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RISK ASSESSMENT OF INDUSTRIAL ENTERPRISES BASED ON THE LOGISTIC APPROACH

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ОЦІНКА РИЗИКІВ ПРОМИСЛОВИХ ПІДПРИЄМСТВ НА ОСНОВІ ЛОГІСТИЧНОГО ПІДХОДУ

In the research process, a logistic approach to risk assessment in the management of an industrial enterprise was considered, aimed at ensuring the rationalization of flow processes in the management system from the point of view of a single material-conductive chain, the integration of individual parts of which is carried out at the technical, technological, economic and methodical levels. The peculiarities of the logistics system of an industrial enterprise are determined by a number of important factors. These factors are grouped into appropriate groups. The classification of the interrelationships of the equipment of the micrologistic system of the industrial enterprise is considered. According to the results of the research: measures aimed at increasing the efficiency of risk management of an industrial enterprise based on a logistic approach are proposed.

Losses and expenses arising from the occurrence of risks of an industrial enterprise starting with single objects - equipment of the sixth rank and

accumulating in a hierarchical order to the first level - the micrologistic system of the enterprise. An important role in reducing losses from technical risks along the main chains of the production subsystem belongs to the service subsystem, which is designed to ensure the normal operation of the production subsystem with production services - repairs, transport services, energy.

The service subsystem substantiated in this work from the point of view of the logistics approach is considered in two ways: on the one hand, it is a source of risks, and on the other, it is a tool for minimizing the consequences of risks in the production subsystem, which should ensure the reliable operation of the main equipment. The article reveals the peculiarities of the material, information and service flow of the micrologistic system of the enterprise, it is noted that the implementation of the risk management system requires the use of monitoring and improvement of the database for the production and service subsystems of the enterprise and the creation of a knowledge base that will allow assessing the risks of interconnected production and service flows as well as predict the economic consequences and optimize costs for measures to settle losses in the event of a risk event.

У процесі дослідження було розглянуто логістичний підхід до оцінки ризиків в управлінні промисловим підприємством, спрямований на забезпечення раціоналізації потокових процесів у системі управління з точки зору єдиного матеріально-провідного ланцюга, інтеграції окремих частини якого здійснюється на технічному, технологічному, економічному та методичному рівнях. Розглянуто особливості логістичної системи промислового підприємства зумовлені низкою важливих факторів. Ці фактори згруповано в відповідні групи. Розглянуто класифікацію взаємозв'язків обладнання мікрологістичної системи промислового підприємства. За результатами дослідження: запропоновано заходи, спрямовані на підвищення ефективності управління ризиками промислового підприємства на основі логістичного підходу.

Втрати та витрати що виникають при настанні ризиків промислового підприємства починаючи з одиничних об'єктів - обладнання шостого рангу і в ієрархічному порядку акумулюються до першого рівня – мікрологістичної системи підприємства. Важлива роль в зменшенні втрат від технічних ризиків за основними ланцюгами виробничої підсистеми належить підсистемі обслуговування, що призначена для забезпечення нормальної роботи

підсистеми виробництва виробничими послугами - ремонтами, транспортними послугами, енергією.

Підсистема обслуговування, обґрунтована в даній роботі з позиції логістичного підходу, розглядається двояко: з одного боку – вона є джерелом виникнення ризиків, а з іншого – інструмент мінімізації наслідків ризиків в підсистемі виробництва, що повинна забезпечити надійну роботу основного обладнання. В статті розкрито особливості матеріального, інформаційного та сервісного потоку мікрологістичної системи підприємства, відмічено, що впровадження системи управління ризиками потребує використання моніторингу і вдосконалення бази даних за підсистемами виробництва та обслуговування підприємства і створення бази знань, що дозволить оцінювати ризики взаємопов'язаних виробничих та сервісних потоків а також прогнозувати економічні наслідки і оптимізувати витрати на заходи щодо врегулювання збитків при настанні ризикової події.

