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ABSTRACT

of the dissertation for the degree of Doctor of Science

TERRITORIAL ORGANIZATION OF CONSTRUCTION MATERIALS INDUSTRY OF ABSHERON ECONOMIC-GEOGRAPHICAL REGION

Specialty:	5401.01-Economic Geography
Field of Science:	Geography
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GENERAL CHARACTERISTICS OF THE WORK

Actuality of the topic. Within the framework of the geographical division of labor of the republic, each region is distinguished by its specialization and specific problems. Absheron economic-geographical region (present-day Absheron-Khizi and Baku economic regions) as the center of the construction materials industry is the area with the richest mineral-raw materials resources in the country. During the period of independence, government decisions and state programs on the development and territorial organization of construction materials were implemented, significant progress was made in this area in Absheron economic and geographical region. It should be noted that the strengthening of the material and technical base of construction materials in Absheron region, the rational use of resources and the creation of new industrial structures within the framework of market principles based on environmental sustainability occupy an important place among the prospects for the development of the Republic.

At present, the presence of more than 100 non-ore deposits in the region has created large-scale production opportunities, but the full and efficient use of these resources has not been ensured. Despite the fact that not only Absheron, but also other regions are provided with a local raw material base for the development of construction materials in the country, 90% of the consumption of building materials is economically contradictory and worrying.

The stay of high import dependence on construction materials in the republic is a strategic challenge for the national economy, and it is necessary to carry out scientific research in the direction of solving this problem. In this direction, the scientific analysis of the problems, prospects and territorial organization of the construction materials in Absheron economic and geographical region is of particular relevance.

For this reason, it is very crucial to study the features of economic and geographical development of construction materials in Absheron economic and geographical region, to ensure the efficient use of existing raw material resources, to identify complicated solutions for reducing dependence on imports and strengthening local production

and to investigate the issues of ensuring environmental sustainability.

The object and subject of research. The object of study is the economic and geographical processes related to the formation and territorial organization of construction materials in the Absheron economic and geographical region. The subject of the study is the development prospects of the territorial organization of the construction materials in the Absheron economic-geographical region, increasing its productivity and identifying objective solutions to the problems encountered and studying them in detail.

Aims and duties of the research. The purpose of the study is to study the current state and dynamics of development of the territorial organization of construction materials in the Absheron economic-geographical region, to identify factors affecting the formation of this area, as well as to present promising development directions and strategic approaches that will contribute to the economic development of the region. To achieve this goal, the solution of the following tasks is required:

- To justify the scientific-theoretical approach in the territorial organization of construction materials;
- To study the current state and economic potential of raw materials resources of Absheron economic-geographical region, to investigate the volume, quality and efficiency of use of raw materials in industrial production;
- Assessment of the current situation on the basis of analysis of economic indicators and dynamics of development of construction materials in Absheron economic-geographical region, analysis of production capacities, productivity and contribution of the industry to the regional economy;
- Determination of the role of the research area in the provision of construction materials of the republic;
- Identification of existing environmental problems and ways to solve them, analysis of environmental impacts of building materials production and development of measures to ensure environmental sustainability in construction materials;
- To improve the territorial organization of construction materials in Absheron economic-geographical region and determination of

development prospects, preparation of scientifically substantiated proposals to increase the economic potential of the region and ensure sustainable development of industry, compilation of relevant maps.

Research methods. Statistical, visual and comparative analysis, field study, systematic approach, mathematical analysis, grouping and mapping methods through GIS were used in the research work.

Main statements for the defence of the thesis:

-To study of the scientific and methodological foundations of the territorial organization of construction materials in the Absheron economic and geographical region, study of the role of mineral and raw material resources and socio-economic potential of the region in the formation of industry;

-To analyze the dynamics of modern development of construction materials in Absheron economic and geographical region, to analyze the current state of environmental problems in this sector and ways to solve them.

- To determine the role of socio-economic development strategies in increasing industry competitiveness in Absheron economic-geographical region, investigation of areas with special prospects for the development of construction materials and determination of directions for improving territorial organization;

Scientific novelty of the research. Comprehensive study of economic and geographical problems of territorial organization of construction materials in Absheron economic and geographical region is based on the following scientific innovations:

-The current state of construction materials of Absheron economic-geographical region was assessed in economic-geographical aspect and structural problems were investigated. The role of construction materials in the implementation of the country's sustainable development strategy has been determined;

- The region's construction raw materials resources were analyzed and the existing opportunities and future prospects of the newly created construction materials areas were clarified;

-Environmental problems and waste management in construction materials were investigated and suggestions and recommendations were made for their effective use and mitigation;

-In the Absheron economic and geographical region, the directions of the construction materials, which can be more competitive, gain a stronger position in global markets and make a significant contribution to the development of the republic, are indicated.

Theoretical and practical importance of the research. The results obtained during the study are of practical importance not only for the Absheron economic and geographical region, but also in other regions in terms of the development of construction materials, increasing employment and improving socio-economic conditions.

The results of the dissertation can be used in the preparation and implementation of state programs, as well as as an educational resource for higher and secondary special education, in particular, in the teaching of the subject "economic and social geography of Azerbaijan".

Approbation of the study. Content, obtained results and scientifically substantiated recommendations of the dissertation work "Modern Problems of Geography: Integration of Science and Education" (Baku-2022), "Organization and management of natural economy systems in Karabakh and Eastern Zangazur economic regions" (Baku-2022), "The role of Heydar Aliyev in the development of science and education in Azerbaijan" (Baku-2023), «Географические Аспекты Устойчивого Развития Регионов» (Гомель-2023) was reported at the republican and international scientific-practical conferences.

In total, 12 scientific works on the topic of research work were published.

The name of the organization where the thesis work has been carried out. The dissertation work was performed at the Department of "economic and political geography of Azerbaijan" of the Institute of Geography named after academician H.A.Aliyev of the Ministry of Science and education of the Republic of Azerbaijan.

The structure and volume of the dissertation work. The dissertation consists of an introduction, 3 chapters, 10 paragraphs, conclusions and suggestions, a list of 122 used literature. The research work contains 143 pages with computer writing, 35 tables and 6 maps and 5 figures.

Introduction – 11,932, Chapter I – 68,286, Chapter II – 49,061, Chapter III-60,051, Conclusion and Suggestions - 8,091 consists of the number of signs. The dissertation consists of a total number of points 197,421 with the exception of the list of literature.

