\theta - t_{c(i-1)+q}^\theta, 0) - t_{\max}^{q+} > 0, \quad q = \overline{1, c}, \quad (3)$$

let's use induction on the number of processes $m \geq 2$.

Fig.



Let $m=2$. In this case, the set of all admissible characteristic sets of a system of identically distributed competing processes $\beta = (t_q^\theta, t_{c+q}^\theta) \in S(\beta)$, $q = \overline{1, c}$.

Let inequality (3) be satisfied for $m=k$, we will show that it is also valid for $m=k+1$. With $m=k+1$ we get:

$$t_{ck+q}^{\theta} + \sum_{i=2}^{k+1} \max(t_{c(i-2)+q}^{\theta} - t_{c(i-1)+q}^{\theta}, 0) - t_{\max}^{q+} > 0, \text{ where } t_{\max}^{q+} = \max_{1 \leq i \leq k+1} t_{c(i-1)+q}^{\theta}, q = \overline{1, c}.$$

The last inequality for all $q = \overline{1, c}$ is equivalent to an inequality of the form:

$$t_{ck+q}^{\theta} + \sum_{i=2}^k \max(t_{c(i-2)+q}^{\theta} - t_{c(i-1)+q}^{\theta}, 0) + \max(t_{c(k-1)+q}^{\theta} - t_{ck+q}^{\theta}, 0) - \max_{1 \leq i \leq k+1} t_{c(i-1)+q}^{\theta} > 0.$$

If $\max_{1 \leq i \leq k+1} t_{c(i-1)+q}^{\theta}$ is achieved with $i = k+1$, i.e. $\max_{1 \leq i \leq k+1} t_{c(i-1)+q}^{\theta} = t_{ck+q}^{\theta}$, then

$$\begin{aligned} t_{ck+q}^{\theta} + \sum_{i=2}^k \max(t_{c(i-2)+q}^{\theta} - t_{c(i-1)+q}^{\theta}, 0) + \max(t_{c(k-1)+q}^{\theta} - t_{ck+q}^{\theta}, 0) - t_{ck+q}^{\theta} = \\ = \sum_{i=2}^k \max(t_{c(i-2)+q}^{\theta} - t_{c(i-1)+q}^{\theta}, 0) + \max(t_{c(k-1)+q}^{\theta} - t_{ck+q}^{\theta}, 0) > 0. \end{aligned}$$

Here the first term is greater than zero, because otherwise $\mu \in S(\beta)$, which contradicts the conditions of the theorem, and the second term is equal to zero, since $t_{ck+q}^{\theta} \geq t_{c(k-1)+q}^{\theta}$.

If value $\max_{1 \leq i \leq k+1} t_{c(i-1)+q}^{\theta}$ is in the interval $1 \leq i \leq k$, then we have:

$$\begin{aligned} t_{ck+q}^{\theta} + \sum_{i=2}^k \max(t_{c(i-2)+q}^{\theta} - t_{c(i-1)+q}^{\theta}, 0) + \max(t_{c(k-1)+q}^{\theta} - t_{ck+q}^{\theta}, 0) - \max_{1 \leq i \leq k+1} t_{c(i-1)+q}^{\theta} = \\ = t_{c(k-1)+q}^{\theta} + \sum_{i=2}^k \max(t_{c(i-2)+q}^{\theta} - t_{c(i-1)+q}^{\theta}, 0) - \max_{1 \leq i \leq k+1} t_{c(i-1)+q}^{\theta} + \\ + t_{ck+q}^{\theta} - t_{c(k-1)+q}^{\theta} + \max(t_{c(k-1)+q}^{\theta} - t_{ck+q}^{\theta}, 0). \end{aligned}$$

Here $t_{c(k-1)+q}^{\theta} + \sum_{i=2}^k \max(t_{c(i-2)+q}^{\theta} - t_{c(i-1)+q}^{\theta}, 0) - \max_{1 \leq i \leq k+1} t_{c(i-1)+q}^{\theta} > 0$ by inductive hypothesis and due

to the fact that $\max_{1 \leq i \leq k+1} t_{c(i-1)+q}^{\theta} = \max_{1 \leq i \leq k} t_{c(i-1)+q}^{\theta}$.

We will further show that $t_{ck+q}^{\theta} - t_{c(k-1)+q}^{\theta} + \max(t_{c(k-1)+q}^{\theta} - t_{ck+q}^{\theta}, 0) \geq 0$:

- if $t_{c(k-1)+q}^{\theta} = t_{ck+q}^{\theta}$ equality to zero is obvious;

- if $t_{c(k-1)+q}^{\theta} > t_{ck+q}^{\theta}$ we get that

$$t_{ck+q}^{\theta} - t_{c(k-1)+q}^{\theta} + \max(t_{c(k-1)+q}^{\theta} - t_{ck+q}^{\theta}, 0) = t_{ck+q}^{\theta} - t_{c(k-1)+q}^{\theta} + t_{c(k-1)+q}^{\theta} - t_{ck+q}^{\theta} = 0;$$

- if $t_{c(k-1)+q}^{\theta} < t_{ck+q}^{\theta}$, we have that $\max(t_{c(k-1)+q}^{\theta} - t_{ck+q}^{\theta}, 0) = 0$, then

$$t_{ck+q}^{\theta} - t_{c(k-1)+q}^{\theta} + \max(t_{c(k-1)+q}^{\theta} - t_{ck+q}^{\theta}, 0) = t_{ck+q}^{\theta} - t_{c(k-1)+q}^{\theta} > 0.$$

The theorem has been proven.

4. Conclusion

The results obtained have numerous areas of application, in particular, they can be used in the design of system and application software aimed at multiprocessor distributed computing systems and complexes, as well as in solving problems of optimal use of computing resources.

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Pedagogical sciences

THE POTENTIAL OF STEM-BASED DISCIPLINES IN THE DEVELOPMENT OF RESEARCH AND ENGINEERING ACTIVITIES

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STEM БІЛІМГЕ НЕГІЗДЕЛГЕН ПӘНДЕРДІҢ ЗЕРТТЕУШІЛІК ЖӘНЕ ИНЖЕНЕРЛІК ІС-ӘРЕКЕТТІ ДАМУДАҒЫ ӘЛЕУЕТІ

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Abstract

Nowadays, the demand for the fields of science, technology, engineering and mathematics (STEM) is growing day by day. The STEM education system has great potential in the development of research and engineering activities of students. More precisely, the combination of theoretical knowledge with practical skills allows students to succeed. Approaches to STEM education at the stage of scientific and technological development of society and Industry 4.0 are one of the most important factors ensuring economic growth. The main purpose of determining the potential of STEM-based disciplines in the development of research and engineering activities is to empower students to create innovative projects by deepening scientific and technical knowledge, developing research and engineering skills. The study used methods of system integrated analysis and case study with a comprehensive consideration of all important aspects in determining the potential of STEM education in the development of research and engineering activities. The study showed that STEM-based learning increases the ability of students to conduct scientific research, master new technologies perfectly and implement engineering projects. At the same time, we have found that the technical knowledge and practical skills of students are strengthened during the development of engineering projects. The results of the study proved that in the future, the STEM education system will contribute to increasing the scientific and technical potential of students. This research has been/was/is funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP23488947)

Аңдатпа

Қазіргі заманда ғылым, технология, инженерия мен математика (STEM) салаларына деген сұраныс күн санап артуда. STEM білім беру жүйесі білім алушылардың ғылыми-зерттеу және инженерлік іс-әрекеттерін дамытудағы әлеуеті зор. Дәлірек айтқанда, теориялық білімді практикалық дағдылармен ұштастыра отырып білім алушылардың жетістікке жетуіне мүмкіндік береді. Қоғамның ғылыми-техникалық дамуы мен индустрия 4.0 кезеңінде STEM білім беру тәсілдері экономикалық өсуді қамтамасыз ететін

маңызды факторлардың бірі болып табылады. STEM-ге негізделген пәндердің зерттеушілік және инженерлік іс-әрекетті дамытудағы әлеуетін анықтаудағы негізгі мақсат – білім алушылардың ғылыми-техникалық білімдерін тереңдету, зерттеушілік және инженерлік дағдыларын дамыту арқылы инновациялық жобалар жасаудағы мүмкіндіктерін кеңейту болып табылады. Зерттеу барысында STEM білім берудің зерттеушілік және инженерлік іс-әрекеттерді дамытудағы әлеуетін анықтауда барлық маңызды аспектілерді кешенді түрде қарастыра отырып, систематикалық кешенді анализ және case study әдістері қолданылды. Зерттеу нәтижесінде STEM-ге негізделген оқыту білім алушылардың ғылыми зерттеулер жүргізуге, жаңа технологияларды жетік меңгеруге және инженерлік жобаларды жүзеге асыруға қабілеттерінің артатынын көрсетті. Сонымен қатар, инженерлік жобалар жасау кезінде білім алушылардың техникалық білімдері мен практикалық дағдылары нығаятынын анықтадық. Зерттеу нәтижелері болашақта STEM білім беру жүйесі білім алушылардың ғылыми-техникалық әлеуетін арттыруға ықпал ететіні дәлелденді. Бұл зерттеуді Қазақстан Республикасы Ғылым және жоғары білім министрлігінің Ғылым комитеті қаржыландырды (ЖТН «AP23488947»).

Keywords: STEM disciplines, research activities, engineering activities, scientific and technical education, STEM education

Түйін сөздер: STEM пәндері, зерттеушілік іс-әрекет, инженерлік іс-әрекет, ғылыми-техникалық білім, STEM білім беру

Кіріспе

Қазіргі уақытта ғылым мен технология қарқынды дамып, қоғамның ғылыми-техникалық жетістіктері жоғары деңгейге көтерілуде. Бұндай жағдайда STEM-ге (ғылым, технология, инженерия және математика) негізделген пәндердің маңыздылығы арта түскенін байқаймыз. STEM пәндері білім алушыларға теориялық білім берумен шектелмей, зерттеушілік және инженерлік қабілеттерін дамытуда елеулі үлесін қосады.