Keywords: *assessment, risk, logistics approach, logistics system, industrial enterprise.*

Ключові слова: *оцінка, ризик, логістичний підхід, логістична система, промислове підприємство.*

Statement of the problem in a general form and its connection with important scientific or practical tasks. The functioning of Ukrainian enterprises in the conditions of the current state of war, which, according to public expectations, is expected to transition into the post-war period, makes the need to adjust approaches to risk management urgent. This is especially true of enterprises reorienting themselves to military lines.

The beginning of the invasion of the Russian Federation in 2014 led to a crisis in the steel industry. The industry suffered from damage to the railway infrastructure, shortage of raw materials and shelling of industrial facilities. In a few years, the domestic industry faced a new challenge - the coronavirus pandemic, which led to the closure of markets and a drop in consumption. But the great war played a decisive role. Compared to 2013, Ukraine lost about 80% of its steel production volume. And the largest share of this fall occurred precisely in 2022. In 2022, Ukraine smelted

almost 6.3 million tons of steel - only a third of the result of 2021. Moreover, most of these volumes (58%) were produced in the 1st quarter. The production of rolled products also suffered losses, which decreased by 72% to 5.4 million tons. As a result, Ukraine dropped out of the top 15 largest steel producers in the world ranking last year, falling from 14th to 25th place. However, in the future - after the end of the war - the domestic consumption of metal products will increase several times, according to some estimates, to at least 15 million tons, since the restoration of infrastructure facilities and the housing stock will require millions of tons of steel.

Therefore, forecasting the activity of industrial enterprises in new conditions is already relevant today. The logistics concept of managing an industrial enterprise is of particular importance. The need to use logistics at enterprises is related to the evolution of the management process and the peculiarities of the production processes of industrial enterprises. This becomes especially relevant in today's wartime environment, when an industrial enterprise must organize its activities in such a way as to minimize the risks, losses and costs associated with the processes of production, maintenance and transportation.

Analysis of recent research and publications. . Many scientific works of domestic and foreign scientists and practitioners are devoted to the study of issues of improving the activity of an industrial enterprise on the basis of the logistics concept and logistics management tools [1-8]. Logistics management is based on general management theory. In contrast to traditional logistics management, all management functions need to be oriented towards a single criterion of the enterprise's performance, the essence of which is to maximize the ratio of aggregate volumes of income and expenses, as well as to achieve the necessary level of adaptability of the enterprise to external changes through the balancing of logistics flows. The fundamental difference between enterprise logistics management and traditional enterprise logistics management is the mandatory combination of resource movement technology with enterprise logistics flows, which excludes, on the one hand, irrational formation and use of resources, and on the other, untimely fulfillment of the enterprise's obligations to customers [9]. Z.V. Gerasymchuk and N.E. Tsyganyuk [10] single out the main constructive principles of logistics:

- systemicness, which means the organization of all types of activity of the system as a single process;

- complexity, which involves the formation of all types of support (developed infrastructure) for the implementation of the movement of flows in specific conditions; coordination of actions of direct and indirect participants in the movement of resources and products; implementation of centralized control of tasks that are solved by the logistics divisions of the enterprise; the company's desire to cooperate with external parties; partners in the commodity chain and establishment of strong ties between different divisions of the enterprise within the limits of internal activities;

- scientificity, which ensures the execution of calculations at all stages of material flow management, from planning to analysis; performing detailed calculations at all stages of material flow management from planning to analysis; recognition by qualified personnel of the status of the most important resource of logistics units of enterprises;

- specificity, which provides for movement with the lowest costs of all types of resources; logistics management by accounting and costing units, the results of which are measured by the product received;

- constructive features: dispatching of the flow, continuous tracking of the movement and changes of each object of the flow and prompt adjustment of its movement;

- reliability: ensuring uninterrupted and safe movement, reservation of communications and technical means for changing the flow trajectory if necessary; wide application of modern technological means of movement and traffic control; high speed and quality of receiving information and its processing technology;

- variability: the possibility of flexible response of the enterprise to fluctuations in demand and other negative effects of the external environment;

- general quality management;

- global optimization;

- general costs.

The purpose of the article is to determine the expediency of using a logistic

approach in risk assessment of industrial enterprises.