THE MAIN CONTENT OF THE DISSERTATION WORK

In the introductory section of the dissertation work, the purpose, relevance and main issues of the study are presented.

Chapter I, titled **The scientific and methodological foundations of the territorial organization of the building materials industry,** examines the scientific and theoretical foundations of the territorial organization of the industry and explains the existing approaches and concepts. At the same time, the historical development stages of construction materials were investigated, at the end, the economic-resource potential of the region's construction raw materials resources was assessed and the role of socio-economic factors in this sector was comprehensively analyzed.

The territorial organization of the construction materials is a complex process that is formed by the interaction of economic and geographical factors. In the research work, the theoretical approaches of such important researchers as A.T.Khrushchev, U.Isard and P.Krugman in this direction were analyzed. It should be noted that their conceptual views reveal the role of factors such as resource base, economic efficiency and market demand in the process of spatial organization of the industry.

A.T.Khrushchev noted that the resource factor plays a decisive role in the territorial organization of the construction materials, emphasizing the relationship of the location of the industry with mineral and raw material resources and fuel resources.

A.E.Fersman emphasized that the construction of industrial geography only on the basis of the mineral raw material factor is an inaccurate approach, noting the need for joint consideration of economic and natural factors. He believed that the source of raw materials does not always carry the role of an industrial center, but acts

as an important factor in the location of industry. A.T.Khrushchev, on the other hand, developed this approach, arguing that the commissioning of the field should be determined not only by the volume of natural resources, but also by economic efficiency [1].

U.Isard approached the territorial organization of industry on the basis of integrative and spatial economy models, identifying transport costs, labor market and agglomeration effects as the main factors. He stated that technological development and automation reduce the impact of traditional factors [2].

P.Krugman linked the spatial concentration of industrial enterprises within the framework of the "New economic geography" model with the breadth of the consumer market. He suggested that large cities and regions with high population density are attractive for industry in order to minimize transport costs and expand access to the market [3].

Thus, an analysis of different approaches to the territorial organization of the industry shows that the spatial organization of the construction materials is a multifaceted process. Although Khrushchev emphasized the dependence of this process on the resource base, Isard emphasized the role of technological development and logistics, and Krugman noted that the consumer market is one of the main factors in the location of the industry. In modern times, a combination of these approaches is important for determining the optimal model of location of the industry.

The territorial organization of the construction materials in the republic was investigated by various researchers and the factors affecting the development of this area were comprehensively analyzed. Z.N.Eminov, C.N.Ismayilov, N.A.Pashayev and A.I.Ibrahimov and other researchers studied the economic and geographical aspects of

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[1] Selected Works. / Edited by A.A. Agirrechu, G.I. Gladkevich, S.A. Tarkhov, V.E. Shuvalov. - Smolensk: Oikumena, 2010. - 320 p.

[2] Walter, İ. Location and Space- Economy, A general theory relating to industrial location market areas land use and urban structure / İ.Walter. - Cambridge: Mit PR, - 1972. - 369 p.

[3] Krugman, P.R. Geography and trade / P.R.Krugman. - Cambridge: MIT Press, - 1992. - 156 p.

construction materials, spatial organization and dynamics of development of industry, studied the natural resource potential, geographical position and the interaction of economic factors.

Based on the resource-centric approach, H.I.Mahmudov, Z.C.Efendiyeva, N.V.Ahmadov and N.V.Mammadov studied the country's mineral and raw material resources and assessed their economic efficiency for industry. Environmental aspects of construction materials were investigated by S.B.Khalilov, K.B.Bayramov and other researchers, and the importance of taking into account the principles of environmental sustainability in the development of industry was noted.

H.A.Khalilov and V.A.Guluzade studied the distribution of natural resources and the influence of the relief on the location of industrial areas. The role of state programs in the development of construction materials was analyzed by researchers such as Z.S.Mammadov, S.E.Ahmadova, A.S.Shakaraliyev, G.A.Shakaraliyev, S.H.Rizayev, M.K.Ramazanov. At the same time, Z.S.Mammadov studied the role of transport and logistics in construction materials in his research and made recommendations on increasing economic efficiency in product transportation.

According to the chronological-methodological approach and structural-functional analysis, studies show that the development of construction materials in our republic is divided into three stages: the Soviet period, the period of independence and the modern period. In Soviet times, the foundation of industry was laid, extensive construction projects were implemented. During the period of independence, the use of local materials and the preservation of traditional architecture were promoted, and in modern times, technological innovations and environmental sustainability have become the main direction of development of the industry.

The predominance of sedimentary rocks (clay, marl, sandy-calcareous aleurite, calcareous sandstone, etc.) of all periods from chalk to anthropogenic in the geological structure of the Absheron Peninsula contributed to the formation of various construction raw materials resources in the region.

In the study, based on the resource-geo-economic approach and

spatial-analytical method, the volume, use and geographical distribution of about 100 construction-raw material resources of Absheron economic-geographical region were investigated and their impact and prospects on industrial development were determined [4].

The research results have determined that 50% (323,186.42 thousand m³) of the total reserve of 511,368.15 thousand m³ in 46 limestone deposits in the region is being exploited. 70% of these deposits are directed towards the production of cube stone, 20% towards cement, and 10% towards lime production. 23 deposits with a total reserve of 185,337.73 thousand m³ are kept in reserve, and since 1983, one deposit with a reserve of 2,844 thousand m³ has been conserved.

During the study, the level of exploitation (IS) of the region's limestone deposits was analyzed and these deposits were divided into three groups:

-Deposits with a high IS level (above 60%): Vulkan (87.0%), Shuvalan (64.4%), Turkan-I (60.0%), Zira (64.2%).

-Deposits with an average IS level (20%-50%): Garadagh-I, Garadagh-II (51.9%), Mashtaga (40.1%), Sangachal (30.6%), Hajivelli (31.8%).

-Deposits with a low IS level (below 20%): Gazanag (0.7%), Karvan Saray (5.7%), Ramana (1.8%), Buzovna (10.7%).

It should be noted that this economic indicator makes a significant contribution to determining the degree and prospects of exploitation of deposits, as well as to the effective management of raw materials, sustainable development of industry and the formation of strategic decisions of the state.

During the study, the annual rate of exploitation (IIS) of limestone deposits was calculated. Deposits with a high IIS indicator are Garadagh-I, Garadagh-II (291.6 thousand m³) and Guzdek (1497.9 thousand m³), those with an average IIS are Turkan I (34.9 thousand m³) and Vulkan (33.6 thousand m³), while deposits with a low IIS indicator are Shuvalan (1.0 thousand m³) and Zira (1.3 thousand m³).