STEM білім берудің басты мақсаты – білім алушыларды ғылыми зерттеулер жүргізуге, инженерлік жобалар жасауға және оларды тәжірбие барысында жүзеге асыруға қабілетті маман ретінде дайындау. STEM-ге негізделген пәндердің дамуы Қазақстанда елдің ғылыми-техникалық әлеуетін арттырып, экономикалық өсуіне әсер ететін маңызды бағыттардың бірі болып табылады.

Білім алушылардың STEM (ғылым, технология, инженерия және математика) пәндеріне деген қызығушылығы олардың болашақтағы кәсіби дамуы мен жетістіктері үшін маңызды. STEM пәндеріне деген білім алушылардың қызығушылығын зерттеді. Ерлер мен қыздардың көзқарастары бойынша зерттеушілік саласына қызығушылықтары жоғары екенін көрсетті. Сонымен қатар STEM білім беру арқылы болашақ мансап арасындағы байланысты орнату жолдарын іздеу қажеттілігін ұсынды [1].

Инженерлік іс-әрекеттерді дамыту білім алушылардың техникалық дағдыларын шығармашылық қабілеттерін және практикалық білімдерін дамытуға бағытталған. Бастауыш сынып мұғалімдері білім алушылардың STEM-ге негізделген пәндерге қызығушылығын арттыруда дәлірек айтқанда, білім алушылардың инженерлік қабілеттерін дамытуда зерттеу жүргізді. Зерттеу нәтижелері білім алушыларға тәжірбиелі инженерлермен білім алу, инженерлік ақыл-ой әдеттерін енгізу олардың қызығушылығын арттыруға септігін тигізетінін көрсетті [2].

Ғылым, технология, инженерия мен математика (STEM) білімінде ғылыми зерттеу мен жобалау маңызды орын алады. Зерттеу және жобалау көбіне бір-бірінен бөлек оқытылады. Ал бұл зерттеуде зерттеу мен жобалауды байланыстыра отырып, ортақ білімдер туралы түсінік беруді қарастырды. Бұл өз кезегінде студенттерге STEM кәсіби салалары бойынша тұтас және шынайы көзқарас қалыптастыруға мүмкіндік берді [3].

Зерттеушілік және инженерлік іс-әрекеттер STEM білімінде жиі қолданылады. Бұл зерттеу білім алушылардың ғылыми зерттеу мен жобалау іс-әрекеттеріне деген көзқарастарын зерттеуге бағытталған. Зерттеу нәтижелері білім алушылардың зерттеу және жобалау әрекеттерін орындауға оң көзқараста екенін, сондай-ақ, жобалау іс-әрекеттеріне деген қызығушылығы жоғары екенін көрсетті [4].

Көптеген ғалымдар ғылым, технология, инженерия мен математика (STEM) білімінің интеграциясы ұлттық экономикаға пайдалы екенін айтты. Бұл зерттеу сандық және сапалық әдістерді пайдалана отырып, STEM интеграцияланған жобаға негізделген оқыту (PJBL) әрекетін қарастырды. Сауалнама нәтижелері білім алушылардың көпшілігі ғылым мен инженерлік пәндердегі STEM маңыздылығы жоғары екенін айқындады [5].

Ғылыми-зерттеу әрекеті тек теориялық негіздерге ғана емес, сонымен қатар нақты деректер мен тәжірибелерді қамтиды. Бұл зерттеудің негізгі мақсаты мектептегі білім беру контекстіндегі ғылыми-зерттеу әрекетінің негізгі ерекшеліктерін ашу болып табылады. Жасалған қорытындылар, білім алушылардың ғылыми-зерттеу әлеуетін дамытудың ерекшеліктеріне мүмкіндік беретін және оқу тиімділігін арттыруға ықпал ететін оқу бағдарламаларын әзірлеу ұсынылды [6].

Зерттеушілік және инженерлік іс-әрекеттерді дамыту білім алушылардың ғылыми-техникалық білімдерін арттырып, олардың шығармашылық және практикалық дағдыларын өркендетуге негізделген маңызды әрекет болып табылады.

STEM-ге негізделген пәндер білім алушыларды ғылыми зерттеулер жүргізуге, сыни ойлауға және техникалық дағдыларды меңгеруге қызықтырады. Зерттеушілік іс-әрекет арқылы білім алушылар деректерді жинап, талдау жасауды, гипотеза құруды және ғылыми әдістерді қолдануды меңгереді. Инженерлік іс-әрекет арқылы білім алушылар жобалау, құрастыру және жаңашыл шешімдер табуға деген қабілеттерін дамытады. STEM-ге негізделген пәндерді меңгеру арқылы білім алушылар кәсіби дамумен қатар, қоғамның технологиялық жетістіктеріне өз үлестерін қоса алу мүмкіндігіне ие бола алады.

Зерттеу әдістері

Зерттеу жүргізу барысында ғылыми мақалаларды таңдау алдын ала анықталған критерийлерге сай таңдалды. «STEM пәндері», «зерттеушілік іс-әрекет», «инженерлік іс-әрекет», «ғылыми-техникалық білім», «STEM білім беру» түйін сөздер бойынша іздеу жүргізіліп, соңғы жылдардағы мақалалар ескерілді.

Зерттеу әдістері зерттеу нәтижелерінің сапасы мен сенімділігін қамтамасыз етеді. Зерттеу мақсаттары мен міндеттеріне сәйкес ғылыми еңбектерге систематикалық кешенді анализ, case study және т.б. әдістер қолданылды.

Систематикалық кешенді анализ, case study – ғылыми еңбектерді қарастыра отырып, зерттеу тақырыбына қатысты маңызды аспектілерді кешенді түрде қарастырып, жүйелі талдау әдісі. Бұл әдісті жүзеге асырудағы негізгі әрекеттер 1-кестеде көрсетілген.

Кесте 1.

Систематикалық кешенді анализ, case study әдістері негізінде ғылыми еңбектерді зерттеу барысындағы іс-әрекет кезеңдері.

Кезеңдер	Іс-әрекеттер
1	2
1 кезең	- Кілт сөздер бойынша ғылыми еңбектерді іздеу - Жоғарыда аталған 5 кілт сөз бойынша жекелеген мақалалардың нәтижелерін талдау
2 кезең	Мәліметтерді талдау - Сандық талдау – ғылыми еңбектердің статистикалық әдістерінің нәтижесін анықтау - Сапалық талдау – мақалалардағы нәтижелерге контент талдау әдісін қолдану
3 кезең	- Алынған нәтижелер бойынша қорытынды жасау

Білім беру бағдарламаларына талдау жүргізу «Univision.kz» сайты арқылы жүзеге асырылды. Қазақстандағы білім беру бағдарламаларында STEM-ге негізделген пәндерді енгізген ЖОО туралы ақпараттарды талдай отырып, STEM білім берудің мақсаты айқындалды. Сонымен қатар шет елдердегі білім беру бағдарламаларына STEM оқыту енгізілген пәндерді анықтадық.

Зерттеу нәтижелері

Ғылыми еңбектерге кешенді талдаудың тұжырымы

Кілт сөздер бойынша мақалаларды іздеу және жинақтау нәтижесінде STEM-ге негізделген пәндерді оқытуға қатысты оннан аса мақала анықталды. Алайда шолу нәтижесінде тек 6 мақала таңдалынып алынды. Мақалаларды таңдап алу жарияланым уақыты, зерттеуге қатысушылар, зерттеуге қолданылған әдістер секілді критерийлерге негізделген. Ғылыми

еңбектерге талдау нәтижесі білім беру саласындағы STEM-ге негізделген пәндердің тиімділігі бар екенін көрсетеді. Таңдалынған 6 мақаланың систематикалық кешенді анализ, кейс стади талдауының қорытындысына тоқталайық.

Зерттеушілік іс-әрекет білім алушылардың зерттеу құзіреттілігін дамытуда маңызды рөл атқарады. Б.Құрбанбеков ғылыми еңбегінде физика бойынша зертханалық жұмыстарда білім алушылардың зерттеу құзіреттілігін дамытудың ең тиімді жолдарын анықтауда зерттеу жүргізді. Зерттеу жүргізу барысында білім алушыларды бақылау және эксперимент топтарына бөліп алу арқылы статистикалық маңыздылығын есептеді. Бақылау және эксперимент тобының арасындағы статистикалық айырмашылығын тәжірбиеге дейін анықтап алды. Алынған деректердің пайыздық таралуын салыстыруға арналған χ^2 критерийі қолданылды. $p = 0,05$ мәнділік деңгейі үшін $\chi^2 = 5,99$ критерийінің критикалық мәні және еркіндік дәрежесінің саны $\nu = 2$. Нәтижесінде бақылау және эксперимент топтарының арасында статистикалық айырмашылық табылмады. Зерттеу құзіреттілігін анықтауда тәжірбиеден кейін χ^2 критерийінің мәні $6,18$ ге тең болды. Бұл бақылау тобы мен эксперимент тобы арасында статистикалық айырмашылықтың бар екенін көрсетті. Зерттеу нәтижесі физикадағы зерханалық жұмыстар шеңберінде шағын зерттеулерді ұйымдастыру педагогикалық жоғары оқу орындарының бакалавр білім алушыларының зерттеу құзіреттілігін қалыптастыруда оң нәтиже беретінін анықтады [7]. Хасан Демир, Муджахит Косе зерттеулері STEM білім берудің білім алушылардың инженерлік іс-әрекеттеріне әсерін анықтауға бағытталған. Зерттеуде сандық әдіс қолданылып, 7 сыныптың 74 білім алушысына зерттеу жүргізілді. Алдын ала тестілеу нәтижелері бойынша STEM білім берудің әсері топтар арасында статистикалық айырмашылығының жоқ екенін көрсетті. Тестілеуден кейін эксперимент және бақылау топтары арасында айтарлықтай айырмашылық анықталды ($t(72) = 2,108$ $p < 0,05$). Жаратылыстану және математика бойынша тестілеуде топтар арасында айырмашылық болмағанымен, технология ($t(72) = 2,033$ $p < 0,05$) және инженерия ($t(72) = 2,475$ $p < 0,05$) саласы бойынша айырмашылық анықталды. Зерттеу нәтижесі STEM оқытудағы іс-шаралар білім алушылардың инженерлік іс-әрекеттерін жақсартатынын айқындады [8]. Э. Кутлу STEM білім берудің инженерлік білімге әсерін анықтауда зерттеу жүргізді. Бақылау және эксперимент топтар арасындағы зерттеу инженерлік жобалаудың білім алушылардың зерттеушілік қабілеттерін дамытуға әсерін статистикалық талдау арқылы анықтады. Бақылау тобы мен эксперимент тобы (оң қабылдау $z = 3,831$, $p < 0,05$; Теріс қабылдау $z = 3,833$, $p < 0,05$; шындықты қабылдау, $z = 3,834$, $p < 0,05$; позитивті қабылдау $z = 3,737$, $p < 0,05$; $z = 3,732$, $p < 0,05$) арасында статистикалық айырмашылығы барын анықтады. Зерттеу нәтижесі STEM білім беруде инженерлік жобалаудың білім алушылардың зерттеушілік іс-әрекеттеріне оң әсері бар екенін анықтады [9].

