REPUBLIC OF AZERBAIJAN

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ABSTRACT

of the dissertation for the degree of doctor of philosophy

"DEVELOPMENT OF THE METALLURGY INDUSTRY OF AZERBAIJAN AND IMPROVEMENT OF INTER-REGIONAL ECONOMIC RELATIONS"

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GENERAL CHARACTERİSTİCS OF WORK

The actuality and the degree of problem development of the research. Currently, the metallurgical industry, which is one of the important sectors of the economy of the Republic of Azerbaijan, includes pipe-rolling, aluminum, steel casting and recycling enterprises engaged in the extraction and refining of ferrous and non-ferrous metal ores, as well as the production of flux and refractory materials, and the annual expansion of industrial sectors creates a favorable environment for this sector.

Nowadays, due to emerging requirements linked with the sustainable development of oil and gas industry, ferrous metallurgy is mainly placed in Ganja-Dashkasan and Absheron-Khizi economic regions.

At present, due to the needs of the continuous development of the oil and gas industry, ferrous metallurgy is mainly located in the Ganja-Dashkasan and Absheron-Khizi economic regions. Thus, since 2009, 8 state and 34 non-state metallurgical enterprises have been operating in the Republic of Azerbaijan, but since 2010, the number of state enterprises has been 6, and the number of non-state enterprises has been 24, and their activities are based on the extraction and processing of iron ores.

In general, in terms of deposits of ferrous and non-ferrous metals,rare and noble (gold) metal deposits, as well as non-metallic minerals, our country is rich enough, and are mined in the Gadabay gold ore deposit. After the commodity gold extracted here was refined in Geneva, Switzerland, the next batch of gold bars in the amount of 4900.0 troy ounces (152.4 kg), which is the profit share of the Government of the Republic of Azerbaijan, was accepted by the State Service for Control over Precious Metals and Precious Stones of the Ministry of Finance of the Republic of Azerbaijan on 19.09.2012 and placed in the Central Bank of our country. Before that, 16512.9 troy ounces (513.6 kg), which is the profit share of the Government of the Republic of Azerbaijan, were accepted and placed in storage at the Central Bank. In general, the amount of gold belonging to the Government of the Republic of Azerbaijan in

storage at the Central Bank to date has reached 21413.4 troy ounces (666.0 kg). Its market value as of today (21.09.2012) is 37.9 million. $.

This scientific investigation demonstrates that, measures taken to enhance metallurgical industry do not eliminate fundamentally existing problems and difficulties within the sphere. Thus, despite positive outcomes associated with the recent social-economic reforms implemented in the given sphere, still shortcomings are visible. An application of new technologies, increasing production capacities and investments in the sector will create positive impact on the speedy resolution of the emerging difficulties. In general, the further increase in demand for metal products in both domestic and foreign markets and its satisfaction is substantially determined by the expansion of production in the metallurgical industry. Therefore, the development of this field should be in the focus of the state. In modern times, the development of the metallurgical industry and the factor of environment are inseperable. Therefore, as in other areas of industry, the implementation of production in the metallurgical industry does not go without impact on the environment. The damage to the environment in the activities of both ferrous and non-ferrous metallurgical industries should be thoroughly studied, and minimizing their environmental impacts by fully ensuring their compliance with the technological process is one of the timely issues of the day. Thus, ensuring the development of the metallurgical industry is very important in terms of the perspective development of the country's economy and is relevant and significant in terms of the requirements of the modern era.

In the conditions of a market economy, the development of the metallurgical industry in Azerbaijan, the rational development of its raw material deposits, the prospective development of the mining metallurgical industry, and the improvement of intra-regional and inter-regional economic relations in the conditions of new management are important. In this regard, the study of the above issues from the point of view of economic efficiency and the progress of the metallurgical industry of our country within the framework of national interests require new approaches.

In order to study the development of the metallurgical industry in our country under the new economic conditions, it is of vital importance to investigate development of the ore-mining industry and its impact on industrial sectors. The economic reforms carried out in our country have necessitated a new approach to the wide range of economic issues the formation of fresh views. In recent years, Azerbaijani economists and scientists Alirzayev A.G., Aliyev T.N., Aliyev A.E., Huseynov T.T., Nadirov A.A., Nuriyev A.Kh., Nabiyev N.E., Sultanova R.P., Shekaraliyev A.Sh., Yuzbaşiyeva G.Z. and others have studied individual problems of the economy, including industry and metallurgical industry in their research.

Russian scientists Guvich L.Y., Denel A.K., Kishkin S.T., Kolobiev N.I., Petrakov A.F., Petrov B.V., Polukhin P.I., Sklyarov N.M. and others, and foreign scientists Milliken R., Michael D., Christopher S., William K., Johannes S. and others have conducted research in this direction, but it has not been a specific subject of research.

Ackowledging the importance above-mentioned scientists' scientific investigations, the formulation of the problem in this way has not been been discussed. Thus, from the perspective of the prospective development of the metallurgical industry of Azerbaijan, the progress of its inter-regional economic relations is appropriate and the solution of this problem possess great importance.

The object of research is the metallurgical industry of the Republic of Azerbaijan.

The subject of the research is the development characteristics, conditions and directions of stimulation of the development of mining, especially metallurgical industry enterprises in the Republic of Azerbaijan, as well as the improvement of inter-regional economic relations.

Aims and objectives of the study. The main aim of the dissertation is to develop scientifically based proposals and recommendations in order to stimulate the development of the country's economy, especially the mining and metallurgical industry

of Azerbaijan, based on new technologies, and improving interregional economic relations.

For the purpose of achieving this very aim it is rational to deal with a set of scientific tasks given below:

- identification of the role and place of the metallurgical industry in the national economy, as well as in socio-economic development;
- determination of the natural and economic conditions for the development of the mining and metallurgical industry at present stage;
- justification of the assessment of the use of mineral ore resources in the development of the metallurgical industry;
- investigation of the opportunities of the metallurgical industry to influence the deepening of inter-regional economic relations of the republic;
- determination of the impact of mineral and mineral resources on the development and specialization of the mining and metallurgical industry;
- assessment of the state of development of the metallurgical industry, which creates the basis for the development of the country's economy;
- study of the application of innovations in the metallurgical industry of Azerbaijan;
- assessment of the ability of the country's metallurgical enterprises to develop independently;
- ölkənin metallurgiya müəssisələrinin müstəqil inkişaf etmə qabiliyyətinin qiymətləndirilməsi;
- preparation of scientifically substantiated proposals and recommendations for improving the optimal development program in terms of stimulating metallurgical enterprises, taking into account the improvement of intra-regional and inter-regional economic relations;
- determination of directions for the development of inter-sectoral cooperation relations in the country's metallurgical industry;

- application and calculation of economic-mathematical methods in metallurgical enterprises;

Research methods. Following research methods have been applied-comparative, systematic and analytical analysis, logical generalization, statistical grouping, graphic methods and economic-mathematical methods of the Eviews-12 application software package.

