UDC 69

Enkhtuvshin I., Ganchimeg J. A comparative study of the Procurement process of Mongolian mining companies

Enkhtuvshin I., Ganchimeg J.
Graduate School of Business
University of Science and Technology
Ulaanbaatar city, Mongolia

Abstact. *Mongolia's mining sector alone accounts for 25 percent of the gross domestic product. In addition, a large amount of investment has been attracted from foreign and domestic organizations and purchases of goods, works and services are being made. This feature of the mining industry is important only when the output of the mine is converted into economic circulation and wealth. In the current conditions of globalization, the role of procurement in the social and economic development of any country tends to increase more and more. Investment and purchase activities aimed at converting the country's budget into efficient use have determined a completely new approach to the social, economic and industrial development of countries. Effectively organizing government procurement to create an optimal economic structure, to increase the efficiency of the use of all types of resources, to improve the productivity of the national economy, to ensure the sustainable social and economic development of the country, and to spend the country's budget efficiently and effectively. Our country has developed and approved legal acts with a special focus on forming the legal basis of the market economy system and procurement. In recent years, foreign trade turnover has been steadily increasing. In particular, the foreign trade deficit is decreasing every year. The total turnover of foreign trade in 2005 was 2241.2 million US dollars. dollars, 6108.6 million US dollars in 2010. dollars, in 2015 it was 8466.8 million US dollars. dollars, 10536.12 million US dollars in 2017. 27.3% or 2261.6 million dollars from the previous period. increased by dollars. Mineral raw materials and textiles accounted for 71.1% of total exports in 2000, while in 2005, mineral raw materials and precious metals accounted for 73.9%. In 2010, these products accounted for 87.1%, and in 2017, they increased by 2.1 points to 89.2%. In 2022, the share of treasure products in exports will be 84.1%. Therefore, it is important to conduct a comparative study and analysis of the purchasing process of major mining enterprises in our country.*

Keywords*: state mining enterprises, procurement, procurement.*

Рецензент: Дудкина Ольга Владимировна, кандидат социологических наук, доцент. Донской государственный технический университет (ДГТУ), г. Ростов-на-Дону, Факультет «Сервис и туризм», кафедра «Сервис, туризм и индустрия гостеприимства»

INTRODUCTION

Since the 1990s, Mongolia has transitioned from a planned economy to a free market. Since then, there have been major changes in the country's society and economy. In this way, the foundations for the formation and development of a completely new socio-economic system based on market relations were laid in Mongolia. Changes and reforms taking place rapidly in the world have affected the social and economic development of countries. Along with this, the role of procurement has become increasingly important.

When the country's budget is transformed into efficient consumption, purchasing activities will determine a completely new approach to social, economic and industrial

development. The competitiveness of countries depends not on the number of people, the size of the territory, or natural resources, but on the effective use of their resources. Procurement began to play a significant role in this.

According to global experience, many countries have developed procurement policies that are suitable for their own characteristics and have achieved results. It plays a decisive role in the social and economic development of developed countries. However, for developing countries, it is one of the main ways to increase the rate of economic growth and overcome the backwardness.

In our country, since 2000, the government has been paying special attention to the formation of the legal basis for procurement and has developed and approved legal acts.

It is becoming very important to study the issue of effective management of purchasing activities, including the purchasing activities of state mining enterprises.

I. THEORETICAL REVIEW

Procurement efficiency has a significant impact on a company's financial performance. Since more than 70% of the cost of manufactured products is purchased goods, materials, and technical resources, small savings obtained in the process of agriculture lead to an increase in total profit and financial stability of the enterprise.

Harrison and Van A. Hoek believe that agriculture is the most "expensive" in the group of operating expenses and has the greatest impact on the efficiency of enterprises. At the same time, the value of purchased products and inventory decreases, which also reduces the amount of capital associated with them. Changes in these two factors - profit growth and inventory reduction - directly affect business profitability [1].

Researcher A.G. Nikolayeva believes that an important factor in effective procurement management is the amount of liabilities that arise when communicating with suppliers and contractors. The existence of this type of debt is an unfavorable factor for enterprises, and if it increases, it can threaten the stability of the entire business [2].

According to the researcher D. L. Volkov, it is important to understand the business sector, because the impact of working capital and its components on profitability will be different and depend on many factors [3].

Research by E. Shueng, H. Xin, M. Porporato, M. Vasab and many other academics has shown that the financial cycle is used to evaluate the effectiveness of working capital management. Effective management of financial cycle components is important to increase business returns [4] [5] [6].

M. Porporato and M. Vasab, analyzing the research conducted on the example of the markets of foreign countries, found that the reduction of the financial cycle can increase the

return. In other words, the smaller the share of working capital in the income, the more efficient the business of the organization is. However, numerous studies have found an inverse and direct relationship between return on assets and inventory turnover time. This is due to the additional resources available in the system. In other words, it is possible to create a necessary safe reserve to prevent the occurrence of unforeseen situations during the supply process, thereby overcoming the situation in a short time with low cost [7].

Researcher R. E. Boyko notes that the inverse relationship between accounts payable and return on assets is also ambiguous, and in some cases it is influenced by factors such as the company's industry, the period of the study, the company's profitability and size, and the level of market competition [8]. .

Researchers K. Lysons and M. Gillingham state that the company places a certain part of the material resources supplied by suppliers in the form of raw materials and semi-finished products in the warehouse. This was considered to constitute the relevant part of working capital. The "dead" time in which inventory is stockpiled increases the length of production and operational cycles. However, the terms of payment of supplies affect the duration of the financial cycle [9].

In addition, the stock of raw materials in the warehouse ensures the continuity of production and reduces the risk of production. As a result, the organization and economic stability of the enterprise is ensured. On the other hand, inventory is the main component of working capital of an enterprise. Its cost, structure and changing trends directly affect the financial stability of the enterprise. In this regard, it is impossible to evaluate the effectiveness of procurement without analyzing the indicators that determine the inventory [10].

I. PART OF THE RESEARCH

It is necessary to analyze the financial and procurement conditions of the major factories and enterprises of our country, such as "Erdenet Udyab" SOE, "Erdenes Tavantolgoi" JSC, "Mongolrostsvetmet" JSC, "Cement Shoi" JSC, and "Baganuur" JSC. said the researcher.

"Erdenet Industry" SOE: In 1972, a feasibility study was approved for the ownership of the copper and molybdenum deposit of "Erdenetyn-Ovoo", and on February 20, 1973, a historic agreement was signed between the Governments of the Republic of Moldova and the USSR regarding the use of the deposit (in its former name). .

"Erdenet" plant (under its former name) was first established with 50:50 ownership in accordance with the agreement between the Governments of the Republic of Moldova and the USSR dated November 22, 1973. It began its operations on December 14, 1978 with the release of its first concentrate. From that time, the history of the Erdenet factory, the largest development in Mongolia in the 20th century, began. The comprehensive construction of

Erdenet City with complete infrastructure followed by mining has become a classic model of a large mining project.

"Erdenet" plant is a joint venture with 51:49 private ownership according to the 1991 agreement between the governments of the two countries. According to the agreement of 2003, working as a limited liability company (LLC), in June 2016, the Russian corporation "Rostech" sold 49 percent of its holdings. In this way, the Government of Mongolia owned 51 percent, and "Mongolian Copper Corporation" LLC owned 49 percent.

On March 21, 2019, the Government of Mongolia issued a resolution and approved the reorganization of "Erdenet Industry" into a state-owned enterprise. The long-term "Sustainable Development Policy" covering production management and management system, operational principles, and development planning was approved by Order No. A/552 dated June 13, 2019 of the General Director of Erdenet Industry. In this context, 25 goals are being proposed within the 5 priority directions: Technology Policy, Technical Policy, Economic and Financial Accounting Policy, Social Policy, and Environmental Policy. The purchase of industrial land is carried out in accordance with relevant laws, legal acts and regulations.Procurement is being done through the Department of Investment and Procurement Policy. Under the authority of the Department are the Department of Procurement of Goods and Materials, the Department of Procurement of Works and Services, the Department of Market Research and Marketing, the Transport Logistics Center, and representative offices in Moscow and Beijing.