Р. Гарай-Аргандона, М. С.Родригес-Варгас ғылыми еңбектерінде виртуалды оқытуда білім алушылардың зерттеу құзіреттілігін зерттеді. Нәтижелер танымдық(58,4%) және топтық(71,9%) құзіреттіліктің басымдыққа ие екенін көрсетті. бұл тұжырымдар білім алушылардың ғылыми-зерттеу қабілеттерін жетілдіру қажеттілігін көрсетеді [14]. Ғылыми еңбектерге талдау білім алушылардың STEM оқытуда зерттеу дағдыларының жақсартатынын көрсетсе [15], STEM түлектерінің зерттеу дағдыларының жоғары деңгейде екенін көрсетті [16].

Дамыған елдердегі STEM-ге негізделген пәндер атауы

Мемлекет	Мамандық	Университет	STEM-ге негізделген пәндер атауы
1	2	3	4
Дания	Химиялық инженерия	Данияның техникалық университеті	Computer Science and Engineering, Engineering physics
Нидерланды	Құрылыс инженерингі	Делфт технологиялық университеті	Computer Science and Engineering, M.Sc Robotics, Data Science and Artificial Intelligence
Швеция	Электротехника және информатика	KTH Корольдік технологиялық институты	Science in Information and Communication Technology, Information and Network Engineering
Германия	Қоршаған орта инженериясы	Карлсруэ технологиялық институты	Electrical Engineering and Information Technology, Chemical and Process Engineering
Нидерланды	Материалтану және инженерия	Эйндховен технологиялық университеті	Data Science & Artificial Intelligence, Science in Data Science

Ғылыми еңбектерге систематикалық кешенді анализ, кейс стади талдаудың нәтижесі STEM-ге негізделген пәндердің зерттеушілік және инженерлік іс-әрекетті дамытуда маңызды рөл атқаратынын көрсетті. STEM білім беру білім алушылардың сыни ойлау қабілеттері мен практикалық дағдыларын арттырады. Сонымен қатар, STEM пәндерінің білім алушылардың ғылыми-зерттеу және инженерлік жобаларға деген қызығушылығын оятады деген қорытындыға келе аламыз.

Білім беру бағдарламаларына талдаудың тұжырымы

STEM оқыту енгізілген білім беру бағдарламаларына талдау жасау білім алушылардың ғылыми-техникалық білімін, зерттеушілік және инженерлік дағдыларын дамытуда ықпалы зор екенін айқындады. Білім беру бағдарламаларына талдау шет елдердің әртүрлі STEM мамандықтары бойынша білім беру жоғары деңгейде екенін көрсетті. Шет елдердегі әртүрлі STEM мамандықтары бойынша ең жақсы жоғары оқу орындары 2-кестеде көрсетілген.

Шет елдердегі білім беру бағдарламаларына енгізілген STEM оқыту білім беру жүйесін жақсартумен қатар экономикалық даму мен инновациялық ыңдаландыруға бағытталған. Бірқатар елдердегі STEM оқыту енгізілген білім беру бағдарламаларына тоқталайық. Канадада STEM оқыту пәні жоғары оқу орындарына енгізіле отырып білім беру жүйесін нығайтып, білім алушылардың жаһандық мәселелерді шешуге және жоғары жетістіктерге жетуіне ықпал жасайды. Сингапурдың көптеген жоғары оқу орындары STEM бағдарламаларын ұсынады. NUS, NTU, SUTD жоғары оқу орындары STEM оқытуды білім беру бағдарламаларына енгізу арқылы білім алушылардың ғылыми-техникалық дағдыларын дамыта отырып, жаһандық нарықта бәсекеге қабілетті маман дайындап шығуға жағдай жасайды.

Қазақстанда STEM оқыту жоғары оқу орындарының бағдарламасына енгізіле отырып, болашақта елдің ғылыми-техникалық әлеуетін арттырып, инновациялық шешімдер мен технологиялық жетістіктердің көптеп пайда болуына ықпал етеді. Гумилев атындағы Еуразия ұлттық университеті білім алушыларға STEM білім бере отырып, ғылыми-зерттеу қызметтік дағдылары бар, оқу үдерісінің мониторингі мен басқаруын жүзеге асыруға қабілетті магистрлерді даярлауды көздейді. Мұхтар Әуезов атындағы Оңтүстік Қазақстан университеті STEM білім беру саласындағы оқытудың заманауи қағидаттарына жауап беретін жоғары білікті, бәсекеге қабілетті магистрлерді даярлауды жоспарлайды. Қожа Ахмет Ясауи атындағы Халықаралық қазақ-түрік университетінің физикада STEM оқытуды енгізудің негізгі мақсаты жаңа салаларда құзыреті бар физика мұғалімдерін даярлау болып табылады.

Қорытындылай келе, STEM-ге негізделген пәндердің жоғары оқу орындарының бағдарламаларына енгізілуі білім беру жүйесінің сапасын жақсартып, білім алушылардың ғылыми-техникалық дағдыларын дамытуға мүмкіндік береді. Сонымен қатар STEM-ге негізделген пәндердің зерттеушілік және инженерлік іс-әрекеттерді дамытудағы әлеуеті зор. Бұл пәндер білім алушыларға тек теориялық білім беріп қана қоймай, сонымен қатар оларды практикалық тәжірибе арқылы оқытады. Білім алушылар нақты жобалар мен зерттеулерге қатыса отырып,

өздерінің аналитикалық ойлау қабілеттерін, мәселелерді шешу дағдыларын және инновациялық ойлауын дамытады деп айта аламыз.

Талқылау

Біз ғылыми еңбектерге систематикалық кешенді анализ, кейс стади әдісімен талдау жасау арқылы STEM-ге негізделген пәндердің зерттеушілік және инженерлік іс-әрекетті дамытудағы әлеуетіне баға бере аламыз. Сонымен қатар білім беру бағдарламаларына талдау жасау STEM оқыту білім алушылардың ғылыми-техникалық дағдыларын дамытып, жаңа шешімдер табуда тиімділігін дәлелдейді. Бұл нәтижелерді басқа ғалымдардың ғылыми еңбектерімен салыстыруға болады.

Серік Полатұлы өз диссертациясында физика мамандарының ғылыми-зерттеушілік құзіреттілігін қалыптастыру бойынша зерттеу жүргізді. Зерттеу кезінде кейс зерттеу әдісі жоғары оқу орындарының болашақ физика мамандарында ғылыми-зерттеушілік құзіреттілігін дамытуда маңызды рөл атқарады деген гипотеза тексерілді. Бақылау және эксперимент тобына жүргізілген зерттеу нәтижесі ұсынылған гипотезаны растай отырып, одан әрі зерттеу жүргізуге мүмкіндік береді [10]. А.Н.Русмана, А. Видодо, В.Суракусума ғылыми еңбектерінде STEM оқыту инженерлік дағдыларға әсер ететінін зерттеді. Бақылау және эксперимент тобына тәуелсіз t-тесттің қолдану арқылы статистикалық айырмашылығын анықтады. Нәтижесінде STEM негізінде оқыту инженерлік іс-әрекетті дамытатынын дәлелдеді [11]. Р.Рочмад STEM-ге негізделген инженерия білім алушылардың шығармашылық ойлауын арттыратынын анықтаса [12], Ш.Н.Альдибекова білім алушылардың ғылыми-зерттеу іс-әрекетіне қызығушылығын көрсетті [13].

Біздің зерттеуіміз STEM-ге негізделген пәндерді оқытуда зерттеушілік және инженерлік іс-әрекетті дамыта отырып, нәтижесінде, STEM оқыту бойынша білім алушылар ғылыми-техникалық дағдыларын жетілдіруге және олардың болашақта инновациялық жобаларға қатысу мүмкіндіктерін арттыруға үлкен ықпал ететінін көрсетті.

Қорытынды

STEM-ге негізделген пәндерді оқу арқылы білім алушылардың зерттеушілік және инженерлік іс-әрекеттерін дамыту білім беру жүйесінің негізгі мақсаттарының бірі болып табылады. Бұл пәндер білім алушыларды ғылыми және инженерлік салалардағы инновациялық шешімдер табуға ынталандырып, олардың кәсіби және жеке дамуына үлкен үлес қосады. STEM пәндері арқылы алынған білім мен дағдылар білім алушыларды болашақта ғылыми-зерттеу және инженерлік жобаларға қатысуға дайын етеді, олардың қоғамдағы және экономикадағы рөлін арттырады, әрі білім беру жүйесінің сапасын жақсартады.