Main clauses defended.

- An examination of the natural and economic peculiar features of the metallurgical industry in the socio-economic development of Azerbaijan considered as one of the major conditions for the deepening of economic relations between the regions of the state.

- The impact of using ore resources on the development of the metallurgical industry, the application of innovations, and the ability of this sector to develop self-reliantly were assessed.

- Directions for improving intra-regional and inter-regional economic relations to increase the efficiency of the metallurgical industry have been identified.

- The impact of metallurgical enterprises on the added value created in the industry was assessed and, prospective development was shown based on the application of econometric methods.

The scientific novelty of the dissertation research mainly consists in substantiating the importance of the metallurgical industry in the country's economy, defiing the development directions of this sector in modern competitive conditions, and preparing practical recommendations for ensuring sustainable socio-economic development. From the perspective of the detailed substantiation of the indicated innovation, the following conclusions are put forward for defense:

- Justification of the pioneering role and place of the metallurgical industry in the national economy, as well as in socio-economic development is provided;

- The natural and economic conditions for the development of the country's mining and metallurgical industry in the current conditions are shown;

- The development of the metallurgical industry and its specialization were determined in the assessment of the use of mineral ore resources;

- The impact of the metallurgical industry on the deepening of inter-regional economic relations in the country was investigated;

- The current state of the metallurgical industry was analyzed and obstacles that negatively affect its development were identified;

- The importance of using innovations in the republic's metallurgical industry in ensuring the sustainability of this sector has been shown;

-Taking into account environmental protection measures, ways of efficient use of ferrous and non-ferrous metallurgy resources in the country have been identified and the ability of metallurgical enterprises to develop independently has been assessed;

-Proposals and recommendations have been developed to improve the optimal development program for stimulating metallurgical enterprises in terms of improving intra-regional and inter-regional economic relations;

- The directions for the development of inter-sectoral cooperation relations in the metallurgical industry have been determined;

- As a result of the application of economic-mathematical methods, the impact of metallurgical enterprises on the added value created in the industrial sector was calculated.

The theoretical and practical significance of the research consisted of substantiating the important place of the metallurgical industry in the socio-economic development of the country, comprehensively analyzing the current situation in this field, and assessing the impact of metallurgical enterprises on the added value created in the industrial sector through the application of economic and mathematical methods.

The generalizations and practical results made in the research work can be used in teaching such subjects as “Economy of Metallurgy”, “Industrial Economics”, “National Economy”, “Introduction to Economics”, “Business Management”, “Fundamentals of Entrepreneurship”, “Econometrics”.

The practical significance of the work is that its main provisions, practical results and proposals allow accelerating production in the metallurgical industry and raising it to a qualitatively new stage.

The proposals put forward in the presented dissertation work can be used in the preparation of specific economic programs to stimulate the promising development of the metallurgical industry, mainly in the complex use of existing resources to reduce or minimize damage to the environment, improve inter-regional economic relations, etc.

Approbation and implementation of the research results. The author has made reports on the main provisions and results of the dissertation work, as well as the practical proposals put forward here, at numerous scientific and practical conferences held at various levels. The recommendations of the research conducted have been mainly confirmed by discussion at the following scientific and practical conferences and publications:

"XXI Scientific Conference of Professors and Faculty" (Sumgayit 1994); "Scientific Conference of Postgraduate Students of ANAS" (Baku, 1994); "XXII Scientific Conference of Professors and Faculty" (Sumgayit, 1995); "XXIII Scientific Conference of Professors and Faculty" (Sumgayit, 1996); "Socio-economic Problems of Innovation-Oriented Development", ARTN, SDU, ANAS International Scientific Conference (Sumgayit, 2012); "Ecology and Protection of Life", ARTN, SDU, ANAS VII International Scientific Conference (Sumgayit, 2012); "Technical and Economic Problems of High Technologies in Azerbaijan" Republican Scientific Conference (Baku, 2012); "I International Conference of Young Researchers" (Baku, 2013); "X International Scientific Conference" (Sofia, Bulgaria, 2014);

"Problems of regional economy: theory and practice", international scientific and practical conference (Moscow, Russia, 2014);

"Energetikanın müasir elmi-texniki və tətbiqi problemləri", beynəlxalq elmi konfrans (Sumqayıt, 2015); "III Beynəxalq Türk Dünyası Araşdırmaları Simpoziumu", cild 4 (Bakı, 2016); "Global Science Innovation" International Conference (USA, Chikcago,

2016); “İqtisadiyyatın davamlı inkişafı: problemlər, perspektivlər” beynəlxalq elmi konfrans (Sumqayıt, 2016); “Qloballaşan və regional inteqrasiya” respublika elmi konfransı (Mingəçevir, 2016); “Azərbaycanın qeyri-neft sektorunda innovasiya fəaliyyətinin genişləndirilməsi” respublika elmi konfransı (Bakı, 2016);

“Financial aspects of development of the state, regions and business entities: current state and prospects” international scientific and practical conference (Ukraine, Poltava, 2017);

Republican scientific conference “Ways to increase the competitiveness of the economy” (Sumgayit, 2017); International scientific-practical conference “Strategic economic reforms: preventive tax policy” (Baku, 2017); “IV International Symposium on Turkic World Studies” (Turkey, Niğde, 2017); International scientific-practical conference “Economic security: current situation and prospects” (Baku, 2018); International symposium “Heydar Aliyev and the Turkic world” (Turkey, Erzurum, 2018); International scientific-practical conference “Economic growth and social welfare” (Baku, 2019);

"Actual problems of economic security of the state, regions, enterprises" III international scientific and practical conference (Russia, Ufa, 2019); "Actual problems of the economic security of the state, regions, enterprises" IV international scientific and practical conference (Russia, Ufa, 2020);

Republican scientific and practical conference "AR 1991-2021: Restoration of state independence, economic and socio-cultural development" (Sumgayit, 2021);

“Current issues of ensuring economic security of the state, regions, enterprises” IV international scientific and practical conference (Russia, Ufa, 2022).

