

A system of measures to achieve the efficiency of the production processes of the enterprise

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Abstract. The paper considers the methodology for calculating and analyzing the efficiency indicators of production processes, systematizes the efficiency indicators that reflect the economic efficiency of the use of production resources. The analysis of the cost level of Public Joint Stock Company “Novorossiysk Commercial Sea Port” for key production processes was carried out. Based on the calculated resource intensity indicators, the amount of relative savings / overspending of resources, as well as the efficiency of their use in a particular production process, is determined. An important point in the work is the calculation and analysis of generalizing indicators of the efficiency of the activity of the analyzed company, which showed the excess of spending limits and the involvement of excess resources in production and economic activities with the current volume of production. Based on the calculations, a matrix of the ratio of effectiveness and efficiency is presented, the construction of which made it possible to draw a conclusion about the uneconomical and ineffective activities of the enterprise. In order to identify the reasons for this situation, the author conducted a SWOT analysis of the production processes efficiency of the company in question, which involves identifying strengths and weaknesses, opportunities for improvement and threats of deterioration. The conducted assessment of the efficiency of production processes made it possible to assess the validity of the costs incurred by the enterprise and develop measures to optimize them. The system of measures to achieve the efficiency of production processes proposed by the author is of great importance, since this type of company has a developed infrastructure and a significant number of employees, which affects the level of its costs. The main ways to achieve cost-effectiveness of production processes are aimed at optimizing not only production, but also management costs, which is especially relevant in modern crisis conditions.

1 Introduction

The improvement of production processes plays an important role in the management of enterprises and organizations. Recently, production process management has been considered as an organizational system that ensures a continuous life cycle and continuous improvement of management mechanisms. The objectives of such a system are the optimization of resources, increasing the efficiency of operations while reducing costs, reducing the time of operations and the overall increase in the profitability of economic activities.

By production processes, we mean not only a process related directly to production, but also processes that have an indirect impact on them, namely, management business processes.

Managing production processes in practice causes the problem of effectively achieving goals with minimal consumption of the necessary or available resources. Therefore, the head of the enterprise inevitably faces the task of finding the optimal balance in the management process between efficiency and profitability.

The development of the analysis of the production processes efficiency is associated with the actualization

of the task of a comprehensive assessment and analysis of the company activity results, not only as a whole, but also its individual segments, which are production processes that largely affect these results. It is the results of such an analysis that make it possible to make effective management decisions aimed at improving and optimizing production processes. A competently conducted and timely cost-effectiveness analysis makes it possible to evaluate the effectiveness of business operations, taking into account the costs associated with the use of labor, capital, materials, time, energy, information and other resources in the production of products (services) and can lead to an improvement in the current activities of the enterprise, optimization of production costs and increased profits.

During the economic instability period of foreign markets, control over the costs of an enterprise is especially necessary in order to stabilize prices for its own products and create additional financial opportunities for business development, which explains the relevance of the chosen topic of work.

The purpose of the paper is to assess the current efficiency of the production processes of a stevedoring company and develop measures to ensure it. The object of study is a large business entity providing a wide range

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of stevedoring services in the seaport – Public Joint Stock Company “Novorossiysk Commercial Sea Port”. The object of study is quantitative indicators characterizing the efficiency and effectiveness of the production processes of the enterprise.

2 Materials and Methods

The structure of the production processes of the organization, as a rule, is built in accordance with industry standards and management standards, supported by its management, allowing achieving the main strategic and operational goals of the organization. The possibility of solving a wide range of tasks and problems of doing business based on the use of analytical tools led to the emergence of a new analytical concept – the concept of business analysis, which has reflected in the publications of many scientists – V.I. Barilenko, A.B.

Baev, V.V. Berdnikov, V.G. Eliferov, V.V. Repin, V.P. Suits, etc. There are also several methods of subjective assessment of processes. In many ways, such techniques were developed in the works of the founders and followers of the business process reengineering methodology, for example, Hammer and Champy, Robson and Ullah, etc. Methods based on the construction of regulatory regimes for the functioning of companies may also be of particular interest [1]. Methods for graphical analysis of processes are less developed. In addition, well-known methods of analysis can be used for qualitative analysis of processes: SWOT analysis, analysis using the Boston Matrix, etc.

To choose the right indicators and approaches to assessing the efficiency of production processes, at the beginning it is necessary to highlight the main production processes of the company in question. The enlarged scheme of the port operator of PJSC “NCSP” is shown in Fig. 1.