STEM-ге негізделген пәндердің зерттеушілік және инженерлік іс-әрекеттерді дамытудағы әлеуеті орасан зор. Бұл пәндер білім алушылардың сыни ойлауын, шығармашылық қабілеттерін және практикалық дағдыларын айтарлықтай арттырады. Білім алушыларды нақты жобалар мен зерттеулерге қатыстыру арқылы STEM білім беру жүйесі оларды болашақта инновациялық жобаларға қатысуға және жаһандық экономикада бәсекеге қабілетті болуға дайындайды. Зерттеудің нәтижелері STEM оқытуда білім алушылардың қызығушылықтарын дамыту арқылы білім беру жүйесін жетілдіру мәселелерін шешуге ықпал етеді.

Бұл зерттеуді Қазақстан Республикасы Ғылым және жоғары білім министрлігінің Ғылым комитеті қаржыландырды (ЖТН «AP23488947»).

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THE ROLE OF ENGLISH CLASSROOMS IN DEVELOPING INTERCULTURAL COMMUNICATION COMPETENCE

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Abstract

This article discusses the importance of English classrooms in developing intercultural communication competence. This research covers the description of formal model of ICC and its elements. In discussion part, the author compares the linguists' ideas about the classroom. In conclusion readers can find some suggestions how to use English classrooms to bring the real atmosphere for students.

1. Introduction.

Stating the problem

The research on intercultural communicative competence (ICC) has been expanding consistently since the late 1980s, driven by the rise of English as a global language and the recognition that while English may address certain communication challenges, it is not sufficient for genuine cross-cultural communication. In recent years there has been an increasing interest in ICC and in the problems of acquiring/teaching ICC, both in schools and, especially, in companies, where intercultural communication is a daily problem, and where personnel find themselves working within a context of life-long learning: the activity of the Council of Europe has played a major role in this process, mainly through the work of such scholars as Byram, Zarate, Béacco (Byram, Zarate 1996; Byram 1997; Byram, Béacco 2003).

Uzbekistan became more open to world economy and the need for ICC is in its peak. The government started setting new reforms about textbooks, syllabus and curriculum of language teaching. Since the cultural studies is most important part of language acquisition experts want to integrate intercultural communication and language teaching.

2. Methodology.

A formal model of ICC

The ICC model we are suggesting comprises just three key elements, likened to software headings, as inspired by Hofstede (1991).

A. the software of the mind

This pertains to the cultural influences on communication. It is important to clarify that we are specifically focused on cultural factors that impact communication, rather than all cultural aspects. These factors are essential for understanding the exchange of messages between individuals with specific communication goals. In this analogy, these cultural elements operate like system files in a computer, remaining unnoticed until an issue arises. Similarly, many cultural values may go unnoticed as they seem natural and shared by all parties involved in communication.

B. the communication software

This refers to the codes in use, both verbal and non-verbal. The main problem here is that all our attention is directed towards verbal language, the choice of words and their morpho-syntactic organisation, while no attention is paid to non-verbal body language (gestures, expressions, proximity of speakers to each other, smells, noises), since this is imagined to be universal, and little attention is paid to the language of body ornaments such as clothes, jewels, etc.;

C. the context software

This is the socio-pragmatic software which governs the beginning, the direction, and the conclusion of a communicative event (whether monocultural or intercultural). We are using the term 'communicative event' as defined in the ethnomethodology of communication, and particularly by Dell Hymes (1972).

The first two sets of 'software' - cultural and communicative - constitute competence, while the third, the 'context software' makes it possible to move from competence to perform.

To create an opportunity to perform the discussed types of software we would like to observe the role of language classrooms.

Historically, cultural education in classrooms has primarily focused on acquiring knowledge about different countries and cultures. In some cases, this involves learning isolated facts with little relevance to the language learning process. In more effective situations, the information is organized based on sociological or cultural anthropological principles and connected to language acquisition. It is evident that classroom settings offer certain benefits in this regard. It allows for a structured and organized presentation of knowledge in line with effective language teaching methods. Furthermore, it provides the opportunity for skill acquisition with the guidance of a teacher. Additionally, the classroom serves as a space for reflecting on the development of attitudes towards cultural experiences. While traditional views often see classroom learning as a preparation for real-world experiences in the future, I propose that engagement with other cultures is ongoing through daily media exposure, interactions with visitors, and collaborative work with individuals from different backgrounds. This blurs the distinction between the classroom and the real world, highlighting the integrated and continuous nature of the learning process where learners evolve beyond the classroom setting. (Byram, Michael, 1997).

The classroom offers opportunities for teaching the skills of interpreting and connecting information from various sources. Knowledge and skills go hand in hand, and the classroom provides a space for teachers and students to practice and reflect on the abilities to analyze and understand documents or events, such as video recordings, in a controlled setting. The skills of interpretation and connection rely on knowledge, and effective methods should be developed to integrate both aspects in educational ways, as demonstrated in certain textbooks (e.g., 'Typisch Deutsch?', 'Sprachbrücke', 'Open Mind'). These skills can also be linked to the skill of exploration. While exploration involves goals of extracting concepts and values from documents and events through personal interaction, this interaction does not necessarily need to occur outside the classroom.

Telecommunication technologies such as email, fax, and video conferencing enable instant communication within the classroom. (Jones, 1995). Additionally, international mail can bring textual data and other materials into the classroom for further exploration. The classroom setting offers the advantage of learners being able to develop skills in interpreting meanings under the guidance of the teacher, and to reflect on the effectiveness of their efforts. Teachers can also provide data gathered from real-world sources, emphasizing the importance of using such information for practicing these skills rather than simply providing facts. While not everyone may have access to telecommunications, they are not a necessary requirement for this learning process.

Discussion.

Learning a new language, whether in a classroom setting or elsewhere, typically involves developing cultural competence. According to Byram (2014) and Kramsch (2006), this element is essential when acquiring a foreign, second, or additional language. Byram (2013) observed that many language teachers aim to expand students' perspectives by incorporating cultural aspects into their teaching. However, the specifics of what and how culture should be taught remain ambiguous due to its broad and multifaceted nature. Despite the long-standing recognition of culture's significance in language education, there has been a tendency to prioritize teaching methods and assessment in other areas of language learning over cultural competence (Byram, 2014).

Teaching the cultural aspects of the English language presents a complex and challenging task due to its widespread use across diverse populations and for various purposes (Dürmüller, 2008; Rindal, 2014; Simensen, 2014). This implies that students are likely to employ English to communicate with individuals from diverse cultural backgrounds, not solely native English speakers. Consequently, there is a need to consider which cultures should be emphasized in instruction and how best to incorporate this into the classroom setting.

Byram et al. (2002) recommend incorporating authentic materials in the classroom to enhance the intercultural dimension of teaching. Authentic materials are defined as genuine language samples created by real speakers or writers for a specific audience with a genuine message. In contrast, non-authentic materials are created for educational purposes (Azri & Al-Rashdi, 2014). When using authentic materials, it is important to provide context and information about the text's origin and purpose. This includes details about where and when the materials were published, the intended audience, and any external events that may have influenced their creation (Byram et al., 2002).

Moreover, Byram et al. (2002) propose that authentic materials should be critically examined in the classroom. This entails designing activities that prompt students to analyze the materials, engage in comprehension, discussion, and writing tasks in the target language. It is advised to incorporate multiple

sources to expose students to diverse perspectives (Byram et al., 2002). *Critical Discourse Analysis (CDA)*, which explores how language may perpetuate or challenge issues like racism, power dynamics, dominance, and inequality, offers a framework for approaching materials by scrutinizing the vocabulary used to describe different groups and uncovering implicit assumptions within the text (Byram et al., 2002, p. 21). Applying CDA principles emphasizes the development of skills alongside knowledge acquisition from materials. Even when using non-authentic materials, it is important to apply these principles and supplement them with additional resources (Byram et al., 2002).

Conclusion:

An interesting finding in classrooms, were that the work with authentic materials and personal accounts were characterized by high-end scores for both intellectual challenge and uptake, and these authentic materials were used as basis for interpretation and analysis and lead to discussions where the teacher and students built on each other's ideas.

Furthermore, I have grown more mindful of incorporating students' cultural backgrounds into my teaching on a regular basis. In a world that is becoming more diverse and interconnected, I believe that fostering students' intercultural skills is a particularly engaging and significant aspect of being a language educator. The insights gained from this project have greatly enhanced my ability to address this aspect in both English instruction, which has proven to be incredibly beneficial.

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Technical sciences

INFLUENCE OF LASER RADIATION WAVELENGTH ON THE STRUCTURE AND PROPERTIES OF THE DIAMOND SURFACE IN LASER HEAT TREATMENT PROCESSES

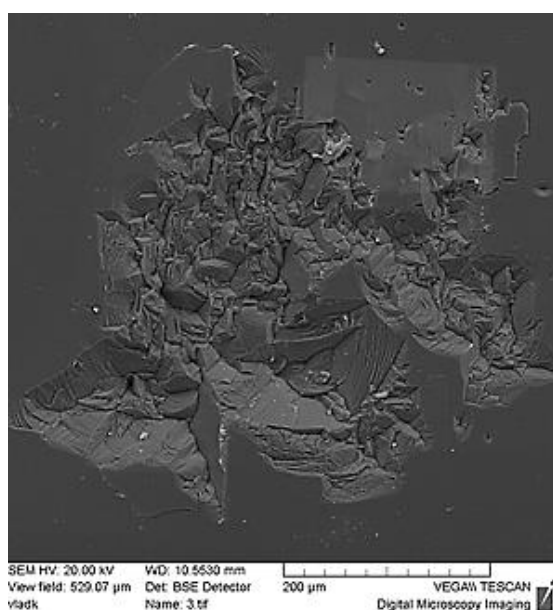
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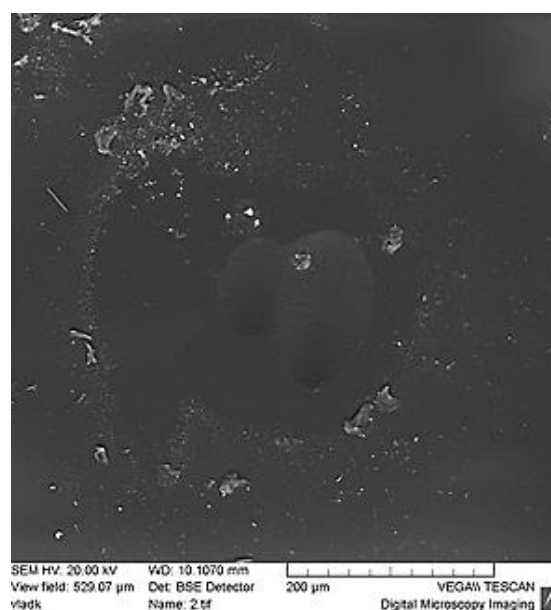
Laser processing has significant advantages over traditional mechanical methods of processing diamond crystals [1]. The advantage of this technology is the ability to obtain narrow cuts with a minimum heat-affected zone, combined with a high productivity of the dimensional machining process. In addition, due to the possibility of varying the parameters of laser radiation, such a process can be relatively easily automated [2–5]. A special important section of scientific research is the study of the features of laser processing of diamond crystals in various crystallographic directions.