The results of the research were reflected in 42 published scientific articles and conference materials, 10 of which were published abroad (7.37 c.v.), with a total volume of 15.87 c.v., and in publications recommended by the Higher Attestation Commission.

The thesis was completed at the Institute of Economics of the Ministry of Science and Education of the Republic of Azerbaijan.

Structure and volume of research work. The dissertation consists of an introduction, 3 chapters, 11 paragraphs, conclusions and a list of literature. The dissertation contains 7 figures, 20 tables, 9 graphs, 1 appendix and covers 162 pages. The total number of characters is 308657, including Introduction (10955 characters), Chapter I (74293 characters), Chapter II (121504 characters), Chapter III (56425 characters), Conclusion (22083 characters), and a list of used literature (19675 characters). The volume of the dissertation, excluding tables, figures, diagrams and used literature, is 291708 characters. The bibliographical list covers 165 titles of literature.

STRUCTURE OF THE THESIS

INTRODUCTION

CHAPTER I. THEORETICAL-METHODOLOGICAL BASES OF THE DEVELOPMENT OF THE METALLURGY INDUSTRY

1.1 The importance of the metallurgical industry and its role in socio-economic development

1.2 Natural and economic features of the development of the metallurgical industry at the modern stage

1.3 Theoretical foundations of the assessment of the use of mineral resources

1.4 The impact of the metallurgical industry on the deepening of inter-regional economic relations of the republic

CHAPTER II. ANALYSIS AND ASSESSMENT OF THE DEVELOPMENT STATUS OF THE METALLURGY INDUSTRY IN THE REPUBLIC OF AZERBAIJAN

2.1 The impact of the location of ore resources on the development of the metallurgical industry and its current state analysis

2.2 Introduction of innovations in the metallurgical industry of Azerbaijan

2.3 Efficient use of ferrous and non-ferrous metallurgical resources, taking into account the effectiveness of environmental protection measures

2.4 Assessment of the ability of metallurgical enterprises to develop independently

CHAPTER III. PROSPECTIVE DEVELOPMENT OF THE METALLURGY INDUSTRY AND IMPROVEMENT OF INTERREGIONAL ECONOMIC RELATIONS

THE MAIN CONTENT OF RESEARCH

The “Introduction” part of the dissertation emphasizes the relevance of the topic, the level of development, reflects the object, subject, goals and objectives of the research, research methods, indicates the main provisions put forward for defense and the scientific novelty of the work, provides relevant information in the subheadings called the name of the organization where the dissertation was performed, its structure and volume.

In the first chapter of the dissertation entitled as “Theoretical and methodological foundations of the development of the metallurgical industry”, the importance of the country's metallurgical industry and its role in socio-economic development are substantiated, the natural and economic features of its development in the modern period are emphasized, the theoretical foundations of the assessment of the use of mineral and ore resources are given, and the impact of this field on the deepening of inter-regional economic relations of the republic is shown.

The leading enterprises of ferrous metallurgy in the Republic of Azerbaijan are the Azerbaijan Mining and Ore Refinery Combine (FSK) for the extraction of iron ore and the production of iron concentrate, steel, rolling, steel pipes, peshtah, etc. The Azerboru Smelting Plant, which is producer, is considered the Baku Recycling Metal Enterprise, which in turn engaged in the collection and supply of metallurgical scrap. Despite the limited reserves of iron ore explored in our country, a gradual decrease in raw material reserves is observed as these deposits are exploited.

Indeed, intensive industrial recycling of metals is realized in the republic at the expense of recycled resources in the form of scrap, sawdust, burnt iron, morally and physically obsolete machinery and equipment, and these resources constitute a sustainable raw material base for the metallurgical industry.

Research shows that the development of ferrous metallurgy dates back to the 1950s, when Azerboru and the Azerbaijan Mining and Mining FSK began their work, and in general, Azerbaijan's

share in the total output of ferrous metallurgy in Transcaucasia was over 30%. The structure of the industry is 10-11% iron ore and concentrate, up to 80% steel, rolled products, pipe products of Azerboru, 8% supply of recycled metals, 4% metal products and steel pipes. Dashkesan FSK is engaged in ore extraction, concentrate production from them and ensuring the demand of the Rustavi Metallurgical Plant (RMZ, Georgia) for this commodity raw material.

Azerbaijan, one of the main metal consumers of the former Soviet Union, is metal-intensive with a developing oil machine building, offshore oil production, oil and gas producing, ship repair enterprises, metal processing, urban economy, railway transport. The Republic of Azerbaijan has a number of metallurgical resources, which were mainly developed in the post-war years, including the following:

- Dashkesan iron ore deposits;
- Khachbulag fluorspar limestone;
- Filizchay,

Mehmana semi-metallic ores, the composition of which consists of a substantial amount of ferrous metals.

The particular weight of the balance reserves of iron ores of the Republic of Azerbaijan was 0.26% of the analogous reserves of the former Union, and 85% in Transcaucasia. Namely, in connection with the discovery of significant iron ore reserves in the Abovyan, Razdan, and Svaran deposits in Armenia, the specific weight of Azerbaijan's iron ore reserves in Transcaucasia decreased noticeably. The multicomponent nature of the Dashkesan ore indicates that it consists mainly of magnetic iron ore similar to Magnitogorsk and is distinguished by its high quality. Under favorable technical, economic and geological conditions, the economic indicators of the production and processing capabilities of the Dashkesan LLC are on average close to those of the former Union, and as these deposits are exploited, the iron content in the ore decreases.

The decrease in the ore content in the mines exploited in the northwestern areas complicates the enrichment technology, at the

same time increases the cost of raw materials for concentrate, which has a negative impact on labor productivity. The remaining reserves in the exploited areas can meet the needs of Dashkesan LLC for a long period of time. The main reserves of ores here are located in the South Dashkesan and Demirchi mines. Processing in these areas at the current volumes will meet the needs of the LLC for raw materials for a longer period.

In market relations, the study of the structure of industrial production by types of ownership is of economic importance. For this purpose, it is important to consider the ownership indicators for the metallurgical industry in the Republic of Azerbaijan (see Table 1).