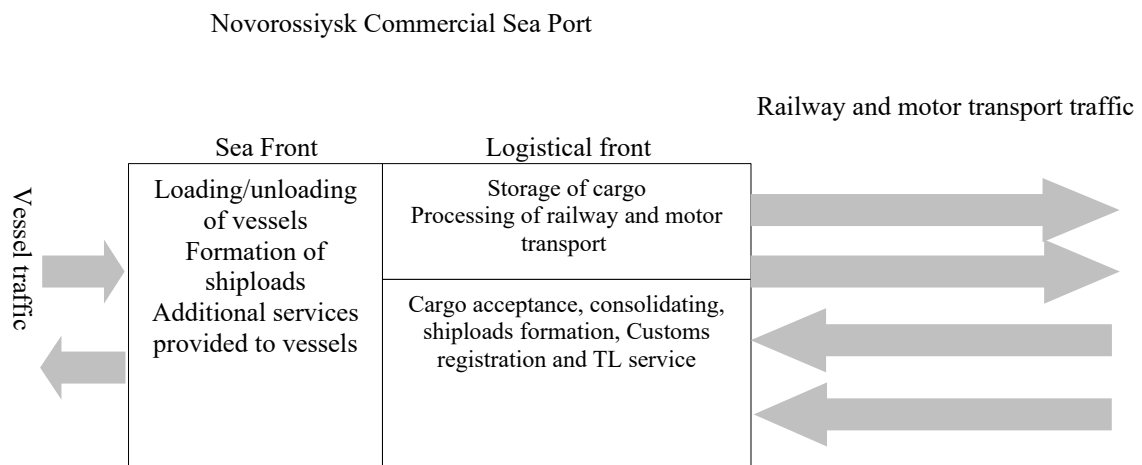


Fig. 1. The scheme of work of the port operator of PJSC “NCSP”.

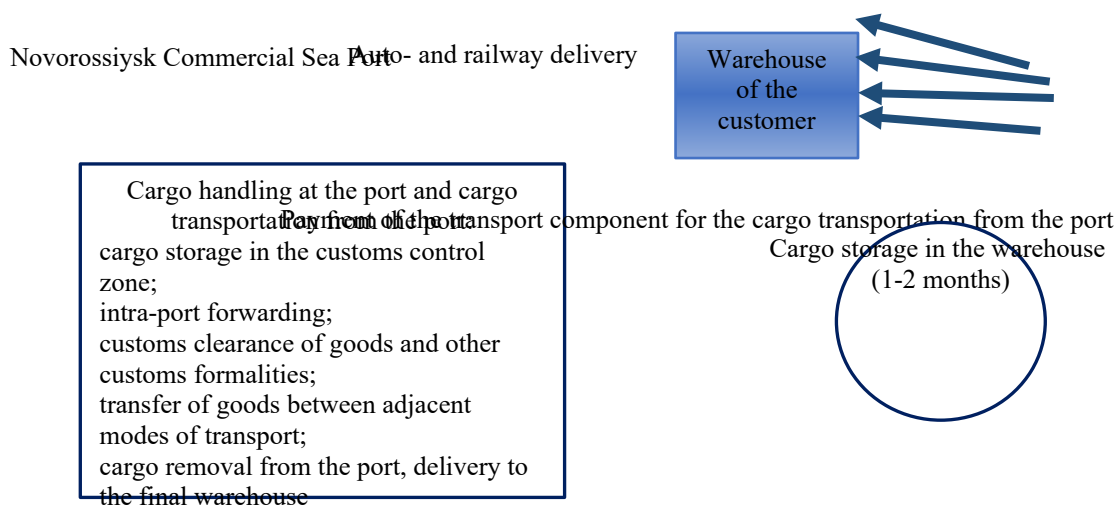


Fig. 2. Scheme of logistics activities of PJSC “NCSP”.

The terminal of PJSC “NCSP” is divided into two fronts: the “Sea front” – the formation of shiploads, loading, unloading of vessels, direct transshipment of railway – ship, auto – ship and the “Logistical front”,

where the processing of railway and motor transport, acceptance, acquisition, storage of goods, customs registration, commercial inspections, and other related logistics services take place (see Fig. 2).

At the first stage of the study, we will perform an analysis of the cost level of PJSC “NCSP” for key production processes, for this purpose we will compile an analytical Table 1.