As of 2024, there are more than 7,000 employees [11]. **Erdenes Tavantolgoi" JSC:** The project started to be implemented on August 27, 2010, and the mining work was officially started. Accordingly, "Erdenes Tavantolgoi" JSC, which is responsible for exploitation of Tavantolgoi coal deposits, was established on December 23, 2010, according to the decision of the Parliament and the Government. The "Erdenes Tavantolgoi" project is in the main areas of coal mining, product processing, infrastructure and factories construction, water supply system construction, additional exploration and research of deposits, delivery of products to international markets, and stock trading in domestic and international stock markets. is implemented.

The procurement process is carried out in accordance with the "Procedures for the Procurement of Goods, Works and Services" and other relevant laws and regulations. In 2023, it is planned to employ 1120 employees and implement 513 projects with a total budget of 4,070.7 billion MNT and a financing amount of 1,122.9 billion MNT. Out of this, 130 tenders with a budget of 2,738.8 billion MNT were organized and a total of 2,580.9 billion MNT contracts were signed. Total budget saving is 157.0 billion MNT.

As of 2024, there are more than 1120 employees [12].

"Mongolrostsvetmet" SOE: "Mongolrostsvetmet" SOE was founded in 1973 under the name "Mongolrostsvetmet" as a joint Mongolian-Russian joint venture under the name of "Mongolrostsvetmet" in accordance with the agreement between the governments of the Republic of Moldova and the USSR (formerly known as the USSR) and began mining fluoride, precious metals and other minerals on the territory of Mongolia. It was established with the aim of mining enrichment, increasing mineral resources, and increasing the country's export capacity. Now in its 50th year of operation, it is Mongolia's first large foreign-invested enterprise.

The joint venture has been transformed into a limited liability company since 2007 and a state-owned enterprise since 2019. From 1973 to 2016, 51% of the Regulatory Fund of the Department of Industry was owned by Mongolia and 49% by the Russian Federation, and from 2016, it was transferred to 100% state ownership of Mongolia.

As of today, the industrial site is operating as the administration in Ulaanbaatar city, the "Bor-Ondur" mountain concentrator plant located in Bor-Ondur Sum, Khentii Province, and the "Shijir Alt" gold plant located in Zaamar Sum, Central Province. The purchase of industrial land is carried out in accordance with relevant laws, legal acts and regulations. Procurement is done through the Department of Procurement and Supply, which is under the Department of Economic and Trade Policy.

As of 2024, there are more than 1,550 employees [13].

"Cement and Lime" SPC: Khotli Cement and Lime Combine was first established in 1983 with the structure of a cement factory, a lime factory, a mountain extraction plant, a repair and mechanic office, and a thermal plant.

According to the Resolution No. 124 of the Government of Mongolia dated March 23, 2022, "Cement Shohoi" TOHK started operating as a state-owned company.

According to the resolution of the Government of Mongolia dated July 5, 2023, "Cement Shohoi" LLC is to be operated as a part of "Erdenes Mongolia" LLC, and "Erdenes Mongolia" LLC is the executor of the rights of state-owned shareholders of "Cement Shohoi" LLC. has been established.

In 2023, by Government Resolution No. 258, the form of the company was changed to a Limited Liability Company. In this way, the status of SPC was officially transferred to the status of LLC on October 31, 2023.

"Cement Shohoi" LLC produces about 1 million tons per year from open-pit mines of "Khotol-1" and "Khotol-2" limestone deposits, and supplies raw materials to Lime and Stone factories. A stone plant produces a semi-finished product (clinker) and supplies it to a cement plant, while a cement plant produces the final product, grade 32.5, 42.5, and 52.5 cement, and sells it to the market.

The procurement process is carried out in accordance with the relevant laws, legal acts and regulations. Procurement is done through the Procurement Department, which is under the Finance and Economic Department.

As of 2024, there are more than 800 employees [14]. **"Baganuur" JSC:** It was first established in 1978 under the name "Baganuur Coal Mine" with a capacity of 200,000 tons of coal. It is now in its 45th year. In 1995, it became a joint-stock company, and in 2012, it became a subsidiary of "Erdenes Mongolia" LLC. 75% of the shares are owned by "Erdenes Mongolia" LLC, 21.06% by Mongolian Coal Corporation, and 3.94% by other small enterprises. It provides 60% of Mongolia's energy coal. As of April 2024, a total of 1139 employees are working. The annual capacity is 4 million tons of thermal coal. In 2024, 80 projects and tenders for a total of 148.4 billion MNT are planned.

The sales revenue of Baganur JSC increased by 14.7 percent on average in the last 3 years. As of 2023, it is planned to earn a total of 214.6 billion MNT, spend 224.4 billion MNT and incur a loss of 9.8 billion MNT. However, in terms of performance, it earned 212.6 billion MNT and spent 222.1 billion MNT, with a loss of 9.5 billion MNT. The planned loss was 249.0 million MNT, and the loss was reduced by 24.1 billion MNT from the previous year. Baganur JSC announced 69 tenders in 2022, and 29 tenders were successful. In 2023, out of 156 tenders, 124 were successful. In 2023, purchases of MNT 635.0 million were made to support domestic production. In 2023, investments of 49.9 billion MNT were financed with own funds.

The procurement process is carried out in accordance with the relevant laws, legal acts and regulations. Procurement is done through the Department of Trade and Supply, which reports to the Deputy Director of Finance and Investment.

As of 2024, there are more than 1140 employees [15].

Electronic Tender for Procurement:

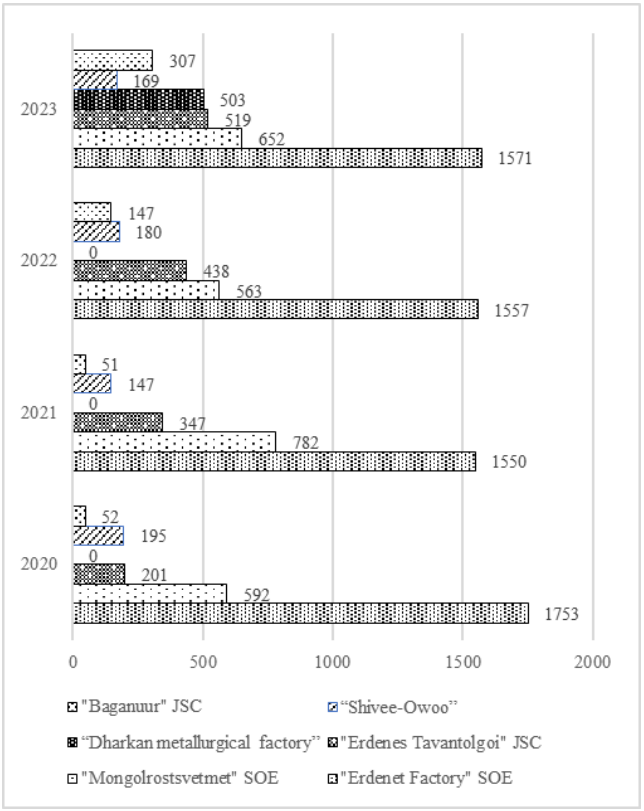
In 2020-2023, the enterprises involved in the research published a total of 12,276 tender invitations through the public procurement system www.tender.gov.mn. This represents 12.1% of the total invitations announced by the electronic system during the above period.