At present, the features of the formation of temperature fields and fields of thermoelastic mechanical microstresses under the influence of laser radiation with a wavelength of 1064 nm on diamond crystals in three main crystallographic directions (along the axes of symmetry of the second, third and fourth order) have been revealed. At the same time, the features of localization of thermoelastic mechanical microstress fields formed in diamond crystals in these crystallographic directions under the influence of laser radiation with wavelengths of 532 nm and 266 nm have not been practically studied.

Processing modes: time (10–120) s, pulse repetition frequency (1–15) Hz, pulse energy (10–20)·10⁻³ J, pulse duration up to 15·10⁻⁹ s. Analysis of the scanning electron microscopy (SEM) results shows that with an increase in the number of laser radiation pulses, the affected area remains the same, but as the absorbed energy increases, a change in the destruction of the surface layer of the material is observed. In this process, the spectral characteristics of the diamond play a significant role, namely the dependence of its absorption coefficient on the wavelength of laser radiation. In the near-infrared region (1064 nm), the material under study is transparent, so the absorption of laser radiation is observed due to the optical destruction of the material with the formation of a layer of crystalline graphite, this is confirmed by SEM studies. When exposed to laser radiation corresponding to the visible region (532 nm), amorphous graphite is formed (Figure 1A). When using ultraviolet radiation (266 nm), partial ablation of the material is observed and a phase transformation zone is formed with minimal destruction (Figure 1B).



A



B

A – one pulses of laser radiation with a wavelength of 532 nm and pulse energy 15 10⁻³ J
 B – one pulse of laser radiation with a wavelength of 266 nm with a pulse energy of 17 10⁻³ J
 Fig. 1 – Diamond surface structure formed by laser radiation

The anisotropy of the thermophysical properties of diamond makes it possible to cut it in various crystallographic directions with different efficiency. The greatest changes in the structure of the cutting plane are observed when the machining plane is parallel to the crystallographic plane (111). In this case, the so-called influx zones are visible, which are characteristic of materials that have undergone complete melting. From the results obtained, it follows that the most effective destruction occurred along the plane (111) of the octahedral crystal.

Mathematical modeling of the dynamics of thermoelastic stresses during laser processing of diamond was carried out using the finite element method. The "diamond-graphite" phase transition was taken into account by cyclically checking the conditions for reaching the graphitization temperature and then assigning the thermophysical properties of graphite to the corresponding areas of the model. The simulation results are presented in Table 1.

Table 1

Results of micromechanical stress analysis under different laser exposure conditions

Wavelength, nm	1064			532			266		
Crystallographic plane	(100)	(110)	(111)	(100)	(110)	(111)	(100)	(110)	(111)
Micromechanical stretching, MPa	22.6	19.6	22.0	136.0	47.7	43.9	43.4	129.0	124.0
Micromechanical compression, MPa	50.0	50.1	40.8	145.0	10.5	90.8	10.1	140.0	134.0

Analysis of the data given in Table 1 shows that the highest values of stress are achieved when treating diamond with laser radiation with wavelengths of 266 and 532 nm and are respectively equal to 129 and 126 MPa in the case of tensile stresses, 140 and 145 MPa in the case of compressive stresses. These stress values do not reach the values corresponding to the ultimate strength of the diamond.

Thus, the modes of heat treatment of diamond with laser radiation with wavelengths of 266, 532 and 1064 nm have been theoretically substantiated and experimentally confirmed. It has been established that at a pulse energy of $(1.5-2.0) \cdot 10^{-2}$ J in the case of laser radiation with a wavelength of 266 nm, the diamond is removed by the ablation mechanism. When exposed to laser radiation with a wavelength of 532 nm, the volume absorption coefficient increases, and the transition of graphite from a crystalline to an amorphous state is observed. At a wavelength of 1064 nm, recrystallization and the formation of crystalline graphite are observed in the laser zone.

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MANAGEMENT OF PROJECTS IN THE FIELD OF URBAN PASSENGER TRANSPORTATION IN UKRAINE

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Project management in the field of urban passenger transportation is a crucial aspect of ensuring the efficiency and quality of transportation services in cities. Ukraine, with its infrastructural challenges and rapid urban changes, requires modern approaches to managing transportation projects. The problems of urban transportation in Ukraine include the devastating impact of military actions, outdated infrastructure, insufficient funding, high wear and tear of vehicles, and substandard passenger service. Implementing effective project management can significantly improve the situation. The aim of the research is to analyze modern approaches to project management in urban passenger transportation in Ukraine, identify the main challenges, and outline development prospects in this field. To achieve this aim, it is advisable to use methods of analyzing regulatory documents, statistical data, as well as reviewing scientific literature and contemporary practices in transportation project management.

Overview of Regulatory Framework. *The main regulatory documents governing urban passenger transportation in Ukraine include the laws "On Motor Transport," "On Urban Electric Transport," as well as numerous Cabinet of Ministers resolutions and Ministry of Infrastructure orders. These documents establish requirements for transportation organization, traffic safety, environmental standards, and other aspects.*

Challenges in Transportation Project Management. *In addition to the described problems, project management issues in urban passenger transportation are particularly relevant in the context of changes caused by Russia's military aggression during 2022-2024. Population migration, destruction of transportation infrastructure, and the need for rapid adaptation to new working conditions create additional demands on project management in this field. A significant problem is also the shortage of qualified personnel both in project management and directly among drivers and management staff in passenger transport.*

Modern Approaches to Project Management. *To enhance the efficiency and quality of passenger service, approaches such as Agile and Lean [1, 2], as well as monitoring and management systems for vehicles, are actively used today.*

Agile is a project management methodology focused on flexible and adaptive planning, continuous improvement, and quick response to changes. In the context of urban passenger transportation, the use of Agile can involve an iterative development process where projects are divided into short cycles (iterations), each including planning, execution, and evaluation of results [1]. This allows for adjustments based on user feedback.

Maintain constant interaction with stakeholders – hold regular meetings with customers, passengers, and other stakeholders to discuss requirements and receive feedback.

Focus on flexible planning – allows for quick changes to the project plan according to changes in requirements or external conditions, such as passenger flow or funding.

Lean is a methodology aimed at maximizing efficiency by reducing costs and eliminating all types of waste. In urban passenger transportation, Lean can be applied to analyze existing processes to identify and eliminate waste, such as waiting time, unnecessary vehicle movements, excess inventory, or redundant processing [3].

Encourage employees to constantly seek ways to improve processes and reduce waste, which can be implemented through regular meetings to discuss improvement ideas.

Depending on the type of project, it is advisable to implement principles of organization, cleanliness, standardization, and discipline to enhance workplace efficiency and safety.

The use of modern information technologies is an integral part of project management in urban passenger transportation. Today, this is vividly embodied in monitoring and management systems for vehicles, information boards, mobile applications, data analytics, and automated ticketing systems.

Use GPS trackers, telematics systems, and other technologies to track the location, speed, and condition of vehicles in real-time.

Provide passengers with up-to-date information on schedules, delays, and vehicle availability through electronic boards at stops and mobile applications.

Analytical data allows for collecting and analyzing large volumes of data on passenger flows, transportation movements, fuel costs, and maintenance for informed management decisions.

Use electronic tickets and contactless payment systems for passenger convenience and increased revenue collection efficiency.

Using Agile and Lean methodologies in combination with modern information technologies provides several key advantages for urban passenger transportation [4]:

- process and resource optimization reduces costs and increases productivity;*
- flexibility and adaptability allow for quick responses to changing passenger needs, improving their experience;*

- continuous monitoring and data analysis help identify and address potential problems before they arise;*

- efficient resource and process management promotes sustainable development of the transportation system even in conditions of limited resources or external shocks, such as economic crises or natural disasters.*

Conclusions. *In Ukraine, project management in urban passenger transportation is becoming increasingly important given contemporary challenges. Implementing modern project management approaches will enhance service efficiency and quality, contributing to the development of sustainable urban transportation systems. In particular, using Agile methodology will allow Ukrainian transportation companies to quickly adapt to changing market conditions and passenger demands, ensuring flexibility in project planning and execution. The Lean approach will help optimize costs and increase process efficiency, which is especially important in conditions of limited resources. Information technologies ensure transparency and control over project execution, improve communication with passengers or customers, and make informed decisions based on real data. Also, one of the key aspects is training personnel in project management. It is necessary to enhance the qualifications of specialists through training and certification according to international standards. Implementing these measures will improve the quality and efficiency of transportation services.*

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TRANSFER AND INTERTRANSPORT INTERVALS IN A TRANSPORT HUB**Rybakova Irina Vasilyevna***a candidate for an academic degree,**Saint-Petersburg State**University of Railways of Emperor Alexander I***ПЕРЕСАДОЧНЫЕ И МЕЖТРАНСПОРТНЫЕ ИНТЕРВАЛЫ В ТРАНСПОРТНО-ПЕРЕСАДОЧНОМ УЗЛЕ****Рыбакова Ирина Васильевна***соискатель кафедры**«Управление эксплуатационной работой»,**Петербургский государственный**университет путей сообщения Императора Александра I***Abstract**

In the logistics transport system of the megalopolis, it is proposed to define transfer intervals for passengers and intertransport intervals for the organization of integrated traffic for a transport hub. The intervals are set based on ensuring: traffic safety; preventing trains from stopping at the entrance signals of separate points or slowing down their progress; full and rational use of available technical means; application of advanced technology and best practices.