[4] Archival materials of the state geological information Fund for Environment and Natural Resources of the Ministry of Ecology and Natural Resources and Annual Report as of 01.01.2024.

Note that the IIS indicator is an economic indicator that allows you to calculate the period of depletion of the deposit.

For instance, in Guzdek deposit, the annual production is 1,497.9 thousand m^3 and the balance reserve is 66,845.4 thousand m^3, so it has been determined that the deposit will be depleted in approximately 45 years.

During the research, based on the reference materials of the state agency for the use of Mineral Raw Materials under the Ministry of Ecology and Natural Resources, the limestone deposits of the Baku economic region were mapped (Figure 1).

The analysis of construction raw material resources has revealed that there are 15.933 million m^3 of construction sand reserves in the region; however, a large portion of it is kept in reserve or has a low exploitation level.

The exploitation level of the Shikhlar deposit is 43.9%, while that of Shurabad is 0.72%. Also, among the sand-gravel deposits in the region with a total reserve of 11.486 million m^3 (Garadagh-Kaftaran, Atachay, Novkhani, Tikhli), only the Atachay deposit has a high IS indicator (1.6%). The total reserve of the sand-gravel deposits in reserve has been estimated to be approximately 5.479 million m^3.

The balance reserves of the 4 quartz sand deposits in the region, which are the raw material for glass production (total reserve of 25 million tons), have been analyzed: Hajivelli (3.6 million tons), Hokmali (8.3 million tons), Yasamal (0.6 million tons), and Zayardag (12.5 million tons). It has been determined that the Zayardag deposit is of strategic importance for the region due to its reserve volume.

Yasamal deposit, which is distinguished by its small volume reserve, is kept in reserve and is suitable for smaller scale use in the future.

The largest decrease in the balance reserves of the exploited deposits was recorded at Zayardag field (2.5%). No significant decline has been observed in Hajivelli (0.4%) and Hokmali (0.1%) fields.

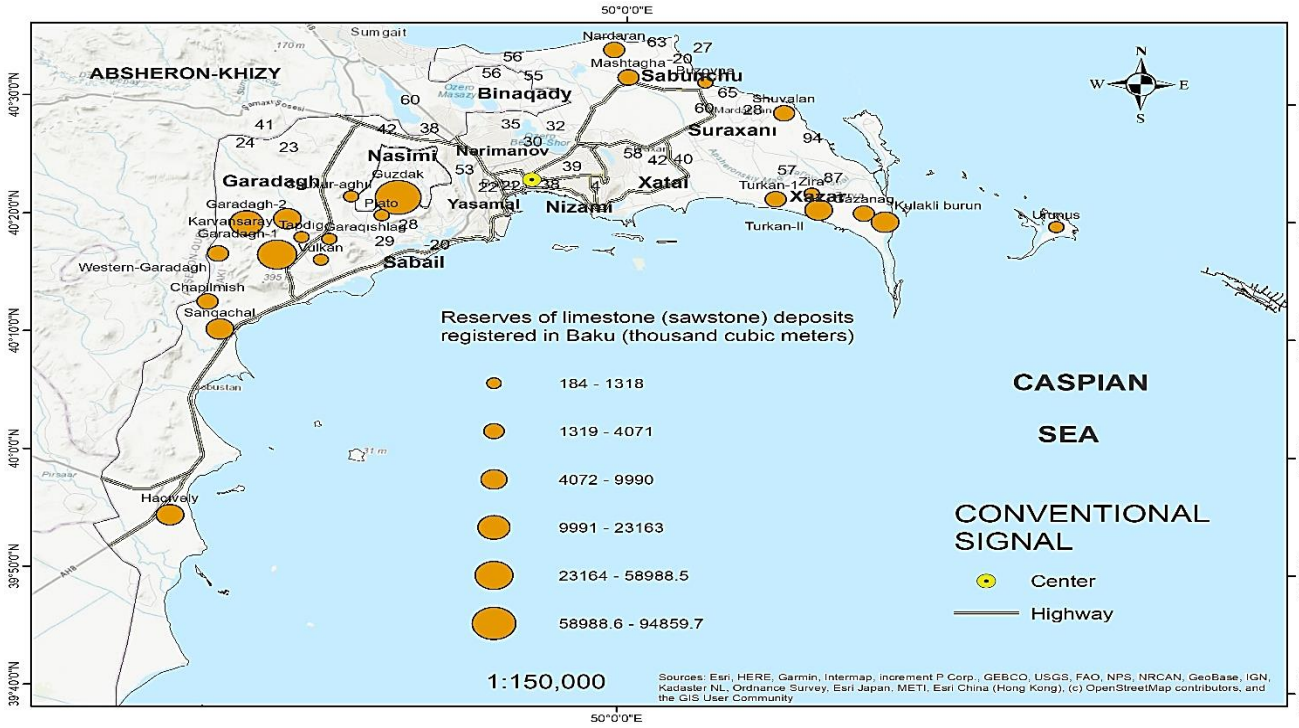

Figure 1. Some limestone (cube stone) deposits registered in Baku economic region (min. m^3). Some limestone (cube stone) deposits registered in Baku economic region (min. m^3).

Source: Prepared by the author on the basis of fund materials of the state agency for the use of Mineral Raw Materials of the Ministry of Ecology and Natural Resources

Dolomite deposits of the region, which are widely used in the production of refractory pottery and glass products, were also analyzed. It has been determined that in the Absheron economic-geographical region, 4 dolomite deposits with a total reserve of 64.5 million tons—Kechigaya (0.2 million tons), Gandartapa (46.9 million tons), Umbakı (8.5 million tons), and Girdag (8.9 million tons)—are registered in the state balance. Gandartapa, Umbaki, and Girdag deposits (64.3 million tons) are in reserve, while a 21.1% decrease has been recorded in the Kechigaya deposit. Additionally, among the silicate sand deposits in the region with a total reserve of 2.369 million m^3 (Girmaku-I and Girmaku-II), Girmaku-II is in operation, and a 12.6% decrease has been observed in its balance reserves, while Girmaku-I has been kept in reserve since 1972.