Based on the analysis of the data in Table 1, it can be observed that in 2019, compared with 2018, the level of costs of PJSC “NCSP” increased. It can be stated that the management policy of the seaport in the field of cost management, especially those of a managerial nature, is irrational and uneconomical.

In 2020, the situation changed for the worse, as there was an increase in coefficients. An increase in the level of production costs by 30.3% – from 0.357 to 0.465 rubles – indicates a decrease in the operational efficiency of the enterprise in terms of managing the formation of production costs and is assessed negatively.

The dynamics of costs in the field of management depends on the phase of the life cycle of the enterprise: in the growth phase, this coefficient, as a rule, decreases; in the phase of stable development, it is constant; in the phase of leaving the market, it may increase.

Table 1. Analysis of the cost level of PJSC “NCSP” for key production processes for the period of 2018–2020.

Indicators	for 2018	for 2019	Absolute deviation	Growth rate, %	for 2020	Absolute deviation	Growth rate, %
The level of costs in the field of production	0.340	0.357	0.017	105.1	0.465	0.108	130.3
The level of costs in the field of management	0.048	0.052	0.004	108.3	0.070	0.018	135.3
Cost ratio of business processes	0.259	0.273	0.014	105.4	0.363	0.089	132.7

Therefore, in 2019, PJSC “NCSP” was in an unstable phase of development, and by 2020 the situation was even more destabilized, since the indicator under consideration had a tendency of a sharp increase – by 35.3% to the level of 2019, up to 0.07 rubles. However, its value does not exceed the established standard, which is equal to 0.15 (or from 15% of revenue), that is, no excessive management costs have been incurred over the past three years.

The dynamics of the cost coefficient of business processes is of key importance. The growth of this indicator in 2020 by 0.089 rubles (by 32.7%) indicates a decrease in the efficiency of managing expenses for the maintenance of the resource base of PJSC “NCSP”, including labor resources, material, and technical resources.

The resource intensity indicators of PJSC “NCSP” are analyzed according to Table 2.

Table 2. Analysis of resource intensity indicators of PJSC “NCSP” for 2018–2020.

Indicator	for 2018	for 2019	Absolute deviation	Growth rate, %	for 2020	Absolute deviation	Growth rate, %
Wage intensity	0.108	0.117	0.009	108.0	0.161	0.044	137.9
Materials intensity	0.128	0.135	0.007	105.6	0.172	0.037	127.3
Depreciation intensity	0.090	0.089	-0.001	99.4	0.125	0.036	139.8
Resource intensity for other costs	0.062	0.067	0.006	109.5	0.077	0.010	114.3
Total resource intensity	0.387	0.408	0.021	105.5	0.535	0.126	130.9

According to the results of the analysis of Table 2 data, it is noticeable that in 2019 the total resource intensity of production processes in PJSC “NCSP” increased by 5.5%, which was facilitated by an increase in wage intensity by 8%, material intensity by 5.6% and resource intensity for other costs by 9.5% compared to 2018. Deviations did not exceed 10% modulo, that is, the costs of these elements were under the control of the management of the company. In 2020, the total resource intensity of the economic activity of PJSC “NCSP” increased by 30.9% compared to 2019, which indicates a significant relative overspending for all types of costs consumed during the production cycle.

There was an increase in wage intensity by 37.9%, material intensity by 27.3%, depreciation intensity by 39.8% and resource intensity for other costs by 14.3%. Significant deviations in modulus exceeding 10% indicate the existing shortcomings in cost management, a low level of cost control and insufficient efficiency of business processes of the port. Since the level of the total resource intensity indicator is less than one, the economic activity of PJSC “NCSP” during 2018–2020 remained profitable and cost-effective. Next, using Table 3, we will evaluate the amount of savings / overspending of the main resources of PJSC “NCSP”.

Table 3. Assessment of savings/overspending of resources of PJSC “NCSP”, thousand rubles.

Indicators	Saving (-) / overspending (+)	
	Period 2018–2019	Period 2019–2020
Wage intensity	240492.2	993985.1
Materials intensity	196928.7	828381.4

Depreciation intensity	-14244.6	799947.4
Resource intensity for other costs	161785.3	216445.9
Total resource intensity	584961.7	2838760.0

An analysis of the data in Table 3 shows that no resource savings were achieved in 2019, the total amount of overspending amounted to 584961.7 thousand rubles. The predominant part of the overspending accounted for labor costs, which included wages and social contributions – 240492.2 thousand rubles. The amount of overspending on materials and other costs is also significant – 196928.7 and 161785.3 thousand rubles respectively. A small saving was achieved only on depreciation costs, which amounted to 14244.6 thousand rubles.