Outline of the main research material. The logistic approach to the management of an industrial enterprise is aimed at ensuring the rationalization of flow processes within the control system from the point of view of a single material-conducting chain, the integration of individual parts of which is carried out at the technical, technological, economic, methodological levels, and the minimization of time and resource costs is achieved through optimization end-to-end management of material, information and financial flows [11].

Logistics management is a combination of system, process and functional approaches to management and separation of its elements on the basis of a system of principles that helps direct its elements to meet the needs of consumers and create prerequisites for effective operational and strategic management of the enterprise (logistics system) as a whole [9].

The logistics system is understood as a complex, organizationally complete economic mechanism consisting of elements-links interconnected in a single process of managing material and related flows, the totality of which, the limits and tasks of functioning are united by the internal and external goals of the enterprise. Any logistics system consists of a set of elements-links between which certain functional connections and relations are established. A link of the logistics system should be understood as a certain economically and (or) functionally separated object, which is not subject to further decomposition within the scope of the task of analysis or synthesis of the logistics system, which performs its local target function related to certain logistics functions.

From the point of view of displaying the properties, the essence of the logistics system is more fully revealed by the following interpretations of this concept:

- is an adaptive system with feedback that performs certain logistic functions and consists of several subsystems with developed connections in the external environment;

- is a complex organizationally completed (structured) economic system, formed by elements-links connected to each other in a single process of managing material and corresponding flows;

– is a complex organizationally completed (structured) economic system consisting of elements interconnected in a single process of managing material and accompanying flows - links, the totality of which, the limits and tasks of functioning are united by the internal and external goals of the economic organization. objectives.

From the point of view of the spatial factor, logistics systems are divided into two large groups: macro-logistics and micro-logistics systems.

The macrologistic system is a large system of managing material flows that includes enterprises and organizations, territorial production complexes, intermediary, trade and transport organizations of various departments, the infrastructure of the economy of an individual country or a group of countries. Micrologistics systems belong, as a rule, to a certain business organization and are intended for the management and optimization of material and related flows (information, transport) in the process of production and (or) supply and sales.

Internal production systems include metallurgical, coke-chemical, hardware and other enterprises of the mining and metallurgical complex, in which the management of material flows in the technological cycle of product manufacturing is optimized. The main tasks of the intra-production logistics system are: effective use of material resources, reduction of stocks of material resources and work-in-progress, acceleration of turnover of working capital of the enterprise, reduction of the main production time, control over the performance of production-related tasks. and management of stock levels of material resources, work-in-progress and finished products in the warehouse system of the manufacturing enterprise, optimization of technological (industrial) transport. The criteria for optimizing the functioning of internal production logistics systems are, as a rule, the minimum cost of production and the minimum time of the production cycle while ensuring the established level of quality of finished products.

Industrial enterprises as a micrologistic system can be generally represented as a set of production subsystems and service subsystems (Fig. 1).