Table 1

Structure of metallurgical production by ownership type (in %)

S.	***Indicators***	***2017***	***2018***	***2019***	***2020***	***2021***
1	By industry, in total	100	100	100	100	100
	including: state property	19,7	17	17,9	21,7	16,6
	non-state property	80,7	83	82,1	78,3	83,4
2	Mining industry	100	100	100	100	100
	including: state property	9,1	6,9	7,8	9,8	3
	non-state property	90,9	93,1	92,2	90,2	97
3	Manufacturing industry	100	100	100	100	100
	including: state property	33,6	33,9	31,3	29,1	32,7
	non-state property	66,4	66,1	68,7	70,9	67,3
4	Metallurgical industry	100	100	100	100	100
	including: state property	0	0	0	0	0
	non-state property	100	100	100	100	100
5	Manufacture of finished al products	100	100	100	100	100
	including: state property	0,2	1,6	0	0	0
	non-state property	99,8	98,4	37,8	50,2	95,3

Source: The table was compiled by the author based on statistical indicators for the relevant years.

A comparison of the indicators shows that the share of state ownership in industrial production in the Republic of Azerbaijan decreased by 3.1% in 2021 compared to 2017. The share of non-state ownership, on the contrary, increased by 2.7% in 2021 compared to 2017. Due to changes in the ownership structure of the extractive industry, in recent years (2017-2021), the share of state ownership decreased by 6.1% and the share of non-state ownership increased by 6.1%. Changes were also observed in the structure by types of ownership in the metallurgical industry. Thus, in 2017-2021, the share of state ownership decreased to almost zero (in 2016, this share was 0.2%), while the share of non-state ownership increased to 100. This create a ground for us to conclude that in recent years, production in the metallurgical industry has been falling under non-state ownership.

The study shows that the most important types of products produced in the country's metallurgical industry are cast iron and steel, seamless steel pipes, clay, aluminum door and window blocks, etc. The most important types of product production in the metallurgical industry are diverse and are reflected in Table 2.

The analysis shows that in the metallurgical industry of our country, mainly steel casting and fittings production types prevail. Ensuring the development of the non-oil sector and national security in the Republic of Azerbaijan will create a basis for further increasing production in the metallurgical industry.

Recently, the production of concentrate at Dashkesan LLC has become indispensable due to the stabilization of ore production and the receipt of agglomerate with an iron content of 59-60% compared to 51% in the blast furnace. Before switching to the new method of wet enrichment, the average ore consumption per 1 t. of concentrate was lower than in the dry separation method, while the increase in raw materials in the extraction of iron from the concentrate due to the wet separation method was greater, which led to an increase in labor productivity by 7.5-8% and an increase in profits.

Table 2

Production of the most important products by type of production activity in the metallurgical industry

№	Indicators	2017	2018	2019	2020	2021
1	Steel casting, thousand tons.	387,3	381,6	325,9	264,5	308,4
2	Steel pipes, thousand tons	45,1	47,8	57,4	49,7	57,6
3	Ferro-alloys, tons	-	-	7005,3	15368,7	13915,4
4	Aluminum pipes, tons	6,7	10,2	81,5	23,0	32,3
5	Aluminum products, tons	51530,4	25461,8	38979,8	53895,8	62766,4
6	Unmanufactured lead, aluminum, zinc, nickel, etc., ton	81311,0	48993,3	40112,4	56237,9	28018,2
7	Copper products, tons	474,6	-	519,7	184,5	418,5
8	Copper wire, tons	457,3	299,5	712,0	965,0	3239,5
9	Reinforcement, thousand tons	251,4	809,1	300,6	223,0	351,5

Source: The table was compiled by the author based on statistical indicators for the relevant years.

The development of the iron ore industry, the improvement of the processing of primary raw materials and secondary resources in the Republic of Azerbaijan directly depends on the implementation of a number of measures, which are as follows:

- Increase in ore production in the perspective of the South Dashkasan, Demirchi deposits;
- future provision of RMZ with Krivoy Rog ore;
- Use of free (empty) labor resources of the city of Dashkasan and its district;
- Rational development of auxiliary resources - fluorspar limestone, bentonite clay;
- Enrichment of waste with full use of accumulated scrap;
- Creation of new enterprises for the production of porous iron and ochre.

The implementation of the above-mentioned measures will allow for the complex usage of Dashkasan ore, enrichment of scrap,

secondary resources and other ferrous metallurgy waste. In terms of the future development of ferrous metallurgy in the country, it is planned to significantly increase ore production in Dashkasan, which, in our opinion, is not considered environmentally expedient.

The second chapter, entitled "Analysis and Assessment of the Development Situation of the Metallurgical Industry in the Republic of Azerbaijan", analyzes the impact of the location of ore resources on the development of the metallurgical industry and its current state, shows the application of innovations in this field, examines the effective use of ferrous and non-ferrous metallurgical resources taking into account the effectiveness of environmental protection measures, and assesses the ability of enterprises operating here to develop independently. When studying the current state of the metallurgical industry, first of all, the activities of organizations that occupy a leading position in this field and can make new contributions to its development should be considered. Studies show that the introduction of innovations in the metallurgical industry these days should begin, first of all, with Azerboru OJSC, which occupies a leading position in this field. The enterprise, operating as an independent joint-stock company, produces pipes and various steel profiles for the oil company, meeting its needs. Investments invested in such enterprises are investments in future generations of the state and the nation and always pay off. From 1989 to the present, the production indicators of the Azerbaijan Pipe Rolling Plant have changed continuously.

The fact that the production of products at “Azerboru” OJSC in 1989 was approximately 590 thousand tons, and last year the production was 16.6 thousand tons clearly shows that compared to the previous period, or rather, compared to 1998, the production volume decreased by 6.013 times (589274: 23000=25.62061). From 1989 to 1999, that is, in 10 years, the production decreased and finally in 1999 the production completely stopped.