Table 1

Comparative study of tender invitations of some state-owned organizations posted on the public procurement system www.tender.gov.mn

№	Organization name	2020 year	2021 year	2022 year	2023 year	SUM
1.	“Erdenet Factory”	1,753	1,550	1,557	1,571	6,431
2.	"Mongolrostsvetmet"	592	782	563	652	2,589
3.	"Erdenes Tavantolgoi"	201	347	438	519	1,505
4.	“Dharkan metallurgical factory”	-	-	-	503	503
5.	"Shivee-Owoo"	195	147	180	169	691
6.	“Baganuur”	52	51	147	307	557
7.	**Sum**	2,793	2,877	2,885	3,721	12,276
8.	The total number of invitations to tender announced through the electronic system	16,524	21,739	30,559	32,893	101,715
7.	**Percentage of total invitations**	16.9%	13.2%	9.4%	11.3%	12.1%

Source: www.tender.gov.mn electronic system of public procurement, 2020-2023 procurement implementation report of the Ministry of Finance's portfolio managers



Source: www.tender.gov.mn electronic system of public procurement, 2020-2023 procurement implementation report of the Ministry of Finance's portfolio managers

Figure 1: Survey of invitations to tender announced by the surveyed organizations in 2020-2023 through the electronic system of public procurement www.tender.gov.mn

"Erdenet Factory" SOE published 1,753 tender invitations in 2020, 1,550 in 2021, 1,557 in 2022, 1,571 in 2023, and a total of 6,431 tenders in 2020-2023. The number of e-invites published in 2023 decreased by 12% compared to 2020.

"Mongolrostsvetmet" SOE has published 592 tender invitations in 2020, 782 in 2021, 563 in 2022, 652 in 2023, and a total of 2,589 tenders in 2020-2023. The number of e-invites published in 2023 increased by 10% compared to 2020.

"Erdenes Tavantolgoi" JSC published 201 tender invitations in 2020, 347 in 2021, 438 in 2022, 519 in 2023, and a total of 1,505 tenders in 2020-2023. The number of e-invitations published in 2023 increased by 2.6 times compared to 2020.

"Shivee-Ovoo" JSC published 195 tender invitations in 2020, 147 in 2021, 180 in 2022, 169 in 2023, and a total of 691 tenders in 2020-2023. The number of e-invites published in 2023 decreased by 15% compared to 2020.

"Baganuur" JSC published 52 tender invitations in 2020, 51 in 2021, 147 in 2022, 307 in 2023, and a total of 557 tenders in 2020-2023. The number of e-invitations published in 2023 increased 5.9 times compared to 2020.

Evaluation and analysis of the effectiveness of procurement management:

In the works of foreign researchers, the following financial indicators are named that allow to evaluate the effectiveness of the acquisition management of an enterprise [16]. It includes:

1) return on assets (ROA);
2) return on sales (ROS);
3) coefficient of capital capacity (capital intensity);
4) share of working capital in assets;
5) the ratio of inventory costs to sales revenue;
6) ratio of accounts payable to sales revenue.

The main indicators that determine the efficiency of inventory management include the following indicators. It includes:

1) inventory turnover rate;
2) inventory turnover period;
3) inventory capacity;
4) the share of inventory reserves in assets.

The following parameters of selected state-owned mining enterprises and enterprises were calculated and compared by the researcher. It includes:

1. **Return on Assets (ROA):**

$$ROA = (TSA \div C) \cdot 100,$$

Here, ROA – return on assets, %;

TSA – net profit, million MNT;

H C – total assets, million MNT.

2. **Return on Sales (ROS):**

$$ROS=(CA \div BO) \cdot 100,$$

Here, ROS – return on sales, %;

TSA – net profit, million MNT;

BO – sales revenue, million MNT.

3. **Capital intensity ratio: The lower this ratio, the more profitable it is.**

$$K_1 = \text{EBH} \div BO,$$

Here, K_1 – capital intensity coefficient;

EBH – non-current assets, million MNT;

BO – sales revenue, million MNT.

4. **Share of working capital in assets**

$$K_2 = (EH \div \text{HC}) \cdot 100,$$

Here, K_2 – share of working capital in assets;

EH – working capital, million MNT;

HC – total assets, million MNT.

5. **Ratio of inventory costs to sales revenue:**

$$K_3 = (\text{T} \div BO) \cdot 100,$$

Here, K_3 – the ratio of inventory costs to sales revenue, %;

T – payment to the supplier, million MNT;

BO – sales revenue, million MNT.

6. **Ratio of accounts payable to sales revenue:**

$$K_4 = (\text{NTO} \div BO) \cdot 100,$$

Here, K_4 – ratio of accounts payable to sales revenue, %;

NTO – debt to the publisher, million MNT;

BO – sales revenue, million MNT.

7. **Inventory turnover rate:**

$$\text{K}_5 = \text{BBE} \div \text{BM},$$

Here, K_5 – inventory turnover speed, times;

BBE – cost of sold products, million ₮;

BM – average stock of inventory, million MNT.

8. Inventory turnover period:

$$K_6=365\div(BBE\div BM),$$

Here, K_6 – inventory turnover period, days;

BBE – cost of sold products, million ₮;

BM – average stock of inventory, million MNT.

9. Inventory capacity:

$$K_7=BM\div BO,$$

Here, K_7 – inventory capacity;

BM – average stock of inventory, million MNT;

BO – sales revenue, million MNT.

10. Share of inventory in assets:

$$K_8 = (BM \div HC) \cdot 100,$$

Here, K_8 – % share of inventory stock in assets;

BM – stock of inventory, million MNT;

HC – total assets, million MNT.

Table 2

Survey of financial indicators to evaluate the effectiveness of procurement management in the surveyed organizations

№	Indicator	Revenue, billion ₮	Return on Assets (ROA)	Return on Sales (ROS)
1.	“Erdenet Factory”	1,683.2	14.2%	22.2%
2.	"Erdenes Tavantolgoi"	1,578.8	4.2%	23.9%
3.	"Mongolrostsvetmet"	98.0	23.0%	20.9%
4.	“Baganuur”	20.2	0.3%	2.3%
5.	Cement lime	20.0	4.2%	14.1%
6.	Average value	680.0	9.2%	16.7%
7.	Minimum value	20.0	0.3%	2.3%
8.	Maximum value	1,683.2	23.0%	23.9%

Source: Researcher's processing from the data source of the financial statements of the enterprises in the mining sector for 2020-2023 in the Glass account (including: "Erdenes Oyu Tologi" LLC 2021-2022 average, "Dharkhani Metallurgyi Udyy" SPC 2021-2022 average , "Cement Lime" SPC are calculated according to the indicators of 2022 respectively).

Table 3

Survey of financial indicators to evaluate the effectiveness of procurement management in the surveyed organizations

№	Indicator	K_1	K_2	K_3	K_4
1.	“Erdenet Factory”	1.52	24.9%	9.4%	3.2%
2.	"Erdenes Tavantolgoi"	7.29	90.4%	34.6%	12.0%
3.	"Mongolrostsvetmet"	0.76	89.1%	15.7%	15.1%
4.	“Baganuur”	1.32	64.2%	23.7%	37.6%
5.	Cement lime	2.89	48.4%	27.5%	3.7%
6.	Average value	2.76	63.4%	22.2%	14.3%
7.	Minimum value	0.76	24.9%	9.4%	3.2%
8.	Maximum value	7.29	90.4%	34.6%	37.6%

№	Indicator	K_5	K_6	K_7	K_8
1.	“Erdenet Factory”	2.87	128.95	8.5%	13.8%
2.	"Erdenes Tavantolgoi"	3.81	137.16	1.4%	11.3%
3.	"Mongolrostsvetmet"	1.46	393.7	29.3%	51.0%
4.	“Baganuur”	3.43	137.51	12.0%	21.9%
5.	Cement lime	3.19	114.53	7.0%	23.8%
6.	Average value	3	182.4	11.6%	24.4%
7.	Minimum value	1.5	114.5	1.4%	11.3%
8.	Maximum value	3.8	393.7	29.3%	51.0%

Source: Researcher's processing from the data source of the financial statements of the enterprises in the mining sector for 2020-2023 in the Glass account (including: "Erdenes Oyu Tologi" LLC 2021-2022 average, "Dharkhani Metallurgyi Udyy" SPC 2021-2022 average , "Cement Lime" SPC are calculated according to the indicators of 2022 respectively).