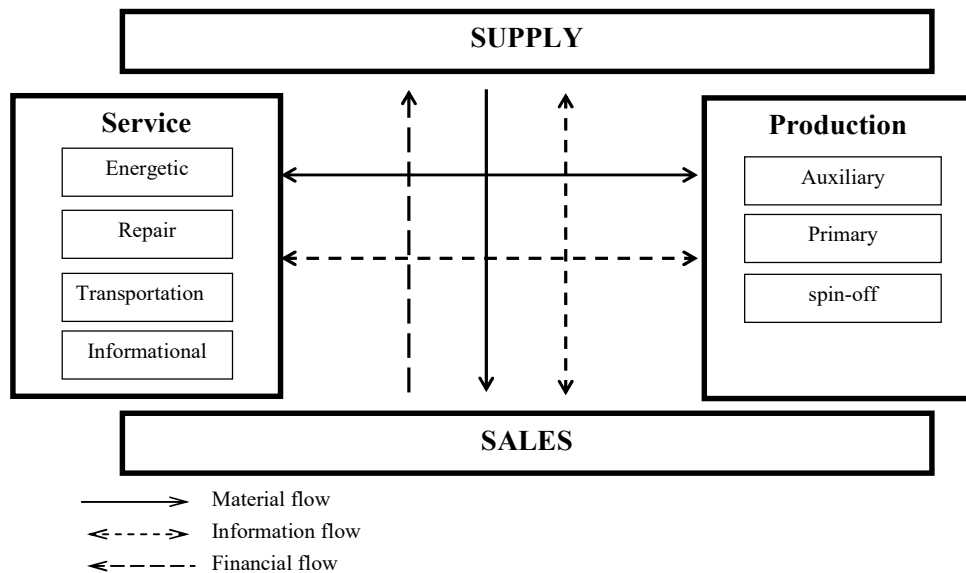


Fig. 1. The structure of the logistics system of an industrial enterprise

The peculiarities of the logistics system of the metallurgical enterprise are due to: the presence of powerful cargo flows of mass and, moreover, massive cargoes (iron and manganese ore, agglomerate, metal scrap, limestone, hard coal, refractories, ingots, rolled goods); large flows of specific cargoes; significant transportation distances; the variety of used types of transport (types of rolling stock and freight vehicles); scattered and a larger number of shops and warehouses (several dozen), which are characterized by the presence of various lifting and transport devices and auxiliary equipment for processing and moving packaged and bulk cargoes.

A industrial enterprise is a complex complex of production shops, technologically and energetically closely connected with each other for the sequential processing of raw materials and semi-finished products into cast iron, steel, rolled products. The composition of the plant's workshops is determined by the nature of the products produced and the features of the metallurgical production technology.

In the mining and metallurgical complex, depending on the features of separation and combination of technological processes, three types of production concentration are traditionally distinguished: plants; full-cycle factories; factories of an incomplete cycle; mini factories.

The production subsystem of the micrologistic system of the enterprise consists of the main, auxiliary and ancillary shops. The composition of the material flow of a

metallurgical enterprise in the "production" subsystem changes in accordance with the scheme presented in fig. 2.

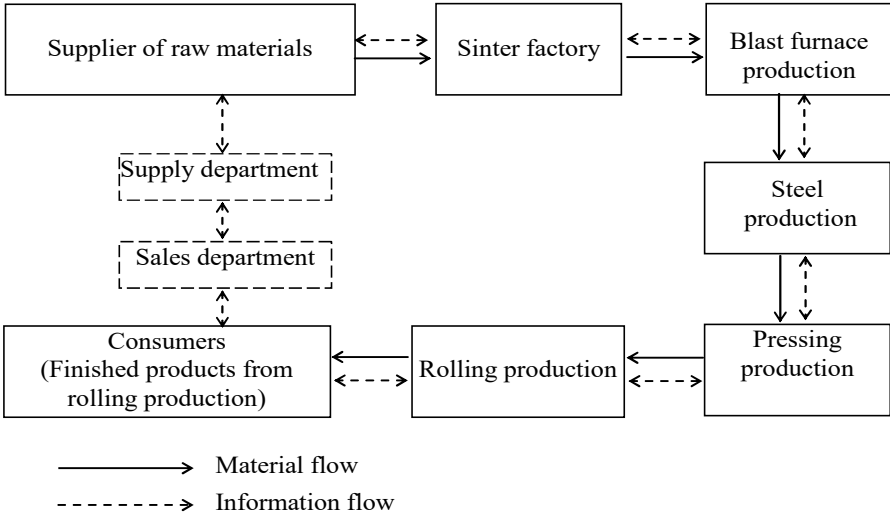


Fig. 2. A simplified diagram of the movement of material and information flows in the "production" subsystem of a metallurgical enterprise

The main object of production logistics management is through material flows. The material flow is understood as a set of raw materials, materials, and semi-finished products that move from suppliers in the form of labor items, enter production units and, turning into finished labor products there, are delivered to consumers through distribution channels [12]:

- powerful cargo flows of massive and heavy cargo (iron and manganese ore, agglomerate, metal scrap, limestone, hard coal, refractories, ingots, rolled steel);
- large and constant flows of specific cargoes (fuel, liquid metals and slag, hot ingots, agglomerate);
- less voluminous cargo flows of material and technical resources for the purposes of repair (capital or ongoing) and construction.