Based on the annual report of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan as of 01.01.2024 and the analysis of the reference materials of the state agency for the use of Mineral Raw Materials under the Ministry of Ecology and Natural Resources, 26 clay deposits have been registered in Absheron economic-geographical region. Of these, 4 deposits are clay with a reserve of 25.84 million m^3, 3 are cement raw material with a reserve of 0.0496 million tons, 9 are brick and tile clay with a reserve of 66.71 million m^3, 7 are expanded clay with a reserve of 137.68 million m^3, 2 are bentonite clay with a reserve of 38.84 million m^3, and 1 is agloporit clay with a reserve of 1.69 million m^3. It should be noted that 18 of the deposits are in reserve, and one of them has been conserved. Statistical analysis revealed that 70% of the region's clay reserves are in reserve. A decrease of 10.5% was recorded in reserves at the fields due to general exploitation work. Currently, the highest decrease in exploitation has been observed in the Zigh (75.2%), Ramana-I (62.4%), and Garadagh-II (58.8%) deposits.

At the end of the first chapter, a systematic analysis of socio-economic factors affecting the development of the building materials industry in Absheron economic-geographical region was implemented. It has been determined that 31.1% of the republic's total workforce is concentrated in Absheron region, and of the total workforce in the region, 77.8% is in Baku, while 22.2% is in the Absheron-Khizi economic region. Additionally, the region holds an average of 62.8% of

the total workforce employed in the industrial sector (Figure 2).

In 2015-2022, significant changes were observed in the labor market in Baku and Absheron-Khizi economic regions. In Baku economic region, the total workforce has increased by 5.4%, the employed population by 5.8%, salaried workers by 31.7%, the average monthly nominal wage by 62.1%, and newly created jobs by 45.2%. In the Absheron-Khizi economic region, the workforce has increased by 43.4%, the employed population by 42.5%, salaried workers by 26.5%, and the average monthly nominal wage by 90.9% [5].

It should be noted that the growth of the total workforce in the Baku and Absheron-Khizi economic regions, which reduces the risk of personnel shortages and allows the expansion of production, creates the potential for attracting more workers to the construction materials in these regions. At the same time, the increase in the number of hired workers in the region facilitates the provision of enterprises producing construction materials with professional labor. The growth of the average monthly salary in Baku and Absheron-Khizi economic regions is a factor that increases the motivation of employees. These economic indicators are factors that play an important role in increasing productivity and improving quality in construction materials, as in other industries.

The transport system plays an crucial role in the development of construction materials. Absheron region meets more than 70% of the country's construction materials production with an efficient infrastructure that ensures the transportation of raw materials and finished products. 35-40% of the mineral cargo transported from the region to other regions is construction materials products. Overall, 70% of the transportation of construction materials in the republic is carried out by road, 20% by rail, and 10% by other modes of transport [6]. In the

[5] State Statistical Committee Of The Republic Of Azerbaijan. *Official website.* URL: https://www.stat.gov.az.

[6] Abdullayeva, N.K. The role of transport economic relations in the transportation of building materials in Absheron-Khizi and Baku economic regions and the improvement of Transportation / / Republican scientific-Pacific conference "the role of Heydar Aliyev in the development of Science and education in Azerbaijan", - Baku: - may 10, - 2023, - P. 227-233.

country, the north-south, east-west, southwest, and northwest (central corridor) transport corridors are of strategic importance for intercontinental transportation.

Absheron region is located at the junction of these international corridors and plays an important role in the development of transit potential. Acting as a logistics center**,** the region stimulates the economy by providing cargo processing and distribution through transport corridors.

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Chapter II, titled **The dynamics of the modern development of the building materials industry in Absheron economic-geographical region**, analyzed the modern development trends, import-export structure and trade partners of construction materials in the region, as well as environmental problems, current situation and prospects for sustainable development.

The dynamics of production of many building materials in Baku and Absheron-Khizi economic regions for 2015-2022 were analyzed during the research. It was found that on average during the research years, Baku economic region paid 50% of the total volume of construction materials produced in the republic, and Absheron-Khizi Economic Region-20% (Figure 3).

Chapter II also analyzed the import-export dynamics of construction materials and determined that 90% of the consumption of building materials is paid by imports.

At the end of Chapter II, environmental problems of construction materials were investigated. It was found that the rapid development of the construction sector in recent years has increased the demand for non-ore materials by 3-6 times, causing depletion of resources and deepening of environmental problems.

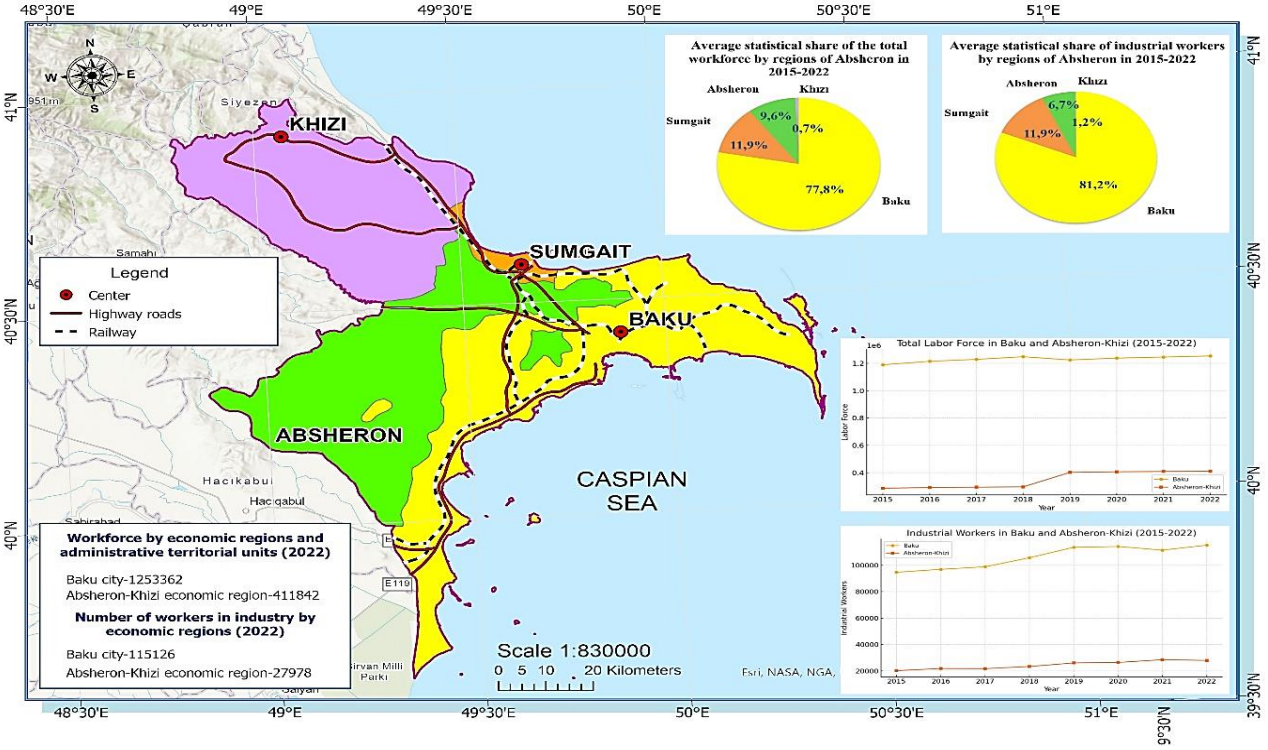

Figure 2. The average statistical share of the workforce by regions in Absheron region in 2015-2022.
Source: Compiled by the author on the basis of SSCRA data.