Аннотация

В логистической транспортной системе мегаполиса предлагается определять для транспортно-пересадочного узла пересадочные интервалы для пассажиров и межтранспортные интервалы для организации интегрированного движения. Интервалы устанавливаются исходя из обеспечения: безопасности движения; недопущения остановок поездов у входных сигналов раздельных пунктов или замедления их хода; полного и рационального использования имеющихся технических средств; применения прогрессивной технологии и передового опыта.

Keywords: *logistics transport system, passenger transportation in the metropolis, passenger logistics processes.*

Ключевые слова: *логистическая транспортная система, пассажирские перевозки в мегаполисе, пассажирские логистические процессы.*

В логистической транспортной системе мегаполиса предлагается определять для транспортно-пересадочного узла пересадочные интервалы для пассажиров и межтранспортные интервалы для организации интегрированного движения.

Пересадочный интервал – это минимальный промежуток времени, необходимый для выполнения операций по высадке пассажира, перехода к другому виду транспорта через территорию транспортно-пересадочного узла и операций по посадке пассажира.

Межтранспортный интервал – это минимальное время, которым разграничивают, прибывающие транспортные средства в транспортно-пересадочный узел.

В классификацию интервалов контактного графика входят пересадочные и межтранспортные интервалы, которые устанавливаются исходя из обеспечения требований безопасности движения, безопасности пассажиров, недопущения накопления транспортных средств на территории транспортно-пересадочного узла, рационального использования оборудования комплекса с применением современных технологий пассажирских перевозок для уменьшения времени нахождения пассажиров в транспортно-пересадочном узле или использовании времени ожидания пассажиров в коммерческих целях и обеспечения досуга для клиентов (рисунок 1).

Интервалы скрещения транзитных пассажиров и интервалы одновременного прибытия пассажиров рассчитываются для обеспечения безопасного пропуска пассажиров через транспортно-пересадочный узел.

Для малых и средних контактных графиков рассчитывают интервалы прибытия и отправления пассажиров, так как в таких ТПУ пассажиры разных направлений пересекаются в зоне пересадки.

Пересадочные и межтранспортные интервалы пересчитывают при изменении путевого развития ТПУ, их технической оснащённости, допустимых скоростей движения поездов и других транспортных средств, технологии работы с пассажирскими поездами, реконструкции ТПУ и прилегающих участков. Рассчитанные интервалы округляются до ближайшего большего целого числа.

Пересадочные интервалы по каждому отдельному пункту утверждают:

- для крупных ТПУ - начальник службы движения;
- для остальных ТПУ - начальник отдела службы движения.

Межтранспортные интервалы рассчитывают в управлении железной дороги и утверждает заместитель начальника железной дороги по перевозкам.

Предлагается следующая классификация интервалов для контактного графика в транспортно-пересадочном узле ИЛТС (представлена на рисунке 1):

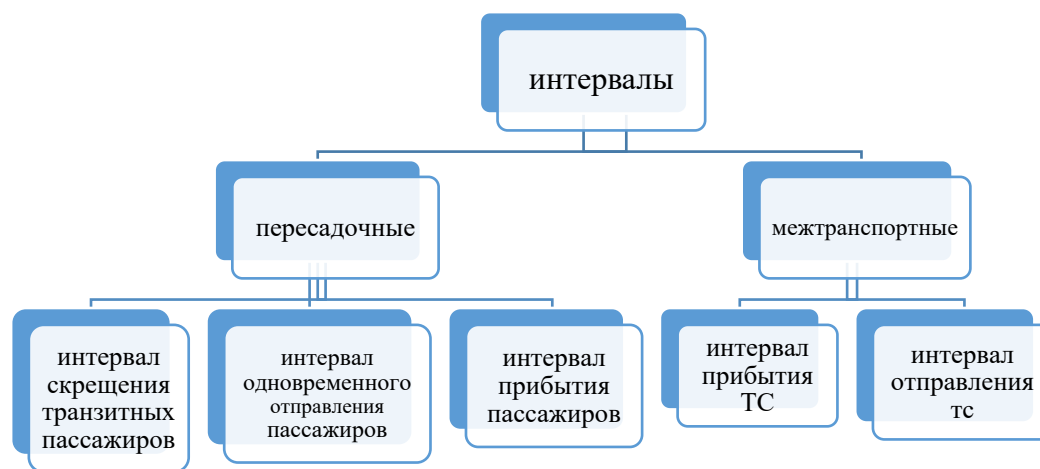


Рисунок 1 – Классификация интервалов в контактном графике движения транспортно-пересадочного узла ИЛТС (составлена автором)

ПЕРЕСАДОЧНЫЕ ИНТЕРВАЛЫ. ИНТЕРВАЛ СКРЕЩЕНИЯ ТРАНЗИТНЫХ ПАССАЖИРОВ. ИНТЕРВАЛ ОДНОВРЕМЕННОГО ОТПРАВЛЕНИЯ ПАССАЖИРОВ. ИНТЕРВАЛ ПРИБЫТИЯ ПАССАЖИРОВ

Интервалы устанавливаются исходя из обеспечения: безопасности движения; недопущения остановок поездов у входных сигналов отдельных пунктов или замедления их хода; полного и рационального использования имеющихся технических средств; применения прогрессивной технологии и передового опыта.

Интервал скрещения транзитных пассажиров ($\tau_{сmn}$) – это минимальный промежуток времени, необходимый для предотвращения скрещения или для пропуска одновременно прибывших транзитных пассажиров при переходе с одного вида транспорта на другой через территорию транспортно-пересадочного узла (рисунок 2).

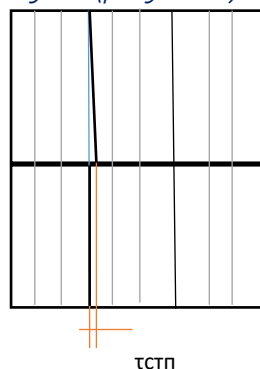


Рисунок 2 – Интервал скрещения транзитных пассажиров (составлено автором)

Минимальный промежуток времени для высадки пассажиров по натурному эксперименту – две минуты, на осуществление пересадки с учетом длины перехода – четыре минуты, на посадку пассажиров – две минуты, в целом интервал, необходимый для предотвращения скрещения или для пропуска одновременно прибывших транзитных пассажиров при переходе с одного вида транспорта на другой через территорию транспортно-пересадочного узла – восемь минут (таблица 1).

Таблица 1

График расчета интервала $\tau_{\text{стп}}$

№п/п	Операция	На операцию	Время, мин				
			3	6	9		
1	Высадка пассажиров	2	■				
2	Пересадка	4		■			
3	Посадка пассажиров	2			■		
	Продолжительность интервала	8	■	■	■		

Интервалом одновременного отправления пассажиров ($\tau_{\text{онп}}$) называют минимальное время между отправлениями пассажиров разными видами транспорта (рисунок 3).

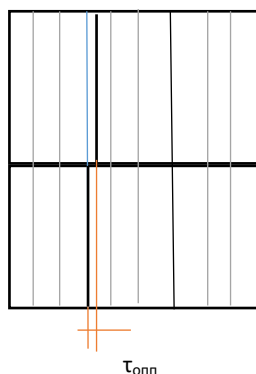


Рисунок 3 – Интервал одновременного отправления (составлено автором)

С учетом натурного эксперимента и анализа площадей транспортно-пересадочного узла установлен график расчёта интервала одновременного отправления (таблица 2).

Таблица 2

График расчёта интервала $\tau_{\text{онп}}$

№п/п	Операция	На операцию	Время, мин				
			3	6	9		
1	Высадка пассажиров	2	■				
2	Пересадка	4		■			
3	Ожидание посадки	3			■		
4	Посадка пассажиров в один вид транспорта	2				■	
5	Посадка пассажиров в другой вид транспорта	2				■	
	Продолжительность интервала	11	■	■	■	■	

Интервал прибытия пассажиров ($\tau_{\text{пн}}$) – время от момента прибытия в транспортно-пересадочный узел пассажиров с одного состава магистрального транспорта до другого (рисунок 4).

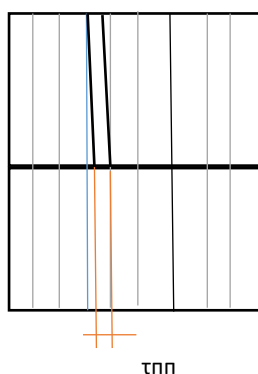


Рисунок 4 – Интервал прибытия пассажиров (составлено автором)

Время от момента прибытия в транспортно-пересадочный узел пассажиров с одного состава магистрального транспорта до другого выбрано с учетом характеристик ТПУ (таблица 3).

Таблица 3

График расчёта интервала $\tau_{пп}$

№п/п	Операция	Время, мин					
		На операцию					
			3	6	9		
1	Высадка пассажиров с одного тс	2					
2	Высадка пассажиров с другого тс	2					
3	Выход на пересадку	1					
	Продолжительность интервала	3					

Интервалы графика движения общественного транспорта могут значительно различаться в зависимости от города, времени суток, дня недели и других факторов. В целом, автобусы и трамваи в крупных городах обычно ходят с интервалом от 5 до 15 минут в пиковые часы и от 15 до 30 минут в остальное время. Что касается поездов и троллейбусов, здесь интервалы могут быть более длительными и зависят от маршрута и графика движения поездов. Величины станционных и межпоездных интервалов зависят от: технического оснащения перегонов; плана и профиля подходов; допустимых скоростей движения поездов, способа управления стрелками и сигналами; длины станционных путей; порядка пропуска через раздельный пункт (с остановкой или безостановочно) и т. д. Невыполнение станционных интервалов приводит к нарушению графика движения поездов и, как следствие, к сбою работы на всём участке и направлении.