In 2020, overspending exceeded 2.8 billion rubles and was observed for all cost elements. In terms of labor costs, materials and depreciation, its value reached 993985, 828381 and 799947 thousand rubles, respectively, for other costs it was slightly lower – 216446 thousand rubles.

Table 4 shows the results of calculating the generalizing indicators of the efficiency of the activities of PJSC “NCSP”.

Table 4. Analysis of the generalizing indicators of the efficiency of the activities of PJSC “NCSP” for the period of 2018–2020.

Indicators	for 2018	for 2019	Absolute deviation	Growth rate, %	for 2020	Absolute deviation	Growth rate, %
Transshipment volume, thousand rubles	78037	73248	-4789	93.9	53973	-19275	73.7
Cost of production processes, thousand rubles.	9779937	9880056	100119	101.0	10443111	563055	105.7
Unit production costs per ton, rubles/ton	125.3	134.9	9.6	107.6	193.5	58.6	143.4
Total cost of business processes, thousand rubles.	11155950	11313127	157177	101.4	12015462	702335	106.2
Total unit costs per ton, rubles/ton	143.0	154.4	11.5	108.0	222.6	68.2	144.1
Revenue from the sale of products (works, services), % of cost	258.2	244.8	-13.4	94.8	187.0	-57.8	76.4

Analyzing the dynamics of unit production costs per ton, we can say that this indicator has changed upward. In 2019, it increased by 7.6% to the level of 2018, and in 2020 – by another 43.4%, the indicator of total unit costs per ton increased from 143 rubles/ton in 2018 to 222.6 rubles/ton in 2020, showing a moderate growth rate in 2019 (8%) and a sharp increase in 2020 (44.1%). In both periods, the main factor of the change was a decrease in the volume of transshipment of PJSC “NCSP” against the background of consistently high costs, especially the semi-fixed part of them.

The revenue from the sale of products in the cost price also decreased – from 258.2% in 2018 to 187% in 2020, whereas at the beginning of the analyzed period the revenue of the port exceeded the cost price by 2.58 times, by the end of the period it was only 1.87 times,

which means an increase in financial and economic risks.

Based on the above data, it can be concluded that PJSC “NCSP” carries out its activities uneconomically, exceeding spending limits and, with the current volume of transshipment, involves excess resources in production and economic activities. This leads to an increase in the cost of transshipment processes and high unit costs for the production of loading and unloading operations.

Since the key performance indicators of PJSC “NCSP”, such as transshipment volume, revenue, profit, cost-effectiveness, are declining in dynamics, the activity of the company is ineffective. Consequently, today the company is in the lower left corner of the matrix, its activities are characterized as uneconomical and ineffective (see Fig. 3).

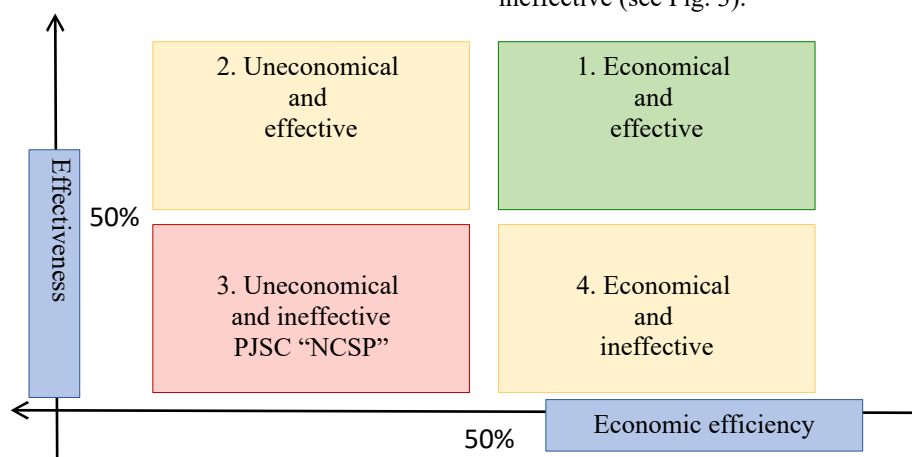


Fig. 3. Construction of the “efficiency/effectiveness” matrix for PJSC “NCSP”.