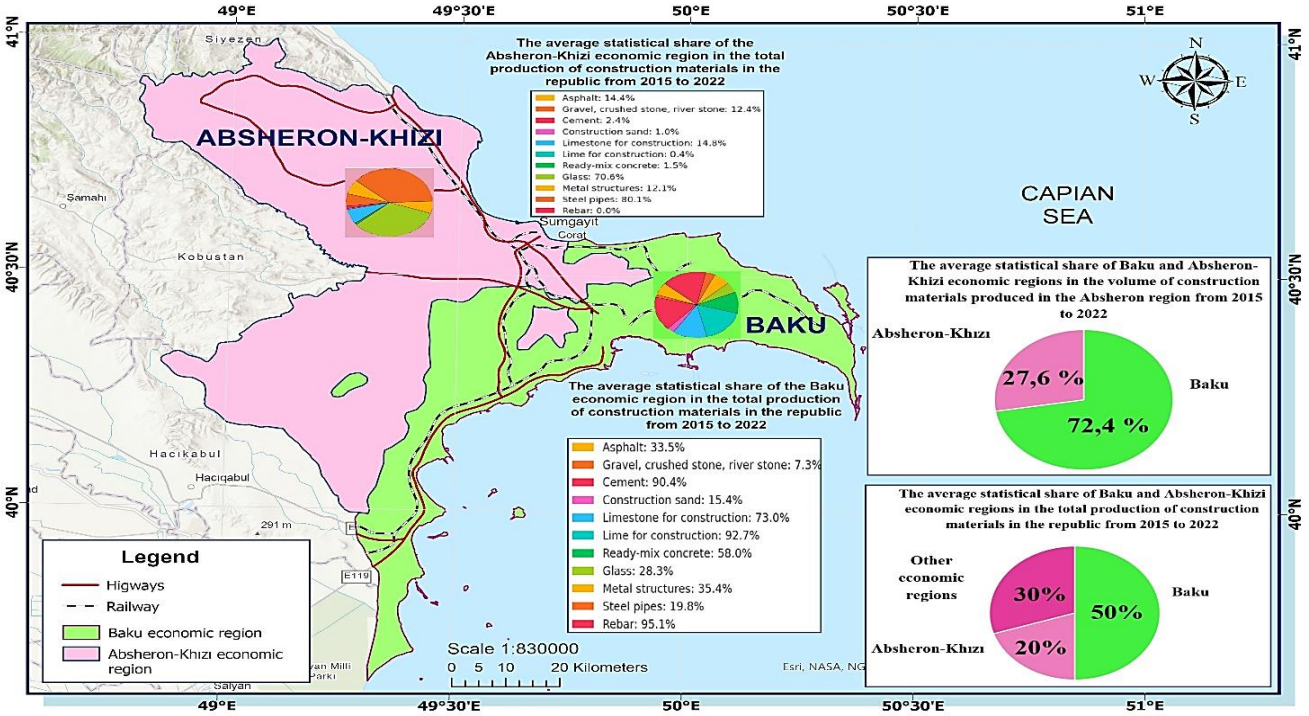

Figure 3. The average statistical share of Baku and Absheron-Khizi economic regions in total production of building materials (2015-2022).

Source: Source: Compiled by the author based on data from SSCRA.

Table 1

The generalized classification of waste generated during the extraction and processing of non-metallic construction raw materials and their potential uses.

Type of waste	Purpose of use of waste
Limestone	Non-ferrous metallurgy, ferrous metallurgy, lime production, facing stone production, glass industry, lime flour for agriculture, sugar industry, reclamation of saline soils, reclamation of oil-contaminated soils, lime milk production, and as a filler in solutions, etc.
Clays	In the production of bricks, mineral flour, ceramsite in the production of cement,in the production of agloporite in the purification of petroleum products in the production of drilling solutions in perfumery, soap industry, etc.
Dolomites	In metallurgy as refractory raw material, in agriculture as fertilizer and lime treatment of acid soils, in the chemical industry, in cement and lime production, in the production of floor and facing tiles, in concrete production, in construction and road works, in the production of quicklime, in filling and coating the edges of martin furnaces, and in other fields.
Quartz sands	It is used in the production of cement, bricks, in the production of concrete, in the preparation of ceramic products in construction mortar, refractory material, glass industry, welding, etc.
Waste from facing stones: scraps with a volume not exceeding 0.2-0.3 m^3 and a length of up to 0.8 m, uncut stones, gravel.	Raw materials for the production of artificial blocks: based on cement binder with marble filler, in the production of facing tiles by pressing or molding methods, in the production of reinforced concrete products; in the production of decorative panels of various sizes, household items, souvenirs, and other natural products.

Source: Compiled by the author on the basis of the fund materials of the state agency for the use of Mineral Raw Materials of the Ministry of Ecology and Natural Resources.

During the analysis, waste was recorded in limestone deposits exploited in the Absheron region, but there were no waste deposits in dolomite, clay, gravel, sand and bituminous rocks. Based on the analysis, it should be noted that while the production in the exploited limestone deposits is 25.4 million m³, the losses exceed 26 million m³. In other words, 60-65% of the mass has been converted into waste during the extraction of limestone deposits. 15% of the unproductive land area (33 thousand hectares) in the region is covered by sand and limestone deposits.[7]

However, during the research, it was found that while the waste can be used as raw material in industry and agriculture, its usage in the Absheron region is almost non-existent.

During the studies, the prospects for the use of waste in construction raw materials were also analyzed (Table 1).