The average return on assets (ROA) value is 9.2%, the minimum value is 0.3%, and the maximum value is 23.0%.

High-income organizations include organizations with a return on capital of more than 20%, medium-income organizations with a return on assets of 5%-20%, and low-efficiency organizations with less than 5% [17]. "Mongolrostsvetmet" LLC belongs to the high-income group, "Erdenet Udyb" SOE belongs to the middle-income group, and "Erdenes Tavantolgoi" JSC, "Cement Shhoy" LLC, and "Baganuur" LLC belong to the low-income group.

Return on sales (ROS) determines the income earned by the organization from the sale of goods and represents the effectiveness of the business operations of the enterprise [18].

For the surveyed enterprises, the average value of return on sales is 16.7%, the minimum value is 2.3%, and the maximum value is 23.9%.

"Erdenes Tavantolgoi" JSC, "Erdenet Udyab" SOE, "Mongolrostsvetmet" LLC are among those with a high return on sales, "Cement Shoi" JSC has an average return, and "Baganuur" JSC has a low return.

Capital capacity indicator (K_1) is an indicator that shows how much capital is used to earn one MNT profit. For the surveyed enterprises, the average value of capital capacity is 2.76, the minimum value is 0.76, and the maximum value is 7.29. In 2019-2022, "Mongolrostsvetmet" LLC earns 0.76 MNT, "Baganuur" LLC earns 1.32 MNT, "Erdenet Udyab" LLC earns 1.52 MNT, "Cement Lime" LLC earns 2.89 MNT, "Erdenes Tavantolgoi" LLC earns 7.29 MNT funds have been spent respectively. As mentioned earlier, an important component of increasing the profitability of enterprises is the reduction of production costs, and this can be done by reducing production logistics costs in the context of material production, including mining enterprises.

The share of working capital in assets (K_2) has an average value of 63.4%, a minimum value of 24.9%, and a maximum value of 90.4%. A high ratio of working capital to assets is often considered a positive sign. It shows that the object of labor prevails over the means of labor in the property of the enterprise.

It should be remembered that an increase in the share of working capital is a normal phenomenon of enterprise activity. This is influenced by the following factors:

• accumulation of depreciation of non-current assets, which leads to a decrease in the value of non-current assets and a corresponding increase in the price of current assets;

• the formation of profits, which leads to an increase in the value of working capital, capital and reserves (losses reduce the value of these parts of the balance sheet).The cost and share of working capital may increase in connection with the withdrawal of loans and credits.

So, the lowest share of working capital in assets is "Erdenet Industry" SOE, "Cement Shoi" SOE and "Baganuur" SOE are in the middle, and "Mongolrostsvetmet" LLC and "Erdenes Tavantolgoi" SOE are the highest.

The ratio of inventory costs to sales revenue (K_3) is 22.2% on average, with a minimum of 9.4% and a maximum of 34.6%.

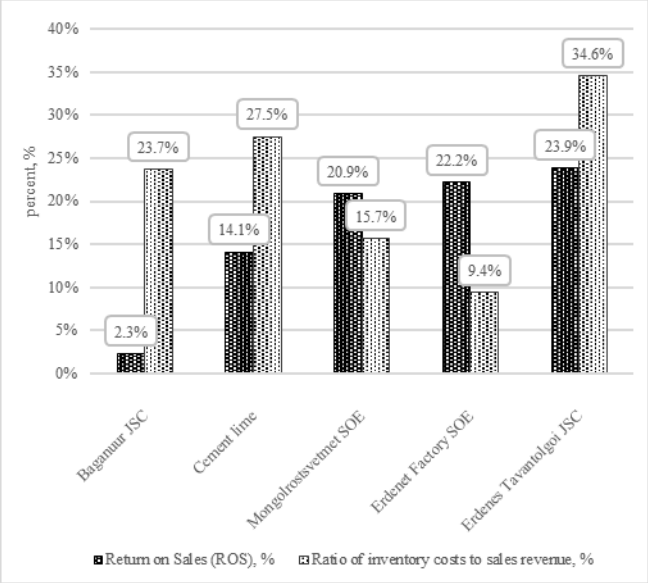
The organization of relations with suppliers occupies a special place in the activities of any enterprise. Timely payment for delivered products is an indisputable condition for concluding any contract or transaction. In some cases, accounts payable can be a source of financing for an enterprise, allowing suppliers to invest unpaid funds in their operations. However, if suppliers make late payments, there may be additional costs associated with late payment of contractual obligations, the company's reputation with potential partners may be damaged, and problems may arise in the future.

- **The average value of the ratio of accounts payable to sales revenue (K_4)** for the surveyed enterprises is 14.3%, the minimum value is 3.2%, and the maximum value is 37.6%.

- **When calculating the indicators of enterprise inventory management: The average value of inventory turnover (K_5)** is 3.0 times, the minimum value is 1.5 times, the maximum value is 3.8 times,
- **The average value of inventory turnover time (K_6)** is 182.4 days, the minimum value is 114.5 days, and the maximum value is 393.7 days.
- **The average value of inventory capacity (K_7)** is 24.4%, the minimum value is 11.3%, and the maximum value is 51.0%.
- **The average value of the share of inventory resources (K_8)** in assets is 11.6%, the minimum value is 1.4%, and the maximum value is 29.3%.

As can be seen from the above indicators, inventory management is efficiently implemented by "Erdenes Tavantolgoi" JSC and "Erdenet Industry" SOE among the enterprises involved in the research. In 2021-2022, "Mongolrostsvetmet" LLC doubled exploration costs compared to the previous year, and increased capital investment by an average of 42 times (including: open-pit mining machines and mechanisms (excavators, dump trucks, and bulldozers).

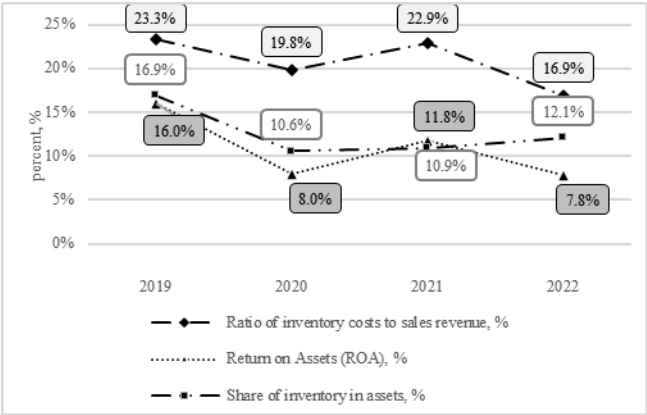
Research shows that increasing inventory capacity significantly reduces return on assets.



Source: Researcher's processing.

Figure 2: Correlation of some indicators for evaluating the effectiveness of procurement management in the surveyed organizations (by company)

According to the results of the research, the return on capital will be the highest in 2019, and the lowest in 2022 at 7.8%. The best asset returns were in 2019 (the year before the global Covid-19 pandemic). The worst year for asset returns was 2022, driven by the global Covid-19 pandemic, rising commodity and inventory prices, and currency appreciation.



Source: Researcher's processing.

Figure 3: Correlations of some indicators for evaluating the effectiveness of procurement management in the surveyed organizations (by year)

In the years covered by the study, the share of inventory in reserve assets varied from 10.6 to 16.9%. In general, increasing inventory capacity is not beneficial.