Table 3

Pipe production volume of Azerboru OJSC in 1989-2023 (t)

№	*Years*	*Pipe production*	*Years*	*Pipe production*
1	1989	589274	2007	25358
2	1990	492735	2008	5298
3	1991	411311	2009	11620
4	1992	260142	2010	32372
5	1993	146428	2011	98000
6	1994	24906	2012	61773,05
7	1995	9849	2013	60785,2
8	1996	1524	2014	32003,7
9	1997	12775	2015	10054
10	1998	3061	2016	23000
11	1999	0	2017	57000
12	2000	3541	2018	58500
13	2001	2076	2019	5770
14	2002	2517	2020	16600
15	2003	5430	2021	22000
16	2004	83	2022	27000
17	2005	1208	2023	35000
18	2006	14034		

Source: *The table was compiled by the author based on statistical indicators for the relevant years.*

However, the management and staff of the enterprise used 12 million 800 thousand manats of financial resources allocated from the state budget in 2000 to partially restore the production and have been continuing since that time. Last year, the production of "Azerboru" OJSC exceeded 98 thousand tons, which indicates that the current capacity of the metallurgical enterprise is used by about 17%. Unfortunately, it should be noted that the production output in 2013 was 60785.202 tons, which can be calculated as 98.4%

(60785.202·100/61773.05) of the previous year. This indicates a decrease in production by about 2% compared to the previous period. Due to the worsening epidemiological situation in the country, production decreased in 2019, and reconstruction work was carried out at the rolling and rolling plant. This year, dehydrogen ions in the metal will be cleaned by installing a vacuum-degassing unit. During this period, BSC will allow casting 130 diameter ingots and increasing the range of production by 220. Currently, the organization is on the verge of obtaining a US standard certificate. This will allow the sale of pipes to Europe, the Russian Federation and Kazakhstan, as well as to the Middle East.

One of the main raw materials of the industry is recycled ferrous metal. Currently, more than half of all steel and cast iron castings in our country are made from ferrous metal scrap and waste. The maximum use of recycled ferrous metal raw materials ensures significant savings in public labor in the country's economy. Their involvement in economic turnover is much lower than the costs of smelting primary raw materials. Thus, the use of 1 ton of scrap metal creates opportunities to save on average 1800 kg of iron ore, 500 kg of coke, 100 m3 of natural gas, etc. raw materials.

As can be seen from the analysis of the data, although the number of operating metallurgical enterprises has been decreasing in recent years, the volume of work carried out in this industry has been steadily increasing. The report from which the table was prepared shows that the volume of metallurgical products for the 2021 reporting year amounted to 846.8 million manat at current prices. With the exception of silver, there are also growth trends in the production of gold and copper concentrate. Although domestic investments in the production of metal ores increased by 5 (50.1:10) times in 2020, a decrease of 39 (50.-46.2) million manat was recorded in fixed capital investments in 2021 (table 4).

Table 4

Cost of metallurgical product (in actual prices)

Indicators	*2017*	*2018*	*2019*	*2020*	*2021*
Volume of metallurgical industry products, works and services, at current prices, million manats	498,6	624,9	575,9	529,9	846,8
Finished metal products, million manats	262,1	249,1	314,1	391,1	387,5
Finished metal products, million manats	300,3	220,7	245,8	265,2	381,6
Metal ore production: public non-public sector in %	50,2 49,8	39,9 60,1	46,6 53,4	48 52	50,7 49,3
Share of the mining industry in the non-state structure in %	0,4	0,4	0,4	0,7	0,4
Share of metallurgy in the structure of the processing industry in %	1,2	1,3	1,2	1,4	1,5
Gold production kg	3667,1	3475,7	3711,5	3570,8	3351,1
Silver production kg	3428,6	3229,4	3819,7	4310,1	4857,7
Copper concentrate kg	2062,5	1649,8	2212,9	1717,5	2681,7
Steel castings and pipes, thousand tons.	387,3 45,1	381,6 47,8	325,9 57,4	264,5 49,7	308,4 67,6
Armature thousand tons.	251,4	309,1	300,6	223	351,5
Metal structures etc.	112827,5	22686,4	38300,2	53577	33238
Non-insulated stranded wire, cables and similar products etc.	13155	8454,3	5183,4	5839,8	6370,3
Indices of production in industry	91,3	111,4	90,5	119,5	121,6
Index of producer prices in the extraction of metal ores in % compared to the previous year	-	116,6-15	98,8	114,8	111,5
Index of producer prices in the metallurgical industry in % compared to the previous year	132,9-10	92,1-15	102,8	98,2	119,8
Index of producer prices in the extraction of metal ores in % compared to the previous year			10	50,1	46,2
Investment in fixed capital for the production of metal ores in mining %			0,1	0,6	0,6
Domestic investment in the metal industry, mln. m.		4,3	16,1	1,8	0,7
Investment in fixed capital in the metal industry in %		0,1	0,2	-	-
Domestic investment in the production of finished metal products, mln. Manat		83,1	44,5	55,2	3,3
Investment in fixed capital for the production of finished metal products in %		1	0,5	0,6	0,2

BSC, which occupies an important place in the development of the metallurgical industry in our country, has created a modern steelmaking complex with a production capacity of 350,0 thousand tons per year based on scrap metal in a short time. The enterprise is the first modern and high-capacity steelmaking complex built during the period of independence. The enterprise, which started its work in 2001 with the support of the National Leader H. Aliyev, has produced more than 2 million tons of construction reinforcement over the years. The steel products (construction fittings and steel bars) manufactured by the company, in addition to the domestic market, were sold in Georgia, Iran, Kazakhstan, the Russian Federation and other regions and were highly appreciated by builders.

The rapid implementation of projects for the construction of multi-storey buildings, cultural and sports centers, bridges, roads, etc. infrastructure facilities in the capital of the republic, Baku, and its regions has set important tasks for enterprises producing construction materials and construction steel products, such as applying advanced international technologies and bringing product quality to even higher standards. In this regard, major reconstruction works were carried out at the BSC company, bringing the production capacity of the enterprise to 770 thousand tons per year. Taking into account the demand for steel products in the domestic and foreign markets, the product range of the enterprise has been expanded, and in addition to construction fittings, it is planned to produce angles, channels, two-section bars, rods, and wire. The company has built an oxygen plant in Baku and Ganja, and has established points for collecting and processing ferrous scrap in Baku, Ganja, Sumgayit, Mingachevir and other cities and regions. These stations also clean the country's land from rusted ferrous metal scraps and wastes that have accumulated over the years, and the Caspian Sea from scraps and wastes from ships and oil production facilities that have reached the end of their service life, thereby implementing measures to positively affect the ecological improvement of the environment.

In metallurgy, it is possible to assess the normal regulation and advancement capabilities of the economic activities of industry enterprises by the following rule. In accordance with the state development scheme, the economic development of economic entities is associated with direct investments directed to their production funds. In order to assess the normal regulation and development capabilities of economic entities in this area, the parameters of the average annual change in the volume of output of that economic entity ΔY and the average annual changes in investments directed to fixed funds Δİ are used.