At the same time, the impact of air pollution on human health in regional quarries was studied and it was found that during the operation of quarries, a high level of emission of dust particles smaller than 10 microns into the atmosphere negatively affects both the environment and the health of workers.

In the research, analyses were conducted on the efficient use of resources and the principles of circular economy, and it was found that in developed countries, more than 50% of construction sector and construction materials waste is recycled, with this figure reaching 80% in the USA and Germany.[8] In particular, the production of recycled concrete and clinker-free cement has been cited as the main alternatives for reducing environmental risks note that over the years of research it has been found that an average of 22% of the waste generated in the construction industry is involved in recycling.[9]

Chapter III, entitled **The prospects for the development of the building materials industry of the Absheron economic-geographical**

[7] State Information-Archival Fund materials on Environment and Natural Resources of the Ministry of Ecology and Natural Resources.

[8] Building for the future: [Electronic resource] / - May 21, 2023. URL: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.constructionaccord.nz/assets/Construction-Accord/files/building-for-the-future.pdf.

[9] Construction in Azerbaijan. -Baku: Materials of SSCRA, - 2024. - 254 P.

region, examines the promising areas of the construction materials, improvement of territorial organization, application of the cluster model and development strategies within the framework of state support mechanisms. Studies show that in general, state support for the development of construction materials in the process of implementing programs for the Socio-Economic development of the regions was provided mainly in the areas of searching for construction raw material deposits and expanding production, and large amounts of financial resources were directed to the implementation of various projects. Figure 4 shows the growth dynamics of total (178.3%), domestic (164.6%), and foreign (188.7%) investments directed towards construction materials sector from 2015 to 2022.[10]

The growth of foreign investment is seen as a positive trend during the period of intensification of competition for investment in the global market.

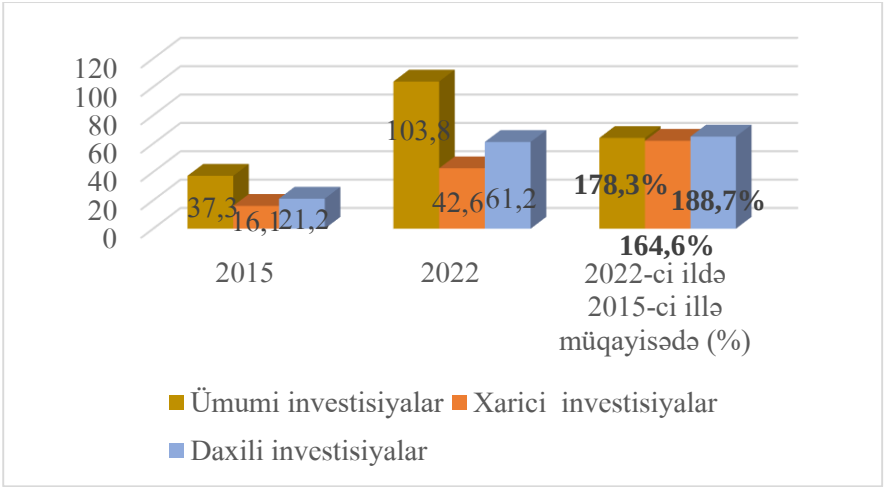

Figure 4. Total domestic and foreign investments in the production of building materials, million manats.
Source: Prepared by the author based on SSCRA data.

[10] Abdullayeva, N.K. Prospects for the development of the building materials industry in state programs and justification of environmental protection issues / / - Baku: Works of the Azerbaijan Geographical Society, geography and Natural Resources, - 2023. №2 (20), - p. 62 - 72.

During the research, the economic indicators of construction materials production enterprises launched in the Absheron region within the framework of state programs from 2004 to 2022 were analyzed, and it was found that during these years, 47.0% of the total enterprises launched for construction materials production in the region were in Sumgait, 6.0% in the Absheron administrative district, and 47.0% in Baku. During the implementation of the first state program, 22.2% of the enterprises serving construction materials production in the region started operations, 33.3% during the implementation of the second state program, and 27.8% during the implementation of the third state program. It should be noted that the implementation of the fourth state program is ongoing, and 16.7% of the constructed enterprises were commissioned between 2019 and 2022 (Figure 5).

Based on statistical analysis, it should be noted that the years 2014-2015 stand out in terms of the development of the construction materials industry, as during this period, large-scale factories for cement production, concrete production, concrete pipe production, and metal structure manufacturing were commissioned. In 2007, 2013, and 2019, however, the increase in production capacity remained relatively stable, but significant growth was observed again in 2021 and 2022, related to the development of glass and polymer products. Statistical analysis shows that the highest production capacity among industrial sectors belongs to cement and metal structure production. In particular, clinker production (5,000 tons per day) and metal structure production (15,000 tons per year) dominate this area. At the same time, glass products, polyethylene and concrete products also have high production capacity. These economic indicators show the development of industrial diversification in Absheron region. It should be noted that the city of Sumgait, whose industrial potential is mainly based on the production of metal structures, steel, glass and chemical products, is the area where industrial enterprises with the highest production capacity are located.