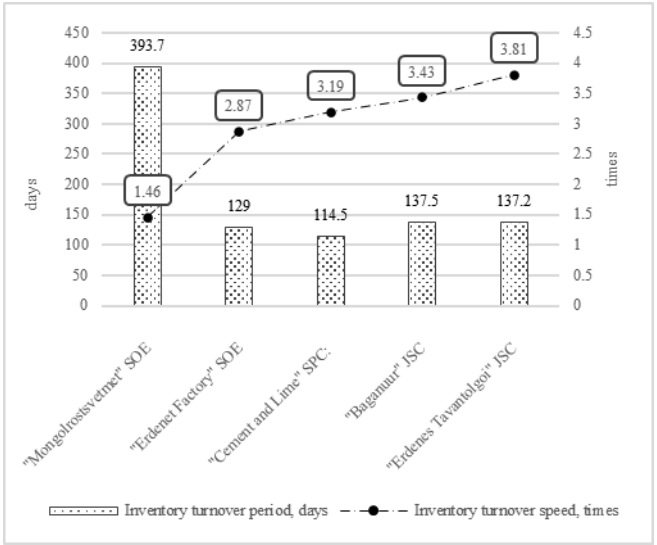


Figure 4: Correlation of some indicators for evaluating the effectiveness of procurement management in the surveyed organizations (by company)

The study showed that the efficiency of enterprises depends on internal (effectiveness of purchasing management, including management and management of purchased inventory) and external environment (changes in prices of raw materials and finished products).

The results of the study clearly show the importance of regularly evaluating the effectiveness of the organization's procurement. Currently, there is no unified method for evaluating the results of procurement of mining enterprises. Separate analysis of individual indicators is often based on the conflict of interests of a particular structural unit and makes it impossible to make a comprehensive assessment and, as a result, correctly set future goals. In such a situation, it becomes important to develop and implement a methodology for evaluating the procurement activities of mining enterprises.

Return on assets indicators are the most important indicators of the organization's performance. In order to make optimal decisions to improve operational efficiency, these indicators should be considered not only statically, but also over time. Changes in these indicators show the results of internal management of the organization. One of the main ways to increase profitability is to increase profits by reducing the cost of purchasing the necessary resources for the enterprise. Inventory costs, on the other hand, depend largely on the efficiency of inventory management, which in turn affects the amount of assets. Regular monitoring of the above indicators and comparison with industry averages is an integral part of effective management.

Mathematical model for optimization of purchasing sustainability:

Based on the quadratic programming model to ensure the operational stability of the researched organizations with purchasing parameters, the optimal management decision-making model can be modeled in the following stages.

1st stage. In the first step, the boundary condition variables of the objective function are selected. It includes:

K_2 – share of working capital in assets;

K_3 – the ratio of inventory costs to sales revenue, %;

K_7 – inventory capacity;

K_8 – selected variables such as share of inventory stock in assets, %.

2nd stage. Determine the criteria for the optimization model. For this, the objective function is represented by the selected variables and its maximum or minimum value is found.

3rd stage. Constraint conditions or a system of policy constraints are established to establish the relationship between factors [19].

A necessary condition for determining the principle of rationality of planning and management is flexibility, or conditions of production and economic alternatives.

The essence of the model for optimizing the sustainability of procurement is to choose such planning and management decisions that best take into account the external conditions, using the internal possibilities of the production activity of enterprises. Therefore, the practical implementation of the principle of optimality of planning and management decisions means finding the solution of a function of the following form:

$$max\ (min)\ f(\bar{\bar{X}}) \qquad (3.1)$$

$$\bar{X}\ \in D$$

Here, $f(\bar{\bar{X}})$- is the objective function of optimization:

$$f(\bar{\bar{X}}) = f(x_1, x_2, \dots, x_n) \qquad (3.2)$$

The conditions of limitation are:

$$\begin{cases} \varphi_1(x_1, x_2, \dots, x_n)\{\leq = \geq\} b_1 \\ \varphi_2(x_1, x_2, \dots, x_n)\{\leq = \geq\} b_2 \\ \dots\dots\dots\dots\dots\dots\dots \\ \varphi_m(x_1, x_2, \dots, x_n)\{\leq = \geq\} b_m \\ x_j \geq 0, j = 1,2, \dots, n \end{cases} \qquad (3.3)$$

Is.

Stone-Jerry customer satisfaction, which is an example of a neoclassical utility function, is represented by the following function [20] [21] [22]:

$$U(x) = \prod_{j=1}^{l} (x_j - a_j)^{\alpha j}$$

A particular case of Stone-Jery customer satisfaction is the Cobb-Douglas production function [23]:

$$U(x) = \prod_{j=1}^{l} {x_j}^{\alpha j}$$

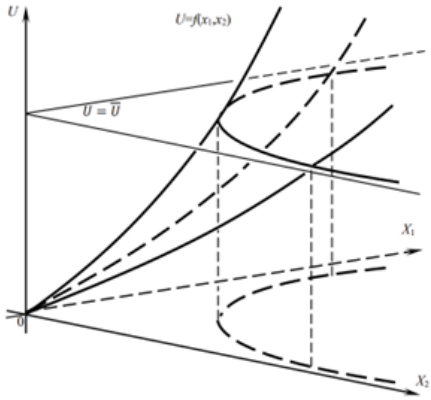


Figure 5: Neoclassical utility function

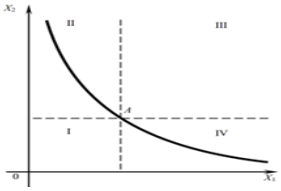


Figure 6: Indifference curve

Then, according to the Stone-Jerry satisfaction function, the sustainability objective function is defined as follows: $Z = \sum_{i=1}^{n}(x_i - c_i)^2 \rightarrow max(min)$ (3.4)

$$a_i < c_i < b_i \quad (3.5)$$

$$x_i \geq 0, i = 1, \dots, n$$

$$a_i \leq x_i \leq b_i, i = 1, \dots, n$$

Here, $x_i \geq 0, i=1,\dots,n$ – research factors,

c_i – weighted average value of factor number i,

a_i – minimum value of factor number i,

b_i – maximum value of factor number i.

In our case, the influencing factors or variables are:

x_1 – share of working capital in assets;

x_2 – the ratio of inventory costs to sales revenue;

x_3 – inventory capacity;

x_4 – is the share of inventory stock in assets.

Table 4

Survey of financial indicators to evaluate the effectiveness of procurement management in the surveyed organizations

№	Indicator	x_1	x_2	x_3	x_4
1.	“Erdenet Factory”	24.9%	9.4%	8.5%	13.8%
2.	"Erdenes Tavantolgoi"	90.4%	34.6%	1.4%	11.3%
3.	"Mongolrostsvetmet"	89.1%	15.7%	29.3%	51.0%
4.	“Baganuur”	64.2%	23.7%	12.0%	21.9%
5.	Cement lime	48.4%	27.5%	7.0%	23.8%
6.	Average value	63.4%	22.2%	11.6%	24.4%
7.	Minimum value	24.9%	9.4%	1.4%	11.3%
8.	Maximum value	90.4%	34.6%	29.3%	51.0%

Then the mathematical model of the optimization will take the following form:

$$Z = (x_1 - 0.63)^2 + (x_2 - 0.22)^2 + (x_3 - 0.12)^2 + (x_4 - 0.24)^2 \rightarrow max, \quad (3.6)$$

The limiting conditions are:

$$0.25 \leq x_1 \leq 0.90 \quad (3.7)$$
$$0.09 \leq x_2 \leq 0.35$$
$$0.01 \leq x_3 \leq 0.29$$
$$0.11 \leq x_4 \leq 0.51$$

Example of thinking: In order to simplify the process of finding the solution of the objective function, the following method can be used. For example, the length of the interval for each indicator or variable can be determined, and all data can be normalized so that the length of each interval is equal to one [24].