The dependence of changes in funds directed to funds in industry enterprises on changes in product output prepared in those organizations is sought in the form of a linear dependence.

$$\Delta \dot{I} = (\alpha 0 + \alpha 1 \Delta Y) \quad (1)$$

In this expression, Δİ-changes in investments directed to fixed funds; ΔY-changes in product production in the economic entity; α1 - coefficient ά acceleration parameter; α0 - indicates that the changes in funds invested in funds on average in 1 year occur due to sources outside of product output.

The significant impact of the increase in the volume of fixed assets in metallurgical enterprises on the volume of production requires taking appropriate measures to increase the volume of investments directed to fixed capital. Thus, the depreciation allowances provided for in production costs should also be spent for their intended purpose and used to restore fixed assets by playing the role of an alternative source of investment directed to fixed capital. In most cases, these are not followed in enterprises.

Thus, the equation $\Delta It^* = -2.2919 - 0.02389\ \Delta Yt\text{-}1$, which we determined by calculating the volume of investments directed to fixed capital in the metallurgical industry and the total product output during 2010÷2022 due to the increase in investments due to the growth of products, proves that the ability of the metallurgical industry in Azerbaijan to have an independent development is extremely weak. In this regard, in order to more effectively utilize the potential of the metallurgical industry under the current conditions, important work should be done to increase the volume

of investments in this field and optimize the economic activities of enterprises in the field.

The third chapter of the dissertation, entitled "Prospective development of the metallurgical industry and improvement of inter-regional economic relations", studies the development of intra-regional and inter-regional economic relations in order to increase the efficiency of the metallurgical industry in the country, shows the improvement of inter-sectoral cooperation relations in this industry, and evaluates the impact of metallurgical enterprises on the added value created in the industrial sector by applying economic-mathematical methods.

The development of intra-regional and inter-regional economic relations is of great importance in increasing the efficiency of the metallurgical industry in the country. The development of the metallurgical industry is inextricably linked with the strengthening of inter-regional economic relations, the equal placement of productive forces, the solution of employment problems of the population and the successful resolution of other issues. Therefore, in the development of the metallurgical industry, importance should be given to the optimal establishment of inter-regional economic relations and, on this basis, to the strengthening of both the intra-regional economy and the effectiveness of inter-regional relations.

The development of intra-regional and inter-regional economic relations in increasing the efficiency of the metallurgical industry mainly takes place between the Dashkesan, Ganja and Absheron regions in the country. The expansion of these economic relations, in turn, will lead to the development of industry in the regions and the production of competitive products, thereby creating the basis for sustainable development. Certain work has been done to develop intra-regional and inter-regional economic relations, ensure the development of industry in the regions of the country, organize competitive product production and ensure its compliance with world standards. The development of a balanced and competitive economy in the regions is directly related to the prospective development of industry. This, in turn, has an impact on ensuring

socio-economic development and the material well-being of the population.

In modern times, the economic essence of added value is one of the fundamental issues that determine the nature of socio-economic relations in society in the context of adequate property relations. The importance of the added value indicator is explained by the fact that this category directly depends on the degree of efficiency of the results of the organization's work. At the same time, since added value is also the main source of formation of the state budget, not only economic entities, but also the state are interested in the increase in added value. In this regard, the assessment of factors affecting the added value created in various areas is of great economic importance. The graph below shows the added value created in the industrial sector and the cost of work and services on the production of products in metallurgical enterprises.

Analytical analyses show that although the added value created in the industrial sector decreased in 2011-2015, it increased in subsequent years and amounted to 35.67 billion manat in 2018. Although the added value decreased in 2019-2021 due to the COVID-19 pandemic, in 2021 this indicator increased in the industrial sector as a whole and amounted to 39.5 billion manat. The income of metallurgical enterprises from work and services developed with the dynamics of the periods corresponding to the change in the added value created in the industrial sector as a whole in 2010-2021. Although the share of the metallurgical sector in the processing industry, which had a share of 28.8% in the total industry in 2021, was 0.3%, the increase in the value of work and services in the metallurgical industry, which plays an important role in the development of other sectors of the economy, has a significant impact on the creation of added value in the industry. In this regard, it is important to assess the impact of the cost of work and services in the metallurgical industry on the added value in the industry.

Based on the data in Chart 1 compiled on the basis of statistical data, it is possible to determine the dependence between the cost of work and services in the metallurgical industry in the Republic of

Azerbaijan and the added value created in the industry for the period covering 2010-2021 using ready-made mathematical software packages, including the Eviews-12 application software package. To determine this dependence, we denote the actual cost of work and services in the metallurgical industry as the cause factor by X, and the added value created in the industry as the result factor by Y, and using the EViews-12 software package, we obtain the following result in accordance with the data in Chart 1.

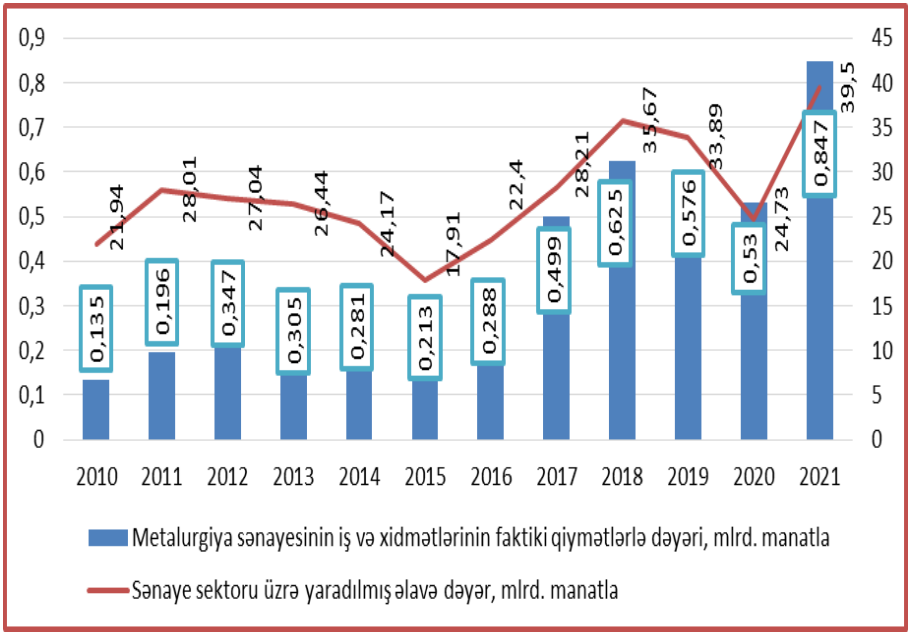

Chart 1. Added value created in the industrial sector in Azerbaijan and the value of works and services in metallurgy at actual prices