To identify the reasons for this situation, we will conduct a SWOT analysis of the profitability of PJSC “NCSP” business processes, which involves identifying strengths and weaknesses, opportunities for improvement and threats of deterioration (see Table 5).

Thus, the existing production processes have many shortcomings that reduce the overall level of efficiency of PJSC “NCSP” and lead to low effectiveness of production processes.

Table 5. Results of the SWOT analysis of the efficiency of production processes in PJSC “NCSP”.

Strengths	Weaknesses
1. Low dependence on suppliers of raw materials and supplies 2. Compliance of the level of management costs with the standards 3. Rational distribution of costs between the main and auxiliary business processes 4. The level of production costs and management costs is fully covered by revenue, which ensures the formation of profit	1. Increase in unit costs for transshipment of one ton of cargo 2. Significant impact of works and services of a production nature performed by third-party organizations on the formation of costs 3. Increasing the complexity of business processes on a stable basis 4. Increasing the level of costs, both in the field of production and management 5. Growth of semi-fixed expenses (rent, depreciation, repair, and maintenance costs) against the background of a decrease in transshipment volumes 6. Low level of cost control
Opportunities	Threats
1. Reduction of unit costs relative to competitors 2. Introduction of equipment with reduced fuel and energy consumption 3. The use of progressive methods of cost management and control over its level 4. Optimization of technological processes of cargo handling on the basis of modern technological equipment, informatization, and automation of business processes 5. Updating and upgrading of equipment	1. Loss of customers due to forced tariff increases 2. Inflation risks 3. The risk of increasing the tariffs of third-party organizations providing services of a production nature 4. Force majeure risks leading to an increase in the costs of the enterprise 5. Downtime of the resource base due to lack of cargo 6. Unforeseen breakdowns of the main technological equipment 7. Unfavorable change in the exchange rate

3 Results and Discussion

For the effective organization of production processes, a stevedoring company requires optimization of both production and management costs. In modern crisis conditions, this need becomes especially urgent. The port costs should be minimized in the following directions (see Fig. 4). Firstly, to increase the efficiency of economic activity, the economic services of PJSC “NCSP” should establish a systematic accounting of expenses at all sites and divisions of the enterprise and identify unjustified costs.

For this purpose, it is necessary: to clearly control the use of resources; to normalize and plan expenses based on the most progressive methods; to find out the reasons for the growth of excess costs and take measures to eliminate them [2]. One of the factors for the low efficiency of production processes at PJSC “NCSP” may be excessive formalization of processes: the tender procedures of the port provide for many suppliers, so most of the time in the procurement department is spent on collecting, processing, and coordinating documentation, rather than searching for suppliers and concluding contracts on the most favorable terms. Therefore, one of the most effective measures to

optimize the cost of purchasing materials for the production process of a port operator is to increase the efficiency of managing relationships with suppliers of fuel, petroleum, oil, lubricants, separation materials, etc.

Another way to save money is to reduce the downtime of the transshipment equipment of PJSC “NCSP”. Unjustified expenses of the port in case of equipment downtime include: staff salaries; fuel, gas, and electricity costs. The main reasons for downtime and ways to eliminate them are given in Table 6.

The implementation of the following measures will make it possible to reduce the costs of repair, maintenance, and operation of fixed assets of PJSC “NCSP” (equipment, buildings, premises, territory) [3]:

- maintenance and repair using its own resources or vice versa, the use of third-party services – it is necessary to calculate which is more profitable;
- negotiations with existing contractors on changing (improving) the terms of service;
- search for new contractors with more favorable conditions;
- increasing the useful economic life of fixed assets;