Each material flow is accompanied by informational and financial flows, and the informational and financial flow does not always coincide in time with the material flow. Logistics activity is based on three foundations: technology as a set of all technical means and equipment accompanying material resources; information as a set of all static and dynamic information about the movement of material and immaterial flows in systems; business Economics.

Each material flow passing through the micrologistics system has its own

technological and logistical chain of movement. Technological and logistic chains are understood as interconnected routes of movement of material and information flows. The points of connection of the links of technological and logistic chains are the workplaces of suppliers and consumers of material resources in workshops, where the physical processing of the material flow, its quality control, storage, storage and further transportation is carried out. The equipment of the micrologistics system can be considered as a set of nodal points of the technological and logistical chains of the movement of the material flow, connected by this material flow. The efficiency of material flow management in the production subsystem is largely determined by the technical condition of the equipment and the provision of conditions for its operation.

The classification of the interrelationships of the equipment of the micrologistic system of the metallurgical enterprise according to the degree of relation to the external environment is shown in Fig. 3

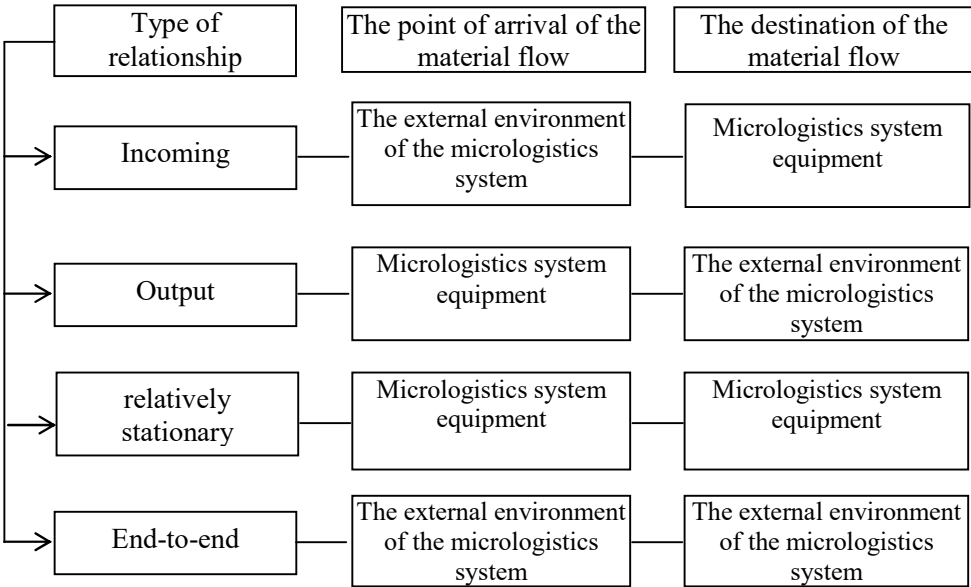


Fig. 3. Classification of interrelationships of micrologistics system equipment

The specificity of all technological and logistical chains of a metallurgical enterprise determines the expediency of using a logistic approach to the study of the economic consequences of technical risks:

- significant (several hundred meters) length of equipment involved in a single technological process;

- a wide range of unit capacities and technological characteristics of individual units;
- strict requirements for the accuracy of maintaining technological parameters (up to 0.2%);
- requirements for reliability and trouble-free operation of the equipment;
- difficult working conditions (shock loads, vibration, high gas and dustiness of the surrounding environment, high temperatures, in many cases, continuous operation of the equipment).

The analysis of metallurgical equipment as elements of the micrologistic system and the interrelationships of structural units within it are determined by ranks, which determine the hierarchical order of the formation of economic consequences at the enterprise level (Fig. 4).