МЕЖТРАНСПОРТНЫЕ ИНТЕРВАЛЫ. ИНТЕРВАЛ ПРИБЫТИЯ ТРАНСПОРТНЫХ СРЕДСТВ. ИНТЕРВАЛ ОТПРАВЛЕНИЯ ТРАНСПОРТНЫХ СРЕДСТВ

Интервал прибытия транспортных средств ($\tau_{птс}$) – время от момента прибытия в транспортно-пересадочный узел транспортного средства до следующего прибытия состава магистрального транспорта (рисунок 5).

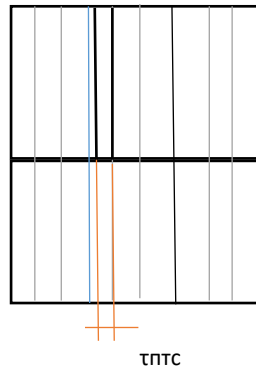


Рисунок 5 – Интервал прибытия транспортных средств (составлено автором)

Время от момента прибытия в транспортно-пересадочный узел транспортного средства до следующего прибытия состава магистрального транспорта рассчитывается исходя из планировочного решения ТПУ и натурного эксперимента (таблица 4).

Таблица 4

График расчета интервала $\tau_{птс}$

№п/п	Операция	На операцию	Время, мин			
			3	6	9	
1	Прибытие одного тс	1	■			
2	Прибытие другого тс	1	■			
3	Выход пассажиров	2	■			
4	Выход на пересадку	1		■		
	Продолжительность интервала	4	■	■		

Интервалом отправления транспортных средств ($\tau_{отс}$) называют минимальное время от момента отправления из ТПУ одного вида транспорта до момента отправления из этого ТПУ другого магистрального транспорта (рисунок 6).

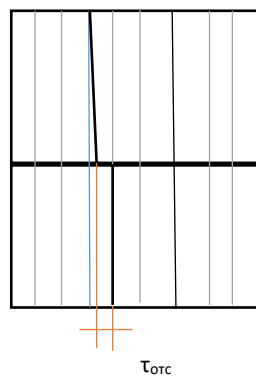


Рисунок 6. Интервал отправления транспортных средств (составлено автором)

Минимальное время от момента отправления из ТПУ одного вида транспорта до момента отправления из этого ТПУ другого магистрального транспорта рассчитывается исходя из планировочного решения ТПУ и натурного эксперимента (таблица 5).

Таблица 5

График расчета интервала $\tau_{\text{отс}}$

№п/п	Операция	На операцию	Время, мин			
			3	6	9	
1	Высадка пассажиров	2	■			
2	Пересадка	4		■		
3	Посадка пассажиров	2			■	
	Продолжительность интервала	8	■	■	■	

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ANALYSIS OF THE POPULARITY OF THE TOPIC THE EDUCATION QUALITY ASSESSING BY PUBLICATION ACTIVITY

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Abstract

Higher education quality assessment has remained a popular topic over the past 5 years. This topic is very important for CIS countries such as Kazakhstan and Russia, as the higher education system is being restructured to meet new challenges of society and new goals of the educational process. Publication activity is one of the indicators of the relevance of the study, so the review of publications is very valuable.

Keywords: *education quality, quality estimation, problems in education, publication activity, indicators of education quality.*

The quality of higher education in the CIS countries has been a hot topic for quite a long time. This is due to the transition to a competency-based model of education, the restructuring of the educational system, as well as the obsolescence of the old system, which cannot cope with new challenges.

A study was conducted, the results of which are published in [1, 2] for a more detailed study of this issue.

Let's consider changes in publication activity on this topic after two months of the current year (Fig. 1).

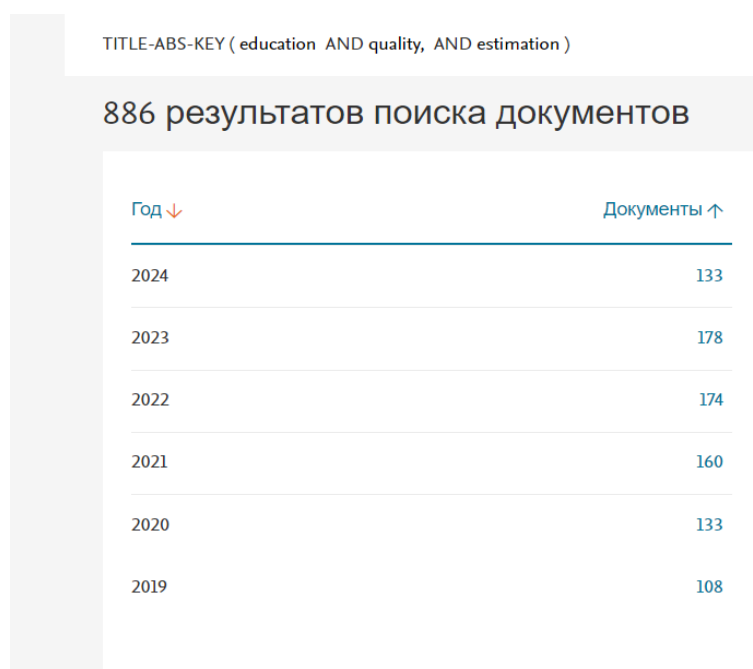


Fig. 1 Research results

When searching with parameters in Title, Abstract and Keywords in the Scopus system, 886 documents were found over the past five years (Fig. 2).

Выберите диапазон годов для анализа: 2019

по 2024

Анализировать

Документы по годам

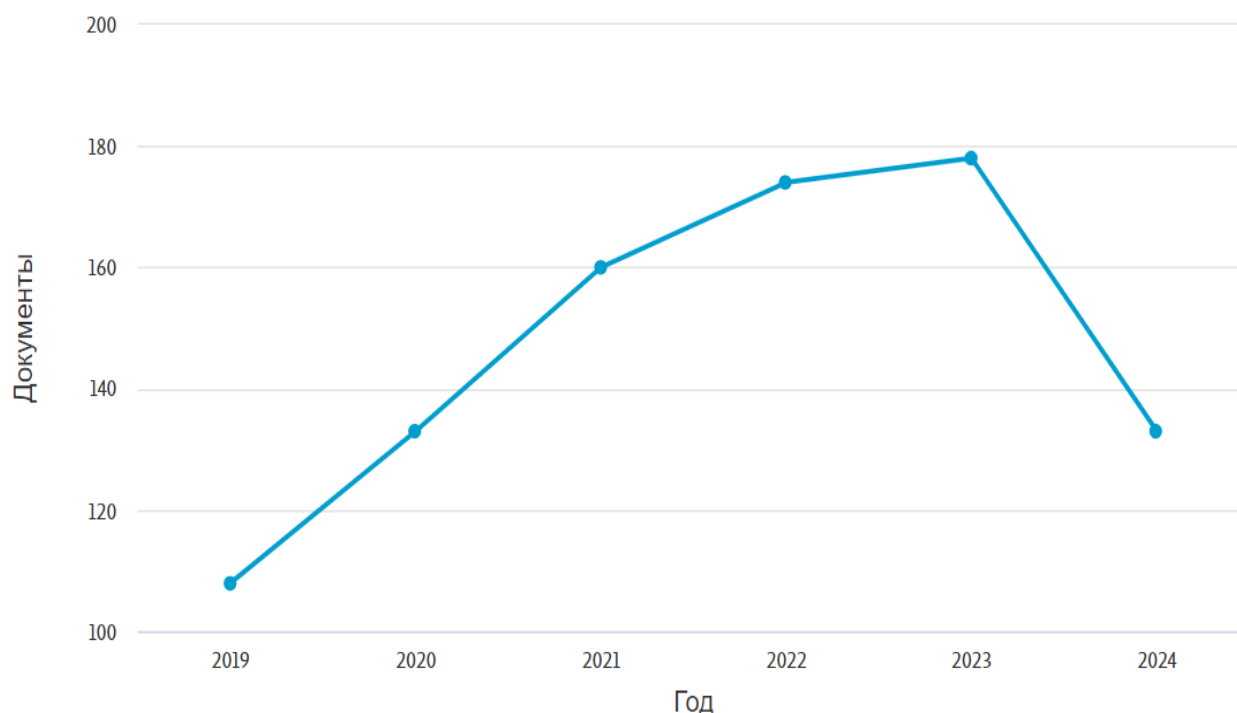


Fig. 2 Research results for the last 5 years

Note that from 2019 to 2023, there was a steady increase in interest in the research topic under consideration. As for 2024, 133 works were published in six months, compared to 2023 (178 works for the entire year)) there is an increase in the number of publications. The greatest interest in the quality of education is shown by researchers from China, the USA, Great Britain, Russia and Germany? For example [3-13]. Unfortunately, Kazakhstan is not among them (Fig. 3).

There are many reasons. One is the low level of funding. Another reason is that scientists prefer to publish in predatory journals due to the lack of peer review and fast publication deadlines. As for the realities of Kazakhstan, scientific policy also tends to quantify science. As controversial as it may be, the current research evaluation system is the main driver of predatory practices. Some countries are taking strict steps and tightening the fight against pseudoscience. According to China's new policy, cases of misconduct will be recorded in a national database. Inclusion in this list may deprive researchers of the opportunity to receive funding or negatively affect their research career in the future. Awareness and understanding of predatory practices is low. In addition, predatory journals are becoming increasingly sophisticated, making it difficult for scientists to distinguish bad journals from good ones. The inclusion of some rogue journals in leading databases adds to the confusion. [8, 10, 13]

TITLE-ABS-KEY (education AND quality, AND estimation)

886 результатов поиска документов

Страна ↑

Документы ↓

 China	171
 United States	115
 United Kingdom	56
 Russian Federation	48
 Germany	45
 India	45

Выберите диапазон годов для анализа: 2019



по 2024



Анализировать

Документы по странам или территориям

Сравнить количества документов максимум по 15 странам/территориям.