Table 5

Result of regression analysis of the relationship between the value of work and services in the metallurgical industry in the Republic of Azerbaijan and the value added generated by the industry

Dependent Variable: Y
Method: Least Squares
Date: 06/30/23 Time: 08:44
Sample: 2010 2021
Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X	24.91853	4.828622	5.160589	0.0004
C	17.43787	2.180494	7.997213	0.0000

R-squared	0.727012	Mean dependent var	27.49250
Adjusted R-squared	0.699713	S.D. dependent var	6.188943
S.E. of regression	3.391443	Akaike info criterion	5.431400
Sum squared resid	115.0188	Schwarz criterion	5.512217
Log likelihood	-30.58840	Hannan-Quinn criter.	5.401478
F-statistic	26.63168	Durbin-Watson stat	1.778147

As can be seen from Table 5, obtained according to the Eviews-12 software package, the coefficients of the causal factor and the effect factor, as well as the free limit, are greater than their standard errors. This characterizes the statistical significance of the coefficient and the free limit of the variable included in the model according to the obtained result. The regression equation according to the Eviews-12 software package will be as follows:

Estimation Command:
==========
LS Y X C

Estimation Equation:
==========
Y = C(1)*X + C(2)

Substituted Coefficients:
==========
Y = 24.9185304259*X + 17.4378729731

$$Y = 24,918x + 17,438,\ R^2 = 0,727$$

According to the regression equation obtained from the Eviews-12 software package, a one-unit increase in the factor X, which expresses the value of work and services in the metallurgical industry at actual prices, increases the result factor Y, which expresses the added value created in the industry, by 24.92 units.

After checking the statistical significance of the established model, it is possible to consider how the explanatory variables included in the model explain the result factor. For this purpose, it is necessary to calculate the elasticity coefficient. If we calculate the elasticity coefficient according to the arithmetic average values of the cause and effect factors for the studied periods in the model Y=24.918x + 17.438 obtained based on the Eviews-12 application software package, we will obtain the following result:

$$E_{met.} = \frac{\alpha \times \bar{x}}{\bar{Y}} = \frac{24,918 \times\ 4,842}{27,4925} = 0,3657$$

Based on the calculated values of the elasticity coefficient, it can be concluded that a 1% increase in the value of work and services in the metallurgical industry in Azerbaijan results in a 0.36% increase in the added value created in the industry.

If we forecast the value of work and services in the metallurgical industry and the added value created in the industry in the Republic of Azerbaijan using the MS Excel program, we will obtain the following results, illustrated in graphs 1 and 2.

As can be seen from graph 1, there is an average correlation between the forecast values of the added value created in the industry in the Republic of Azerbaijan and the time factor, expressed by the regression equation y = 8.8055ln(x) + 12.996 according to the trend model (R^2 = 0.41). According to the graph, according to forecasts, the volume of added value created in industry in Azerbaijan will develop with increasing dynamics until 2030 and will reach 41.2 billion manat in 2030.

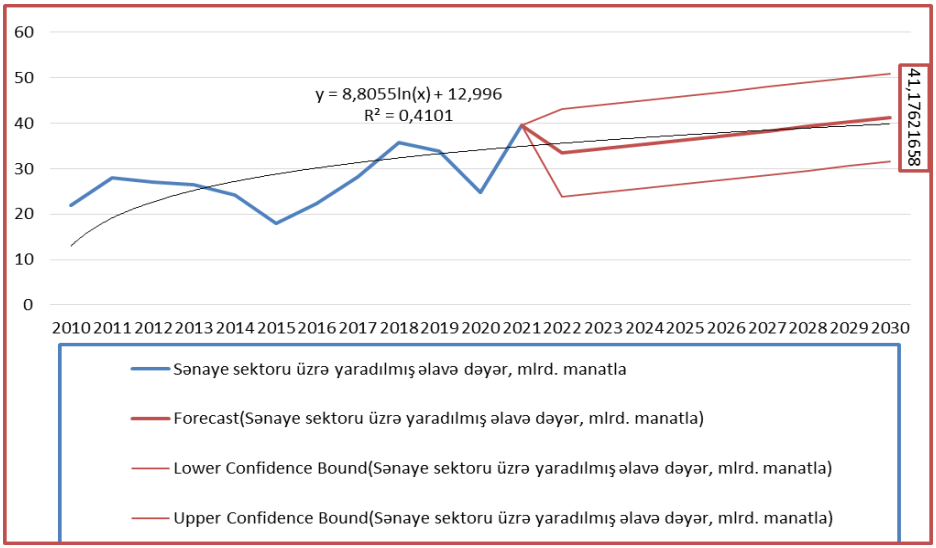

Chart 2. Forecast values of added value created by industry in Azerbaijan until 2030

As a result of the research conducted in the dissertation, the following scientific conclusions and recommendations were made:

1. In modern times, it is imperative to improve the economic mechanism, increase the economic potential of industrial

production, effectively use constructively significant recycled raw materials and involve them in economic turnover. Environmental protection measures in these processes should be implemented by determining the economic and environmental efficiency of the use of recycled raw materials and waste of the industry, and a complex of technical, economic and organizational measures to arm leading areas of production with low-waste and waste-free technological processes.

As a result of the economic analysis conducted in the metallurgical industry of the Republic of Azerbaijan, it was determined that practical work should be carried out in the field of reducing environmental damage in the process of using primary and recycled raw materials, identifying their sources, implementing measures to combat pollution of the natural environment, etc. to optimize the economic system in the production → recycled raw materials → waste → environmental cycle.

2. When forecasting the development of the country's metallurgical industries, it is considered important to regulate the changes taking place in this area, evaluate existing opportunities and study a complex system of indicators that allow studying the production process. This, in turn, necessitates determining the independent development capacity of the studied area and determining the investments directed to fixed assets.

According to the calculations carried out in accordance with the linear dependence of funds invested in funds in the field enterprises on the change in the volume of production here ΔИt = -2.2919-0.02389, ΔYt-1, it was determined that the ability of the considered area to develop freely in the Republic of Azerbaijan is very low. Therefore, investment in the metallurgical industry as a strategic area should be increased and necessary measures should be taken to improve the activities of this area at the expense of various sources.