To find the solution of the objective function, the variables are normalized and the expression in the function bracket (3.4) can be replaced by:

$$(3.9) \quad \Rightarrow \frac{x_i - c_i}{b_i - a_i}$$

Table 5

Examples of solutions to nonlinear quadratic programming problems

Indicator	x_{min}	x_{max}	$\bar{x}$
	a_i	b_i	c_i
x_1	0.25	0.90	0.63
x_2	0.09	0.35	0.22
x_3	0.01	0.29	0.12
x_4	0.11	0.51	0.24

Indicator	Data normalization			
	$z_i = b_i - c_i$	$v_i = b_i - a_i$	$z_i = \frac{b_i - a_i}{v_i}$	$z_i^2 = (\frac{b_i - a_i}{v_i})^2$
x_1	0.27	0.65	0.42	0.17
x_2	0.13	0.26	0.50	0.25
x_3	0.17	0.28	0.61	0.37
x_4	0.27	0.40	0.68	0.46
Нийлбэр				1.25

$$\left.\begin{array}{l} Z_1^* = 0.42 \\ Z_2^* = 0.50 \\ Z_3^* = 0.61 \\ Z_4^* = 0.68 \end{array}\right\}$$ then Z_max=1.25

The thought can be used for easy and quick orientation when needed, but it should be noted that this thought solution is only one case.

Solution of the problem: The solution of the problem was found as follows using the Matlab program. It includes:

$$x_1 = 0.25, x_2 = 0.35, x_3 = 0.29, x_4 = 0.51$$

$$Z_{max} = 2.631$$

Results: The variable with the lowest value in the mathematical model has the greatest effect. Then, the most influential factor is x_1 (the share of working capital in assets), the second is x_3 (inventory capacity), the third is x_2 (the ratio of inventory costs to sales revenue), and the fourth is x_4 (inventory capacity in assets). share of resources) is entering.

The optimization model developed based on the practical activities of mining enterprises will provide an opportunity to ensure the stability of mining enterprises through the organization of purchasing activities.

Correlation-Regression Analysis:

Correlation-regression analysis can be used to determine the influence and change patterns between factors, and with its help, a mathematical model can be created in the form of a regression equation.The main purpose of correlation analysis is to determine the strength and form of correlation between the studied variables.

Regression analysis is used to determine the form of relationship between variables or to detect their relationship, to evaluate this relationship, and to evaluate unknown values of related variables.

Correlation-Regression analysis was performed using Stata 9.0 software [25], [26].

Correlation analysis shows:

- return on sales (ROS) and return on assets (ROA) are strongly correlated;

- the ratio of inventory costs to sales revenue K_3 and the share of working capital in assets K_2 are directly and strongly correlated;бараа материалын багтаамж (inventory capacity)
- K_7 and the share of working capital in assets K_2 have a strong direct correlation;
- the share of inventory in assets K_8 and return on assets (ROA) have a strong direct relationship;
- There is a strong direct relationship between the share of inventory in assets K_8 and inventory capacity K_7.

As a result of comparing the correlations between the variables, no pairs of measures were found with correlations higher than 0.9.

Table 6

Correlation coefficient

Indicator	*ROA*	*ROS*	K_2	K_3	K_7	K_8
ROA	1.0000					
ROS	0.5835	1.0000				
K_2	-0.4142	-0.4315	1.0000			
K_3	-0.4172	-0.1474	0.5014	1.0000		
K_7	-0.2059	-0.4762	0.7332	-0.1050	1.0000	
K_8	0.5522	-0.1277	0.2092	-0.3597	0.6223	1.0000

Table 7

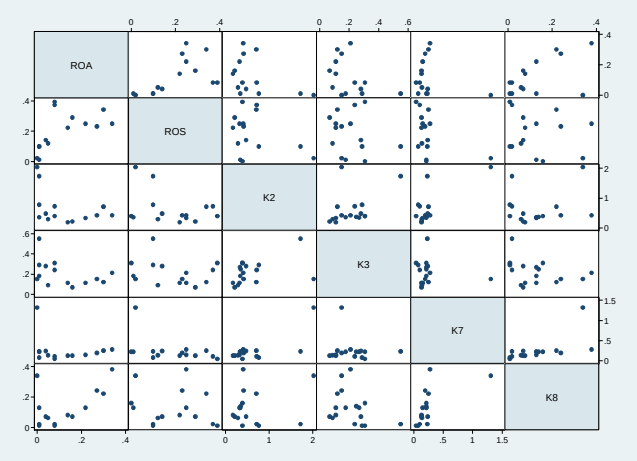
Pearson's correlation coefficient

№	Interval	Note
1.	0.75 – 1.00	very strongly related directly
2.	0.50 – 0.74	strongly correlated directly
3.	0.25 – 0.49	is directly weakly related
4.	0.00 – 0.24	very weak direct correlation
5.	(-0.24) -0.00	the inverse is very weakly related
6.	(-0.49) –(-0.25)	inversely weakly correlated
7.	(-0.74) –(-0.50)	inversely strongly correlated
8.	(-1.00) –(-0.75)	very strongly inversely related

Table 8

Correlation strength

Y3-T	*ROA*	*ROS*	K_2	K_3	K_7	K_8
ROA						
ROS	immediately strong					
K_2	reverse weak	reverse weak				
K_3	reverse weak	reverse very weak	immediately strong			
K_7	reverse very weak	reverse weak	immediately strong	reverse very weak		
K_8	immediately strong	reverse very weak	very weak directly	reverse weak	immediately strong	



Picture 7. Graphic matrix

Regression analysis: Let's develop a regression model of financial and procurement management factors of the surveyed enterprises. Select Y_1-return on assets (ROA) and Y_2-return on sales (ROS) as function indicators.

Table 9

Survey of financial indicators to evaluate the effectiveness of procurement management in the surveyed organizations

№	Indicator	Year	Return on assets (ROA) Y^1	Return on Sales (ROS) Y_2
1.	“Erdenet Factory”	2019	22.3%	25.3%
2.		2020	4.8%	12.1%
3.		2021	15.6%	29.1%
4.		2022	14.2%	22.4%
5.	“Erdenes Tavan Tolgoi”	2019	7.7%	38.9%
6.		2020	1.1%	9.6%
7.		2021	0.7%	9.8%
8.		2022	7.5%	37.3%
9.	"Mongolros-tsvetmet"	2019	34.1%	24.9%
10.		2020	27.1%	23.0%
11.		2021	30.2%	34.1%
12.		2022	0.4%	1.5%
13.	"Cement Lime"	2022	4.2%	14.1%
14.	“Baganuur”	2019	0.0%	0.1%
15.		2020	-0.8%	-1.4%
16.		2021	0.6%	1.0%
17.		2022	-0.1%	-0.1%

№	Indicator	Он	K_2, %	K_3, %	K_7, %	K_8, %
1.	“Erdenet Factory”	2019	32.7%	10.5%	14.8%	13.0%
2.		2020	28.6%	8.9%	14.0%	5.5%
3.		2021	20.6%	7.1%	13.4%	7.2%
4.		2022	17.6%	10.9%	13.0%	8.2%
5.	“Erdenes Tavan Tolgoi”	2019	39.1%	30.9%	4.0%	0.8%
6.		2020	77.4%	28.6%	8.4%	0.9%
7.		2021	172.9%	54.6%	23.4%	1.7%
8.		2022	72.3%	24.3%	11.3%	2.3%
9.	"Mongolros-tsvetmet"	2019	41.4%	20.7%	27.5%	37.6%
10.		2020	41.5%	14.8%	19.9%	23.5%
11.		2021	70.8%	12.1%	25.1%	22.3%
12.		2022	202.6%	15.0%	131.4%	33.8%
13.	"Cement Lime"	2022	48.4%	27.5%	23.8%	7.0%
14.	“Baganuur”	2019	39.3%	30.9%	22.0%	16.3%
15.		2020	33.6%	26.7%	22.0%	12.5%
16.		2021	34.5%	17.8%	21.6%	12.5%
17.		2022	35.7%	24.9%	21.9%	13.5%