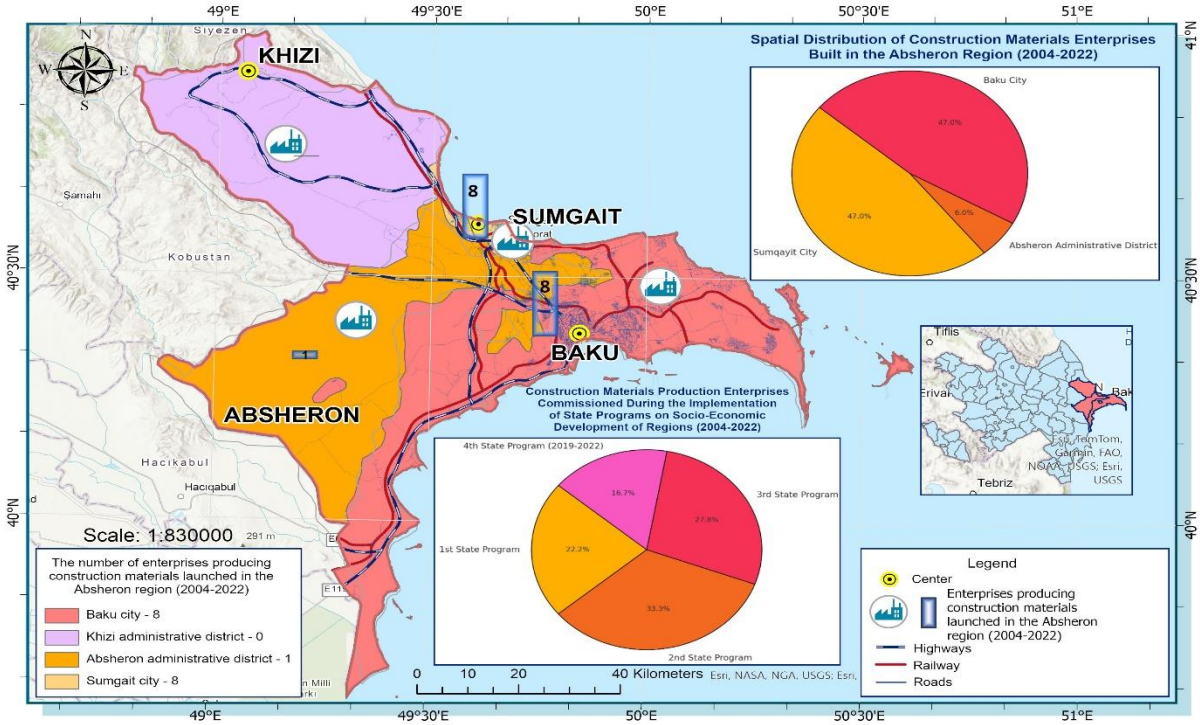

Figure 5. The spatial description of the construction materials production enterprises commissioned in Absheron region during the implementation of state programs from 2004 to 2022.
Source: Prepared by the author based on SSCRA data.

Chapter III also analyzes the sectors with special prospects for the development of construction materials sector in Absheron region, and it was found that the geographical combination of limestone and clay sources in the region, along with the region's good fuel resource supply, provides significant prospects for the development of cement and cement clinker, brick, gypsum materials, glass materials, insulation materials, and other construction materials production sectors.

This section examines the importance of the cluster model in the territorial organization of construction materials and analyzes international experiences, including the examples of the Volgograd, Leningrad, and Moscow Composite Clusters. The resource sharing, innovation exchange, and economic integration opportunities between cluster enterprises were studied, the role of clusters in Azerbaijan's state programs was emphasized, and the prospects for the creation of construction materials cluster in the Absheron region were evaluated.

Chapter III also analyzes the potential for the transformation of the construction materials industry in Baku's Garadagh district into a cluster.

Taking into account the raw material base, transportation infrastructure, and the availability of industrial parks, the conditions for the creation of the "Garadagh Construction Materials Cluster" have been evaluated. Although the density of enterprises in the district is a favorable factor for the formation of a cluster, the weak inter-enterprise connections, the absence of an official cluster structure, and the limited number of innovation centers and skilled workforce training have been identified as the main obstacles. It has been suggested to strengthen government support for cluster development in the region, increase inter-enterprise integration, and expand collaboration with scientific research institutes.

This chapter also analyzes the potential of Sumgait city for the construction materials cluster .

Thus, the establishment and development of the construction materials cluster in the Absheron region, along with ensuring more efficient use of the region's strategic resources, will make a

significant contribution to the overall industrial and economic development of Azerbaijan. The joint efforts of the government and the private sector in this direction will play a decisive role in achieving successful results.

CONCLUSIONS

1. For the first time, a comprehensive study was conducted on the economic and geographical aspects of the modern territorial organization of the building materials industry in the Baku and Absheron-Khizi economic regions. This study systematically examined the theoretical and methodological foundations of the industry's territorial organization and provided an in-depth analysis of the natural and economic factors influencing its development. The findings confirm that the region's natural resource potential offers significantly greater opportunities for the efficient territorial organization of the building materials industry than the current condition. At present, only 34% of the region's total construction raw material deposits (100 deposits) are being exploited—50% of limestone deposits and 30% of clay deposits—while 64% remain in reserve.

2. Our research also revealed a significant imbalance between the production and consumption of building materials, not only in the Baku and Absheron-Khizi economic regions but across other economic regions of the republic as well. Thus, while the natural conditions, raw material resources, and geographical location of other regions—alongside the Baku and Absheron-Khizi economic regions—offer opportunities to enhance efficiency in the building materials industry and meet local demand, a significant concentration remains in the Absheron region. During the research years, an average of 70% of construction materials produced in the republic originated from this region (Baku ER - 50%, Absheron-Khizi ER - 20%), and 80% of construction materials manufacturing enterprises were also located there. As a result, construction (building) materials account for 35-40% of the cargo transported from this region to other

areas. This causes inefficient freight transportation between regions. The severe supply-demand imbalance in the regions highlights the need for strategic planning to optimize supply and demand in this industrial sector.

3. During the study, an analysis of the import and export dynamics of construction materials was conducted to assess domestic market demand. Findings revealed that in 2015, only 6% of the country's construction material consumption was met by local production, while 94% relied on imports. By 2022, these figures had shifted slightly, with local production covering 11% of consumption and imports still accounting for 89%.

Overall, the analysis indicates that the republic favors regional suppliers in the construction materials market, with Turkey, Russia, and Iran remaining the dominant import sources.

4. The study also found that 20% of the total contaminated soils in the region are unusable lands located under sand and stone deposits. Waste accumulation was recorded in all exploited limestone deposits in the Absheron region, with 60-65% of extracted material turning into waste annually. Currently, only 10% of waste generated during raw material extraction and processing is reused, while the remaining 90% is either sent to landfills or released into the environment, causing long-term ecological disruptions.

5. The economic indicators of the construction sector, which is the primary driver of the building materials industry, were also analyzed. It was found that an average of 3.14 thousand km^2 of land is allocated for construction annually, and only 22% of construction waste is recycled. The Absheron region, as the center of construction activity, has accumulated a significant portion of construction waste, accounting for 60.5% of total construction investments (Baku - 52.8%, Absheron-Khizi - 7.7%) during the research years. These findings highlight the urgent need for the adoption of waste management and recycling technologies.

6. The research also conducted an economic-geographical study of promising areas for the development of the construction materials industry in the Absheron region. It determined that the region possesses essential resources, technological infrastructure,

transport networks, and an adequate labor force (accounting for an average of 31% of the republic's total labor force during the research years), making it well-suited for industry expansion.

The close proximity of limestone and clay sources, along with access to fuel resources, provides strong potential for the production of cement, cement clinker, bricks, gypsum materials, glass, insulation, and other construction materials.