3. As an economic factor, payment for environmental pollution in the use of primary and secondary raw materials increases the economic interest of mining enterprises in order to ensure the efficient use of secondary raw materials. Payment for the use of raw materials depends on the volume of materials used by mining and

processing enterprises, the result of anthropogenic and technogenic impacts on the environment in production processes.

At the average efficiency level, the resources used in the economy as a whole, especially in the metallurgical, chemical-metallurgical, construction, and mechanical engineering industries, participate in the development of technically oriented production processes in a complex, multi-tiered hierarchical system of directions. Along with primary raw materials, the economic and environmental benefits obtained from secondary raw materials directly depend on how they are used. This process is a criterion that determines the efficiency of the complex use of material resources in the metallurgical, chemical-metallurgical industries.

4. Economic assessment of secondary raw materials for fuel and energy, metallurgy, and construction materials is carried out taking into account the volume of primary raw material production and the total value of products obtained from them.

One of the effective factors in the organization of the metallurgical industry is the improvement of the preparation of charge materials in ferroalloys and electric alloys. The high level of implementation of this work, the preparation of materials from charges, acts as an important means of ensuring an increase in the usefulness of raw materials, their quality, and reduction of industrial waste.

5. Sustainable and balanced development of regions depends primarily on the improvement of inter-regional relations. Thus, the comparison of the level of economic development of regions is mainly based on the use of indicators of income per capita, efficiency of public labor and efficient use of human labor. The last quantity, which indicates the degree of development, is calculated by dividing the number of employed population in the region by the number of people with working capacity. The conducted research showed that metallurgical regions are mainly located in the Absheron-Khizi and Ganja-Dashkasan economic regions. Considering the existing capabilities of these economic regions, it is necessary to expand production (mainly the Ganja-Dashkasan economic region) and directly affect the socio-economic

development of the region as a whole. Thus, the rapid development of the processing metallurgical industries will have a positive impact on the socio-economic development of the Absheron-Khizi and Ganja-Dashkasan economic regions under study.

6. One of the main factors in increasing the production of ferrous and non-ferrous metallurgy is the efficient use of metal slags and slags. However, the main issue that creates a limitation in this process is its economic aspect. This also includes the weakness of the material and technical base for the processing of metallurgical slags, the lack of material and financial resources, the elimination of which is one of the main requirements of the modern era.

In recent years, the reforms carried out in the country's economy have led to structural changes, which have mainly manifested themselves in the extractive industries and have achieved certain development. Currently, as in the whole world, certain difficulties have arisen in Azerbaijan and the competitiveness of the final product has decreased. It is precisely as a result of this that the share of the extractive industry in the gross domestic product has increased and prevailed over the processing industry. The experience of developed countries shows that the increase in the share of extractive industries usually arises from other reasons - an increase in the share of mechanical engineering, and most of the structural changes are mainly determined by 2 types of relations - metallurgy-mechanical engineering and metallurgy-construction materials production.

7. The direct and indirect demand for means of production, including labor objects, created by the construction, mechanical engineering and metallurgy sectors, accounts for 40% of investment flows in developed countries. In this regard, investments directed to metallurgy in our country can also ensure the development of other sectors. In turn, the development of important sectors such as construction and mechanical engineering should form an increasing demand for the metallurgical industry.

8. The long-term state policy should be aimed at stimulating the activity of industry, including metallurgical enterprises, using organizational and technical mechanisms based on the positive

results achieved by developed countries. The acquisition of modern experience should be applied in accordance with the current economic situation of the Republic of Azerbaijan. The practical application of new experience in the metallurgical industry, which is one of the leading sectors of our national economy, should be given importance. From this point of view, in order to achieve the development of the metallurgical industry, it is imperative to prepare a plan of important measures within the framework of interaction with the state and private sectors.

9. The future development of the metallurgical industry in the republic depends on the production of science-intensive and high-tech, competitive and export-oriented industrial products that meet world standards. From this point of view, the state should support the advancement of areas with growth potential, and in order to create a competitive economy in our regions and ensure balanced progress of the country's economy, it is necessary to: reconstruct metallurgical industrial enterprises from a technical and technological point of view and apply modern methods; apply international standards in organizations working in metallurgy, as in all industries; reorganize the industrial structure; determine the attraction of capital investment in the regions; strengthen investment and innovation activities, apply resource-saving, energy-saving, environmentally friendly, low-waste technologies; use labor resources correctly and purposefully to ensure the economic development of individual regions; determine investment sources and increase their profitability; ensure equal development of regions as a result of the efficient use of labor resources; the importance of increasing the development rate and labor productivity of this industry; Strengthening existing scientific, technical and human resources capabilities; stimulating the export of metallurgical industry products, etc. implementation of measures is in line with the goal.

10. The use of recycled raw materials, waste, auxiliary materials is associated with the application of technical progress in industrial production. In the conditions of scientific and technical progress, raw materials, energy coefficients and their consumption

characteristics change, and at the same time, products obtained from both primary and auxiliary materials, in the system of cooperation, economic complex relations of industry, undergo continuous transformation.

The problems of using recycled raw materials are related to the reduction of waste polluting the environment in the cycle of use of primary and secondary raw materials, and measures to protect the ecological environment. This is confirmed by the fact that the involvement of recycled raw materials in the production exchange and their complex use not only provides economic benefits, but also reduces waste thrown into the environment, covering the soil, polluting water, air, and harming human health, and also serves to protect the ecological environment.

11. As a result of the research conducted, it was found that there is a high correlation between the value of work and services in metallurgy in the country and the added value created in the industry (Y = 24,918x+17,438). Based on the diagnostics of the coefficients of added value created in the industry in the country in the area under consideration, the adequacy of the model was checked on the basis of statistical characteristics in the Eviews-12 package based on the confidence ellipse, residual diagnostics of the model on Q-statistics and histogram normality tests.

The value of added value created in the industry in metallurgy in the country by years, standard errors and the characteristics of the model for forecasting were determined to be suitable for forecasting. Thanks to the application of economic-mathematical methods, it was calculated that the added value created in the industry in the coming years, in other words, until 2030, will be 41.2 billion manats.

It was concluded that with a 1% increase in the value of works and services in the sector, the added value created in the industry increased by 0.36%. Therefore, the development of the metallurgical industry should always be in the spotlight.

The main content and scientific provisions of the dissertation are reflected in the following scientific works of the author:

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