Regression equation:

$$Y_1(ROA) = 0.12 + 0.13K_2 - 0.44K_3 - 0.53K_7 + 1.09K_8 \qquad (R^2 = 0.86)$$

(3.7)

$$Y_2(ROS) = 0.31 + 0.19K_2 - 0.66K_3 - 0.53K_7 + 0.27K_8 \qquad (R^2 = 0.35)$$

(3.8)

Here, Y_1 – return on assets (ROA), percent;

Y_2 – return on sales (ROS), percent;

K_2 – share of working capital in assets;

K_3 – the ratio of inventory costs to sales revenue, %;

K_7 – inventory capacity;

K_8 – share of inventory stock in assets, %.

```
Perpecc 1 (ROA,k2,k3,k7,k8):
      Source |       SS       df       MS              Number of obs =      14
-------------+------------------------------           F(  4,     9) =   13.57
       Model |  .154771907     4  .038692977           Prob > F      =  0.0008
    Residual |  .025663816     9  .002851535           R-squared     =  0.8578
-------------+------------------------------           Adj R-squared =  0.7946
       Total |  .180435723    13  .013879671           Root MSE      =   .0534

------------------------------------------------------------------------------
         roa |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          k2 |   .1337409    .078924     1.69   0.124    -.0447976    .3122793
          k3 |  -.4431212   .2277088    -1.95   0.084    -.9582344     .071992
          k7 |  -.5374961   .1379535    -3.90   0.004    -.8495686   -.2254236
          k8 |   1.095625   .1748723     6.27   0.000     .7000361    1.491213
       _cons |    .121956   .0399113     3.06   0.014     .0316704    .2122415
------------------------------------------------------------------------------
```

Picture 8. Regression $Y_1(ROA)$

```
Perpecc 2 (ROS,k2,k3,k7,k8):
      Source |       SS       df       MS              Number of obs =      15
-------------+------------------------------           F(  4,    10) =    1.36
       Model |  .083108439     4   .02077711           Prob > F      =  0.3139
    Residual |   .15246489    10  .015246489           R-squared     =  0.3528
-------------+------------------------------           Adj R-squared =  0.0939
       Total |  .235573329    14  .016826666           Root MSE      =  .12348

------------------------------------------------------------------------------
         ros |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          k2 |    .191608   .1566903     1.22   0.249    -.1575198    .5407358
          k3 |  -.6636841   .4374717    -1.52   0.160    -1.638432    .3110637
          k7 |  -.5282484   .2910068    -1.82   0.100    -1.176652    .1201551
          k8 |   .2657579   .4043033     0.66   0.526     -.635086    1.166602
       _cons |   .3057095    .088491     3.45   0.006     .1085393    .5028798
------------------------------------------------------------------------------
```

Picture. Regression $Y_2(ROS)$

It can be seen from the regression equation (3.8):

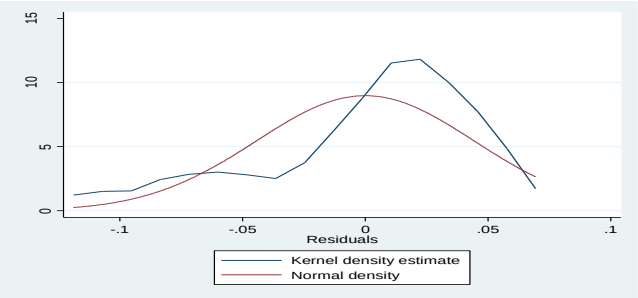
• Return on assets increases by 0.13 points when the share of working capital in assets increases by one unit, the ratio of inventory costs to sales revenue decreases by 0.44 points when the ratio of inventory costs increases by one point, decreases by 0.53 points when the share of inventory capacity increases by one point, and by 1.09 points when the share of inventory reserves in assets increases by one point. is going to grow.

• The coefficient of determination of the regression equation is 0.86, or 83% of reality is explained.

• The share of working capital in assets and the share of inventory reserves in assets have a direct positive effect on return on assets.

• However, the ratio of inventory costs to sales revenue and inventory capacity have a negative impact on return on assets.

• The kernel density function distribution is shown below.



• The Shapiro-Wilk test result is 0.05866, which means that the significance level is greater than 0.05, thus confirming the hypothesis of normal distribution.

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
r	14	0.88029	2.216	1.566	0.05866

The calculated value of W criterion W_T=0.88029 meets the condition that the table value W_x=0.851 is greater.

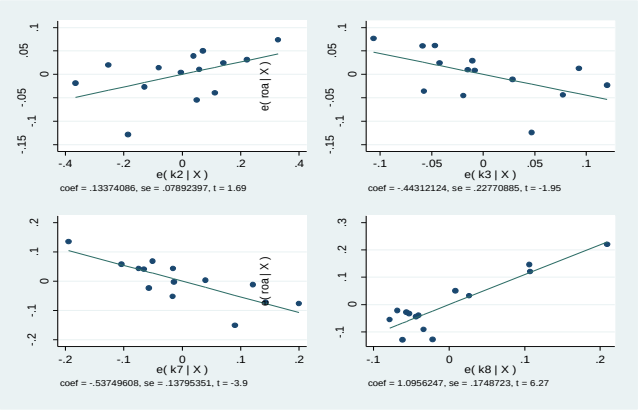
• According to the Breusch-Pagan test, the model is not heteroskedastic (0.6628>0.05).

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of roa

         chi2(1)      =     0.19
         Prob > chi2  =   0.6628
```

• When testing for multicollinearity, the variance inflation factor is 5.79, which is less than 10, so the regression variables are linear combinations of other variables.

Variable	VIF	1/VIF
k2	8.82	0.113404
k7	8.49	0.117805
k3	3.77	0.264979
k8	2.08	0.479950
Mean VIF	5.79	



• Criteria for checking whether the model is correctly defined hatsq P>|t| is 0.564 or the significance level is greater than 0.05, so the selected variables are optimal.

Source	SS	df	MS	Number of obs =	14
Model	.155570828	2	.077785414	F(2, 11) =	34.41
Residual	.024864895	11	.002260445	Prob > F =	0.0000
Total	.180435723	13	.013879671	R-squared =	0.8622
				Adj R-squared =	0.8371
				Root MSE =	.04754

roa	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	.7747815	.3976434	1.95	0.077	-.1004258	1.649989
_hatsq	.6981161	1.174283	0.59	0.564	-1.886463	3.282695
_cons	.009376	.0250615	0.37	0.715	-.0457839	.0645358

• According to the Ramsey reset criterion, the F statistic is 2.84, and the probability of 0.1279 is greater than the significance level of 0.05, so the model is optimal..