7. Additionally, the study explored ways to improve the territorial organization of the building materials industry. By analyzing international cluster models in this sector, it was found that the Garadagh district of the Baku economic region and Sumgait city in the Absheron-Khizi economic region have the highest industrial potential for establishing a building materials cluster. Various proposals were put forward regarding the implementation of clustering strategies as an effective means to support small firms in an increasingly globalized and competitive market.

RECOMMENDATIONS

1. Given the increasing demand for construction materials, greater attention should be paid to geological exploration and resource evaluation. To optimize the use of unexploited raw material deposits in the Absheron region (which account for 64% of total deposits), advanced geological modeling and reserve analysis using Geographic Information Systems (GIS) would be beneficial. Additionally, integrating modern technologies for raw material processing could significantly improve efficiency in the sector**.**

2. With over 70% of the demand for building (construction) materials in Azerbaijan being met by the Baku and Absheron-Khizi economic regions, transportation costs are rising, and regional development remains unbalanced. To address this, new production zones should be identified in other economically and geographically suitable regions. Scientific planning should focus on the industrial potential of these areas, particularly in Karabakh and East Zangezur, where construction activity is expanding. Establishing local construction material enterprises in these regions would enhance self-

sufficiency. This approach may reduce regional imbalances and allow for more efficient use of the industrial potential of the regions.

3. Only 22% of construction waste is recycled in Azerbaijan, whereas in developed countries, this figure ranges from 50% to 70%. Considering that the Absheron region generates approximately 1 million tons of construction waste annually, creating specialized industrial zones for recycling, equipped with modern technologies, would be highly beneficial. Additionally, research should be conducted on adopting "green technologies" and aligning international waste management standards with local conditions. Studies indicate that incorporating recycled materials into new construction products can reduce the need for raw materials by up to 20%. This presents an opportunity to develop "eco-friendly" branded products from recycled materials, which could contribute to Azerbaijan's switch to green economy and competitiveness in international markets**.**

4. Since 60-65% of the waste generated during limestone extraction is not efficiently utilized, modern technologies and broader use of recycling should be introduced in this sector. Currently, only 10% of waste is reused, and this figure should be increased to at least 50%. It would be appropriate to promote the use of waste as alternative raw materials in industry and agriculture. **.**

6. Many former stone and sand quarries in the economic region have been distributed or sold to the population. Given the city's growing population and its expansion towards the outskirts, priority should be given to developing integrated high residential zones in surrounding settlements and villages. With the population in the Absheron region increasing by more than 1.5% annually and the demand for construction materials rising by approximately 5% per year—expected to reach 3 million tons—the need for new construction projects, particularly in peripheral areas, has become increasingly important. There are more than 50 settlements around Baku, many of which have underutilized land resources. To optimize land use and support balanced urban expansion, integrated zones should be developed in surrounding settlements and villages—particularly in Garadagh, Turkan, and Zira—where high-rise

residential buildings and industrial enterprises can coexist. This approach would not only help decongest the city center but also stimulate economic growth in these regions, fostering more sustainable urban and industrial development.

7. Drawing from international clustering models, the establishment of a Building Materials Cluster in the Absheron region should be explored on a scientific basis**.** Although 85% of construction materials production in the region is concentrated in Garadagh, limited technological cooperation among enterprises highlights the need for integrated industry models. To enhance competitiveness and foster innovation, the creation of a Building Materials Cluster in Garadagh and Sumgait would be beneficial.

Scientific Publications Reflecting the Main Content of the Dissertation

1. Territorial Organization of the Building Materials Industry in the Republic of Azerbaijan and Modern Development Issues // Geography and Natural Resources, Baku, 2021, No. 2(14), p. 60-70.
2. Modern Development Issues of the Cement Industry in Azerbaijan // Nakhchivan University Scientific Works (Economics, Philology, History, Geography, Pedagogy, Psychology, Mathematics), Nakhchivan, 2022, No. 3(27), p. 26-34.
3. Territorial Organization of the Concrete and Concrete Products Industry in the Baku Economic Region // Young Researcher Scientific and Practical Journal, Baku, 2023, No. 2(60), p. 54-61.
4. Mineral Construction Raw Material Resources of the Absheron-Khizi Economic Region // Proceedings of the Scientific and Practical Conference on the Organization and Management of Natural Economic Systems in the Karabakh and East Zangezur

Economic Regions, Baku – 2022. №3 (23), - p.- 75-84.
5. The Role of Transport and Economic Relations in the Transportation of Construction Materials in the Absheron-Khizi and Baku Economic Regions and the Improvement of Logistics // Republican Scientific and Practical Conference on the Role of Heydar Aliyev in the Development of Science and Education in Azerbaijan, Baku, 2023, p. 227-232.
6. Prospects for the Development of the Construction Materials Industry in State Programs and Justification of Environmental Protection Issues // Geography and Natural Resources, Baku, 2023, No. 2(20), p. 62-71.
7. Prospects for the Development of Construction Materials Supply in Baku and the Absheron-Khizi Economic Region of the Republic of Azerbaijan // Geographical Aspects of Sustainable Development of Regions: Materials of the V International Scientific and Practical Conference, Gomel, 2023, p. 40-45.
8. Territorial organization of the construction materials industry and problems of modern development of the Banking economic region of Azerbaijan // Geography and Tourism (Geography of recreation and tourism: theoretical and applied issues), (67). – p. 34-39.
9. Construction Materials of the Baku Economic Region // News of the Pedagogical University (Mathematics and Natural Sciences Series), Baku 2002. Vol. 70, No. 2, p. 206-219.
10. Territorial Organization of the Construction Industry in the Baku Economic Region and Prospects for the Transition to a Green Economy // Modern Problems of Geography: Proceedings of the International Scientific and Practical Conference on the Integration of Science and Education, Baku – 2022. Vol. II, p. 121-126.
Factors Influencing the Development of the Construction Materials Industry in the Absheron-Khizi and Baku Economic Regions // Regional Geosystems, Belgorod - 2024. Vol. 48, No. 3, p. 342-353.
12. The Role of Private and State Investments in the Development

of the Construction Materials Industry (Based on the Example of the Baku and Absheron-Khizi Economic Regions) // Geology, Geography, and Global Energy, Astrakhan, 2024, No. 3(94), p. 74-82.

The defense of the dissertaion will be held on 25 April 2025, at 11⁰⁰, at the meeting of the Dissertation Council FD 2.51, operating under the Ministry of Science and Education of the Republic of Azerbaijan, at Baku State University, Faculty of Geography.

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