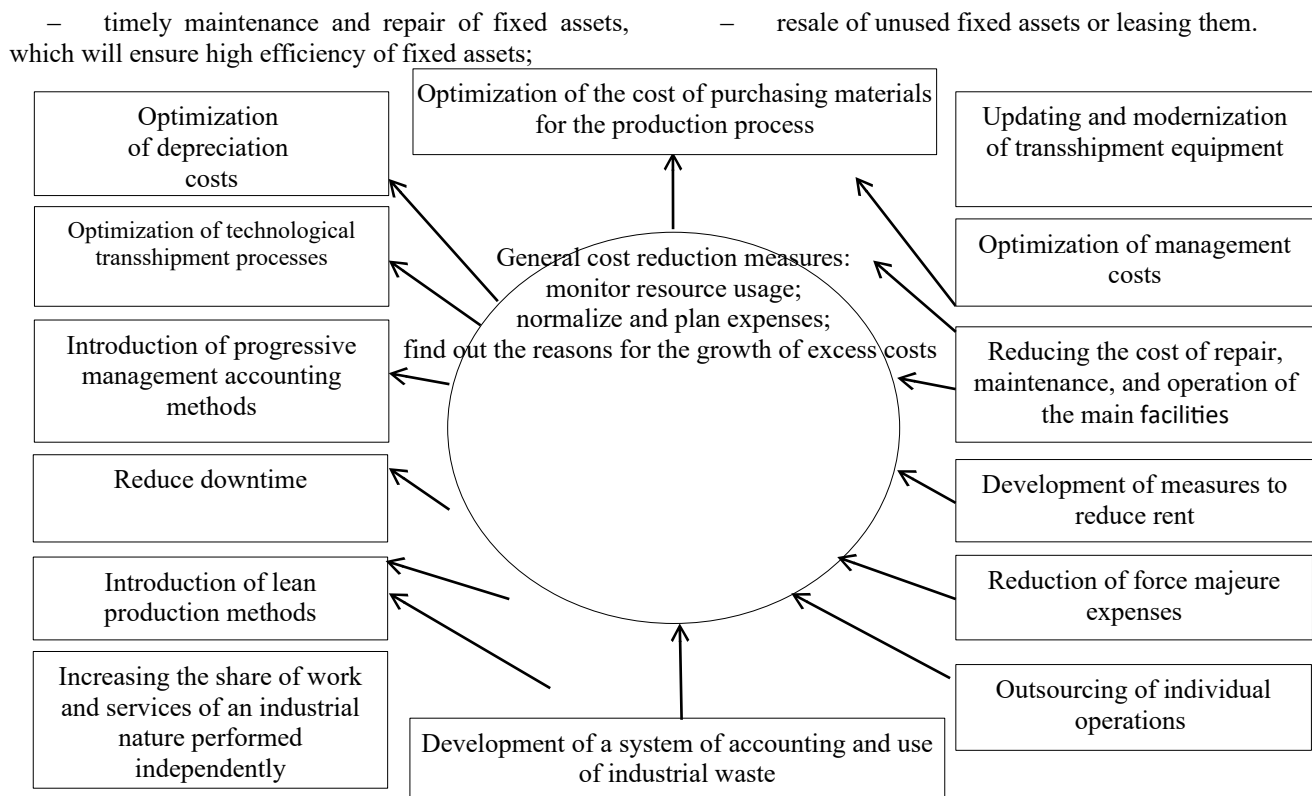


Fig. 4. The system of measures to achieve the efficiency of production processes of PJSC “NCSP”.

Table 6. Causes of equipment downtime at PJSC “NCSP” and ways to eliminate them.

Reasons for equipment downtime	Cost estimation	Recommended measures to eliminate the problem
Equipment breakdown	Staff salaries, equipment repair and maintenance costs	Preventive maintenance and periodic inspection of equipment to timely find a breakdown and eliminate it
The employee went on sick leave, they did not find a replacement for a long time	The plan for the volume of THC has not been fulfilled	Personnel must be interchangeable, which is provided by training, in-service education
Suppliers violated the terms of delivery of materials specified in the contract	The plan for the volume of THC has not been fulfilled	Verification of suppliers, reflection in the contract of penalties for breach of obligations

Since PJSC “NCSP” is experiencing an increase in semi-fixed costs, let us consider the main ways to reduce them. Depreciation is an item that occupies a fairly significant share in the structure of expenses of the port operator. Ways to optimize costs for this item [3]:

- rational use of fixed assets (for example, due to their maximum load in terms of capacity and time);
- purchase of cheaper fixed assets;
- purchase of non-new property (previously used). In this case, according to Art. 258 of the Tax Code of the Russian Federation, the taxpayer has the right to determine the depreciation rate, taking into account the useful life, reduced by the number of years (months) of operation of this property by previous owners;
- abandonment of modernization and reconstruction (which increases the depreciable cost of the fixed asset) in favor of repair work;
- application of a depreciation premium in order to reduce income tax;
- elimination of excess unused equipment.