```
Ramsey RESET test using powers of the fitted values of roa
       Ho:  model has no omitted variables
                   F(3, 6) =      2.84
                 Prob > F =      0.1279
```

According to the regression equation (3.9):

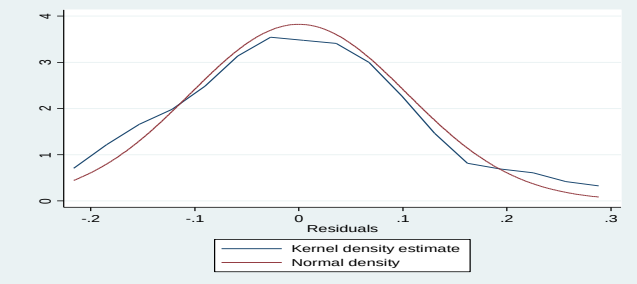
• Return on sales increases by 0.19 units for one unit increase in current assets. When the ratio of inventory costs to sales revenue increases by one, it decreases by 0.66 units. A one-unit increase in inventory capacity will decrease by 0.53 units, and a one-unit increase in the share of inventory reserves in assets will increase by 0.27 units.

• The coefficient of determination of the regression equation is 0.35. It follows that 35% of sales returns can be explained by equation (3.8), and the remaining 65% is the influence of other factors.

• The share of working capital in assets and the share of inventory in assets have a direct positive effect on the return on sales.

• However, the ratio of inventory costs to sales revenue and inventory capacity have a negative impact on sales returns.

• The kernel density function distribution is shown below.



• The Shapiro-Wilk test result is 0.54803, which means that the significance level is greater than 0.05, thus confirming the hypothesis of normal distribution.

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
r	15	0.95148	0.941	-0.121	0.54803

The calculated value of criterion W

W_T=0.95148 satisfies the condition that the table value W_x=0.851 is greater.

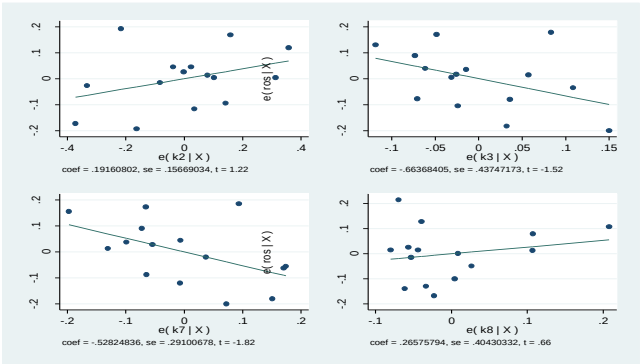
• According to the Breusch-Pagan test, the model is not heteroskedastic (0.8234>0.05).

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of ros

chi2(1) = 0.05
Prob > chi2 = 0.8234

When testing for multicollinearity, the variance inflation factor is 4.62, which is less than 10, so the regression variables are linear combinations of other variables.

Variable	VIF	1/VIF
k7	7.07	0.141453
k2	6.60	0.151569
k3	2.74	0.365482
k8	2.09	0.477604
Mean VIF	4.62	



Criteria for checking whether the model is correctly defined hatsq P>|t| is 0.739 or the significance level is greater than 0.05, so the selected variables are optimal.

```
      Source |       SS       df       MS              Number of obs =      15
-------------+------------------------------           F(  2,    12) =    3.36
       Model |  .084573378     2  .042286689           Prob > F      =  0.0694
    Residual |  .150999951    12  .012583329           R-squared     =  0.3590
-------------+------------------------------           Adj R-squared =  0.2522
       Total |  .235573329    14  .016826666           Root MSE      =  .11218

------------------------------------------------------------------------------
         ros |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .5712719   1.315391     0.43   0.672    -2.294718    3.437262
      _hatsq |   1.453624   4.260296     0.34   0.739    -7.828764    10.73601
       _cons |   .0210909   .1002457     0.21   0.837    -.1973256    .2395074
------------------------------------------------------------------------------

Ramsey RESET test using powers of the fitted values of ros
       Ho:  model has no omitted variables
                   F(3, 7) =      1.03
                   Prob > F =      0.4375
```

According to the Ramsey reset criterion, the F statistic is 1.03, and the probability of 0.4375 is greater than the significance level of 0.05, so the model is optimal.

CONCLUSION

Within the framework of this research, the following tasks were completed:

1. When comparing and analyzing the procurement data of the major factories and enterprises of our country, such as "Erdenet Industry" SOE, "Erdenes Tavantolgoi" SOE, "Mongolrostsvetmet" SOE, "Cement shohoy" SOE, and "Baganuur" SOE:

- The number of employees is between 800 and 1550. However, the largest number of 7,000 employees work in "Erdenet Udyab" SOE.
- Procurement is organized in accordance with relevant laws, legal acts and regulations.
- More than 300-1500 invitations to tenders were published annually through the public procurement system www.tender.gov.mn.
- 20-280 complaints were filed by the bidders per year.
- Total assets are between 230 billion MNT and 15.1 trillion MNT.
- Annual sales revenue is approximately between 83 billion MNT and 2.7 trillion MNT.
- Net profit for the reporting period is between 11 billion MNT and 622 billion MNT. On the other hand, "Baganuur" JSC had a loss of approximately 8.5 billion MNT per year.
- An average of 23 billion MNT to 682 billion MNT is spent annually to purchase inventory.
- The amount of working capital is between 56 billion MNT and 1.7 trillion MNT.
- The amount of non-current assets is between 101 billion MNT and 4.2 trillion MNT.

2. When evaluating and analyzing the effectiveness of procurement management of the organizations involved in the study:

• Average value of return on assets (ROA) is 9.2%, minimum value is 0.3%, maximum value is 23%. Among them: high-income "Mongolrostsvetmet" LLC, middle-income "Erdenet Udyy" SOE, low-income "Erdenes Tavantolgoi" JSC, "Cement Shooi" SOE, "Baganuur" SOE.

• Average value of return on sales (ROS) is 16.7%, minimum value is 2.3%, maximum value is 23.9%. Among them: "Erdenes Tavantolgoi" JSC, "Erdenet Udyab" SOE, "Mongolrostsvetmet" LLC are among those with a high return on sales, "Cement Shoi" JSC is with an average return, and "Baganuur" JSC is with a low return.

• The average value of the capital capacity indicator (K_1) is 2.76, the minimum value is 0.76, and the maximum value is 7.29. In 2019-2022, "Mongolrostsvetmet" LLC is 0.76 MNT, "Baganuur" SOE is 1.32 MNT, "Erdenet Udyab" SOE is 1.52 MNT, "Cement Shooi" SOE is 2.89 MNT, "Erdenes Tavantolgoi" SOE is 7.29 MNT. MNT funds were spent respectively.

• The share of working capital in assets (K_2) has an average value of 63.4%, a minimum value of 24.9%, and a maximum value of 90.4%. The lowest share of current assets in assets is "Erdenet Udyab" SOE, "Cement Shoi" SOE and "Baganuur" SOE are in the middle, while "Mongolrostsvetmet" LLC and "Erdenes Tavantolgoi" SOE are the highest.

• It is observed from the research that increasing the inventory capacity significantly reduces the return on capital.

• According to the research results, the return on capital is the highest in 2019, and the lowest in 2022 is 7.8%. The best asset returns were in 2019 (the year before the global Covid-19 pandemic). The worst year for asset returns was 2022, driven by the global Covid-19 pandemic, rising commodity and inventory prices, and currency appreciation.

• From the results of the research, the importance of regular evaluation of the effectiveness of the procurement of organizations is clearly visible. Regular monitoring of analyzed indicators and comparison with industry averages is an integral part of effective management.

3. A mathematical model for optimizing the stability of the mining organization was developed based on the practical activities of the organizations involved in the research, and the correlation-regression analysis was conducted, and the following results were obtained:

• From the mathematical model for optimizing the stability of the mining organization, the most influential factor in the research work is x_1 (the share of working

capital in assets), the second is x_3 (inventory capacity), and the third is x_2 (the ratio of inventory costs to sales revenue). , the fourth is x_4 (the share of inventory in assets).

- The optimization model developed based on the practical activities of mining enterprises will provide an opportunity to ensure the stability of mining enterprises through the organization of purchasing activities.
- The following indicators are directly related. These include: return on sales (ROS) and return on assets (ROA), the ratio of inventory costs to sales revenue K_3 and the share of working capital in assets K_2, inventory capacity (inventory capacity) K_7 and the share of working capital in assets, goods in assets share of material resources K_8 and return on assets (ROA), share of inventory resources in assets K_8 and inventory capacity (inventory capacity) K_7.
- The developed regression models have a normal distribution, are not heteroscedastic, are optimal, and the variables are optimally selected.

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