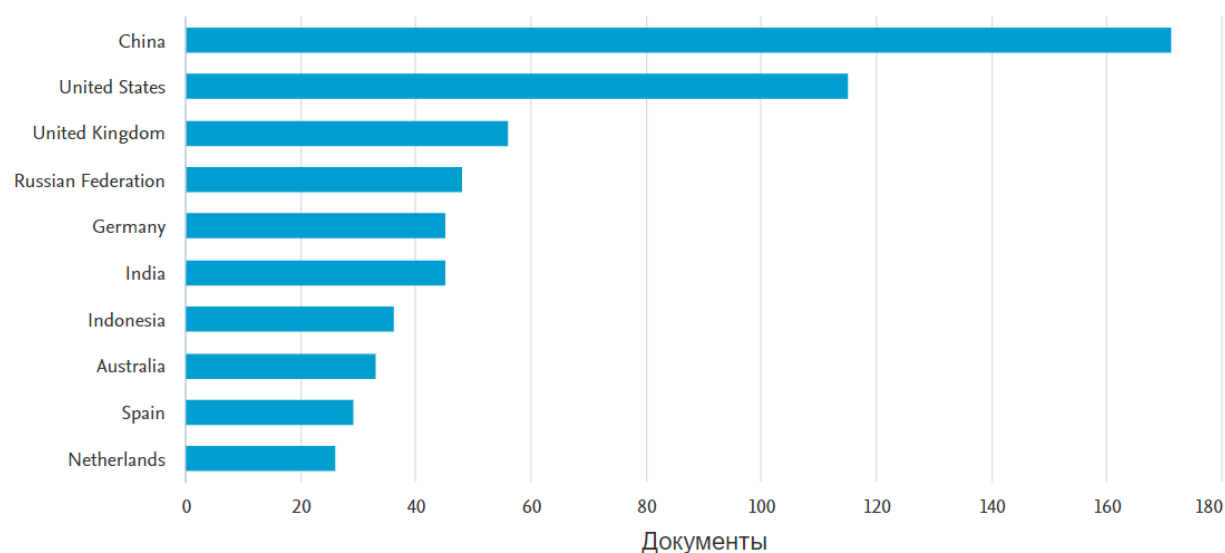


Fig. 3

If we consider the branches of knowledge, this topic is of greatest interest in the field of sociological research. Unfortunately, in the field of modeling the assessment of the quality of education, there is insufficient interest (Fig. 4).

Документы по отрасли знаний

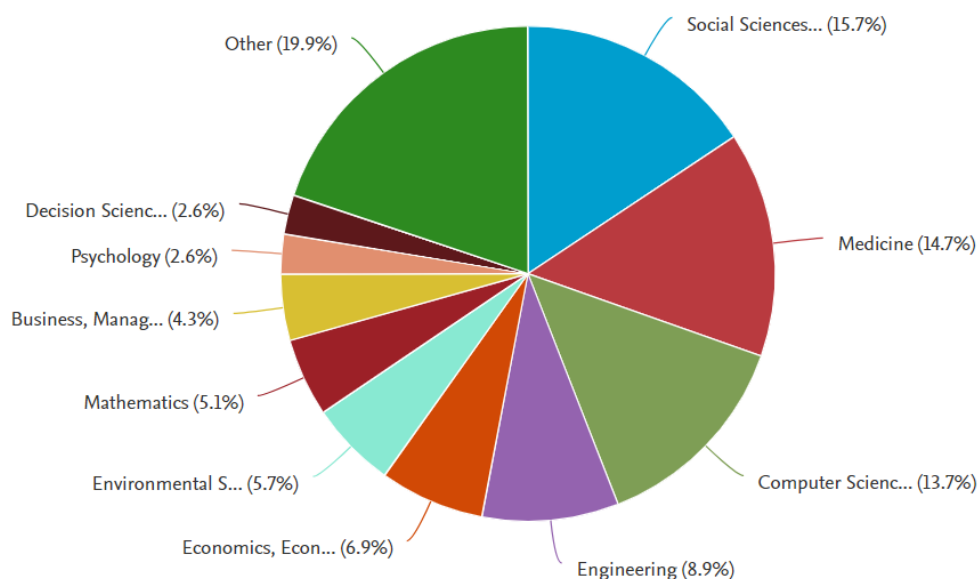


Fig. 4 The branches of knowledge
On request with additional parameters

(TITLE-ABS-KEY (education AND quality, AND estimation) AND TITLE-ABS-KEY (higher AND education) OR TITLE-ABS-KEY (education AND quality AND monitoring))
301 documents were found (Fig. 5).

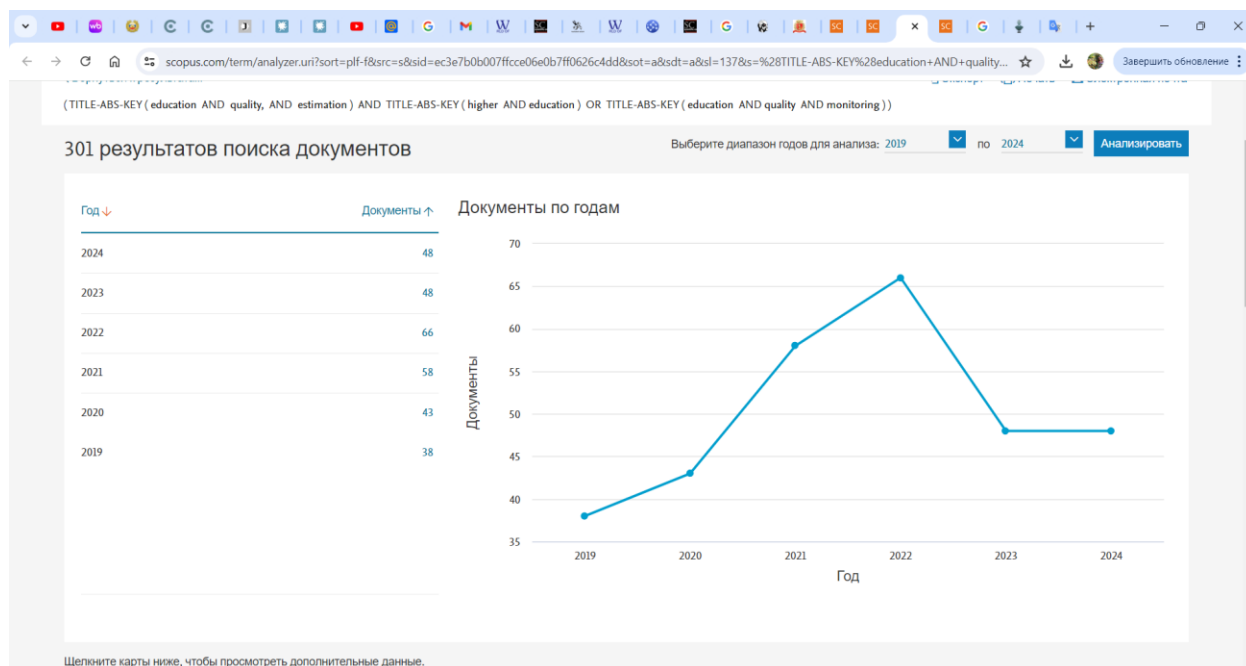


Fig. 5 Research results with additional parameters

More than 70 percent of the documents found are journal articles, indicating serious research in this area (Fig. 6).

Документы по типу

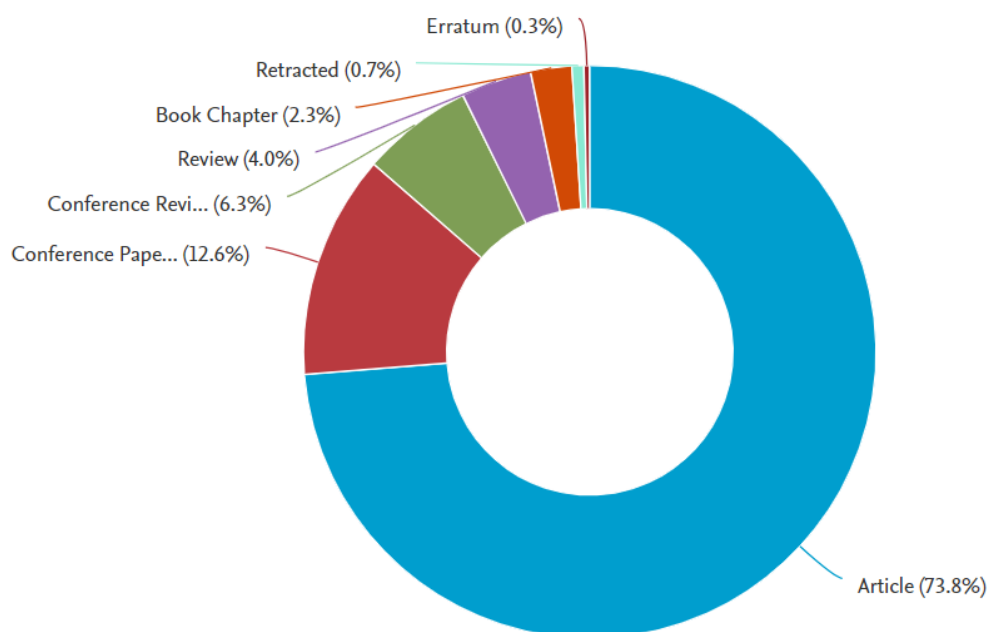


Fig. 6 Types of publications

But, as noted above, this interest is of a social nature and does not affect the areas of modeling and the technical side of the issue.

Conclusions

The conducted research showed that interest in the topic of assessing the quality of education over the past five years continues to remain relevant. The problem of low publication activity of Kazakhstani scientists is associated with a number of reasons, some of them are insufficient funding, publications in predatory journals, lack of knowledge in the field of journal ratings and opportunities for publication in worthy publications. It is also possible to note the interest in the topic of education quality assessment mainly in the field of social research, and not in the field of modeling the assessment process.

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