4 Conclusions

The implementation of the following measures will allow minimizing the rental costs of PJSC “NCSP”: refusal to lease in favor of acquiring leased property, for example, transshipment equipment; negotiations with existing contractors providing rental services on reducing the cost or changing the terms of contracts; transfer of part of the leased area (rental objects) to sublease to third parties.

An increase in the share of works and services of a production nature performed independently without the involvement of third-party organizations is possible, first of all, by optimizing technological processes, updating and upgrading transshipment equipment, performing maintenance and repair of equipment using its own resources.

Optimization of technological processes of transshipment in PJSC “NCSP” can be achieved through the use of modern technological equipment, optimization of technological transport loading, as well as digitalization

and automation of all technological processes of cargo handling. There are many specialized lifting devices for working with certain types of cargo: container spreaders, grabs, screw conveyors, conveyors with submersible scrapers, etc. The use of modern technological equipment makes it possible to enlarge the “lifts”, increase the intensity of loading / unloading and reduce the time of technological operations, thereby reducing the operating costs for transshipment of goods at PJSC “NCSP”.

Optimal loading of technological vehicles will help to reduce the transport costs of PJSC “NCSP”: it is advisable to load vessels fully in accordance with their carrying capacity; the carrying capacity should also correspond to the complexity of the tasks being solved (for example, it is not advisable to use vessels with a high carrying capacity for the transportation of “light” goods). The technological department of the port should coordinate its work with mechanized teams to ensure maximum loading of technological transport when performing THC.

The introduction of automation at the terminals of PJSC “NCSP” will allow introducing a completely new level of consistency in cargo handling, speeding up the processing of ships and cargo flows, as well as reducing labor costs, fuel and energy costs compared to terminals with manual control [4].

Given the technological advances in the industry, if “NCSP” terminals do not take the path of automation of the main production processes, they risk being completely outdated. For example, the Port of Hamburg uses IoT sensors, augmented intelligence technology and smart data to: coordinate the traffic of incoming/outgoing vessels and manage the actions of port teams; to obtain weather information necessary for assessing the availability of berths; to work out various port operation scenarios. Another example is the Qingdao Container Port, which is fully automated and controlled by laser scanners and container positioning systems. The terminal has implemented automatic mooring of ships, fully automated container delivery, automated equipment loading planning, an unmanned intelligent gate system and a number of other systems [5].

It also makes sense to upgrade and modernize the transshipment equipment of PJSC “NCSP”, thereby increasing the efficiency of transshipment and simultaneously reducing fuel and energy costs. Portal cranes of the enterprise are outdated today, a number of experts consider the articulated boom system in portal cranes to be obsolete and economically inexpedient, since the mass of the components of such a system exceeds the mass of the boom itself by several times, which increases unproductive operating costs. Modern methods of electronic control make it possible to provide any trajectory for the movement of cargo by a crane with a straight boom at maximum speeds. Therefore, now in the designs of heavy-duty portal cranes, a straight boom is optimal. Such cranes are offered by both foreign and domestic manufacturers within the framework of import substitution programs, for example, Production Association “Technoros” (Saint-Petersburg). Loaders with reduced fuel consumption are also produced.

The need to develop a system for recording and using industrial waste should also be noted. This significantly

reduces production losses and costs for storage and disposal of waste.

Recently, an actual way to reduce production costs is the introduction of the “lean production concept” (lean management), which consists in optimizing processes by identifying and eliminating hidden losses, providing management infrastructure, changing the mindsets of employees, which in turn increases the efficiency of the seaport. The only disadvantage of this method is its long-term nature since it is often necessary to change the work culture of production personnel.

As part of reducing management costs, PJSC “NCSP” needs, firstly, to review direct management costs, which include various categories of payments to employees.

In the context of a decrease in transshipment volumes and financial results of the enterprise, first, it is necessary to revise such items as premiums and bonuses.

The next category of management costs is secondment costs. In order to reduce the secondment costs, it is possible in local regulations (for example, a collective agreement or regulation on business trips) to set limits on the cost of renting a dwelling (renting exclusively single rooms, not luxury, not premium, etc.), exclude any additional costs, order tickets through specialized sites with payment by bank transfer without additional registration fees, and also set the amount of daily allowance [3]. In addition, the months of quarantine associated with the spread of coronavirus infection clearly demonstrated that the existing technical capabilities make it possible to conduct key negotiations remotely.

A sure way to reduce management costs is outsourcing, that is, the transfer of individual functions (usually non-core) to be performed by a third-party organization. PJSC “NCSP” firstly, should consider outsourcing services in the field of accounting, HR administration, legal support, IT infrastructure support.

To reduce force majeure expenses, PJSC “NCSP” needs to ensure compliance with the payment schedule, control over the fulfillment of contractual obligations and court decisions, control and timely renewal of all necessary licenses, and compliance with antimonopoly and environmental laws.

The primary way to increase the level of control over the costs of PJSC “NCSP” is the introduction of progressive management accounting methods, which are shown in Fig. 5.

For example, the LCC method (Life cycle costing) is a cost accounting method in which the costs of the main processes associated with the development, creation, sale, and after-sales service (operation) of the product are considered as investments to determine the overall benefit from the production of the product. The LCC method helps to solve the following practical tasks: cost control in the context of the stages of the product life cycle; determining the profitability of the product in the long term.

The basis of the “target-costing” concept is the expression: the target cost is the target price minus the target profit. That is, it is expected that new products will be sold at a price that will fully cover the costs and provide the profit necessary for further business development [6].

The cost accounting method “kaizen-costing” is an improved model of the incremental (process, operational) method of accounting and costing using the “Kaizen” philosophy. The main objects of accounting and costing are production processes (work operations). In this concept, the functions of marketing and cost design are implemented jointly, and at the “output” of the system, products are obtained that have the characteristics that best meet the expectations of consumers and the most optimal selling price from the standpoint of its producer and consumer [7].

Strategic cost accounting is understood as a set of accounting and analytical procedures, cost management. This method is necessary for the development of sound management decisions in the field of strategic cost management. This method involves the construction of various situational models that allow, by comparing actual costs with strategic performance parameters, identifying the positive or negative effect of activities carried out within the framework of strategic management.

Analysis and reorganization of value chains make it possible to assess the optimality of the business model of the company as a whole, including identifying those processes that increase or reduce its value; reduce costs by reorganizing the chain (selling assets, outsourcing some processes, creating strategic partnerships with suppliers, etc.). An analysis of strategic cost positioning reveals why some companies are more profitable than the industry average and the level of costs is lower.

Also, as one of the cost reduction tools, an econometric model for assessing the interrelationships of performance indicators of a stevedoring company can be singled out, on the basis of which managers develop recommendations at a specific time, taking into account many factors [8].

The methods listed above will allow PJSC “NCSP” to reduce costs, improve the manageability of the process of distribution and formation of costs, and, in general, will have a positive effect on the efficiency of the main and auxiliary production processes of the enterprise.

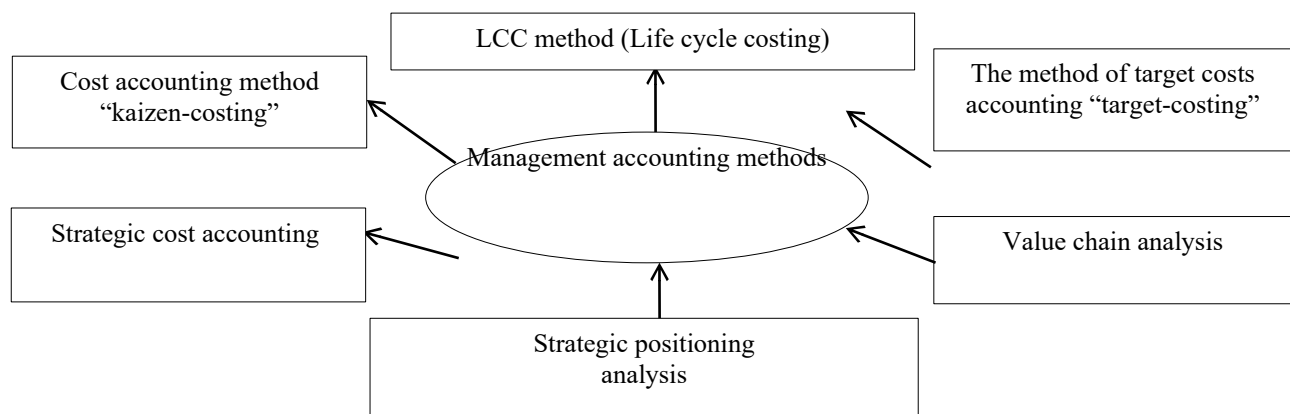


Fig. 5. The most progressive methods of managerial cost accounting.

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