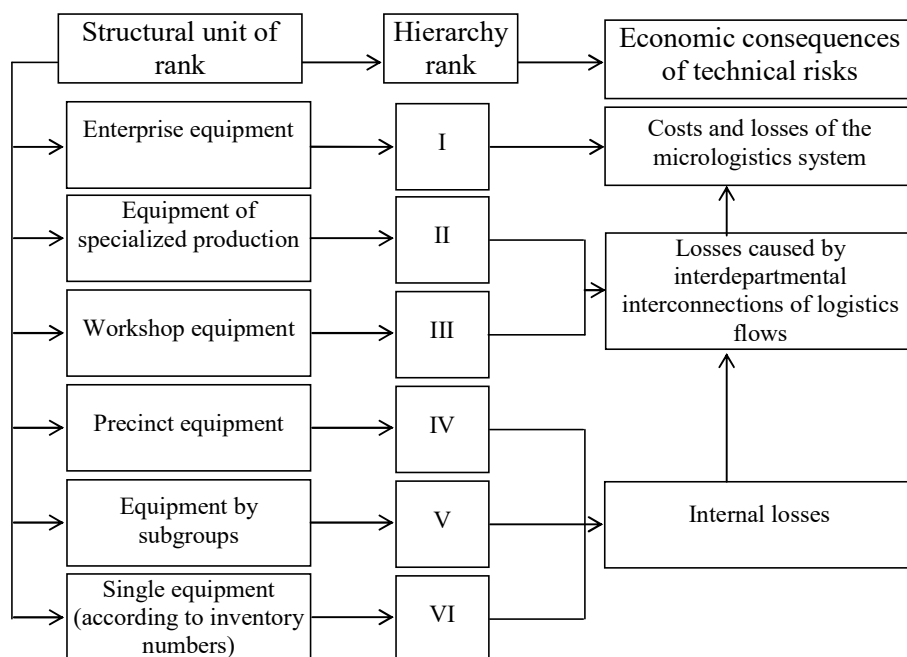


Fig. 4. Hierarchical scheme of formation of economic consequences of technical risks of the micrologistics system

Losses and expenses arising from the occurrence of technical risks starting with single objects - equipment of the sixth rank and accumulating in a hierarchical order to the first level - the micrologistic system of the enterprise. An important role in reducing losses from technical risks along the main chains of the production subsystem belongs to the service subsystem, which is designed to ensure the normal operation of the production subsystem with production services - repairs, transport

services, energy. Energy maintenance provides the enterprise with all types of energy and repairs energy units (power plants, substations, workshops, heating plants, steam boilers, air blowers, oxygen, water pumps, compressors, gas treatment plants). Transport service is provided by rail and road transport to all workshops and farms of the plant (railway network, traction vehicles, depot of steam locomotives and electric locomotives, various devices of suspended and road transport). Computer service provides implementation and technical and software support of information systems. Repair service ensures the manufacture and repair of spare parts, replacement equipment and carries out repair and maintenance of mechanical equipment, metallurgical furnaces, buildings and structures of the plant. The repair service includes the following workshops: mechanical repair, shaped steel foundry, iron foundry, construction repair, rolling mill, electrical repair, as well as a repair shop for metallurgical furnaces. In addition, the service subsystem includes communication shops, control and measuring devices and automation, central factory laboratories.

The service subsystem substantiated in this work from the point of view of the logistic approach is considered in two ways: on the one hand, it is a source of technical risks, and on the other, it is a tool for minimizing the economic consequences of technical risks in the production subsystem, which should ensure the reliable operation of the main metallurgical equipment. The equipment itself, which in ferrous metallurgy is quite complex (machines, aggregates, which, in turn, consist of mechanisms, repair assembly units, assemblies and parts) is the object of technical risks. Figure 5 shows the material, information and service flows in the repair and maintenance subsystem.

The information flow, containing information about failures and also information about the equipment, goes to the decision-making person (DPO). Information flows are received from OPR in the form of:

- information on repair works, which determine the calendar terms for carrying out repairs (per year, per month, per week) and are compiled in accordance with the current provisions on the procedure for the formation and execution of network schedules for equipment repairs), as well as modernization for the reproduction of the equipment resource;

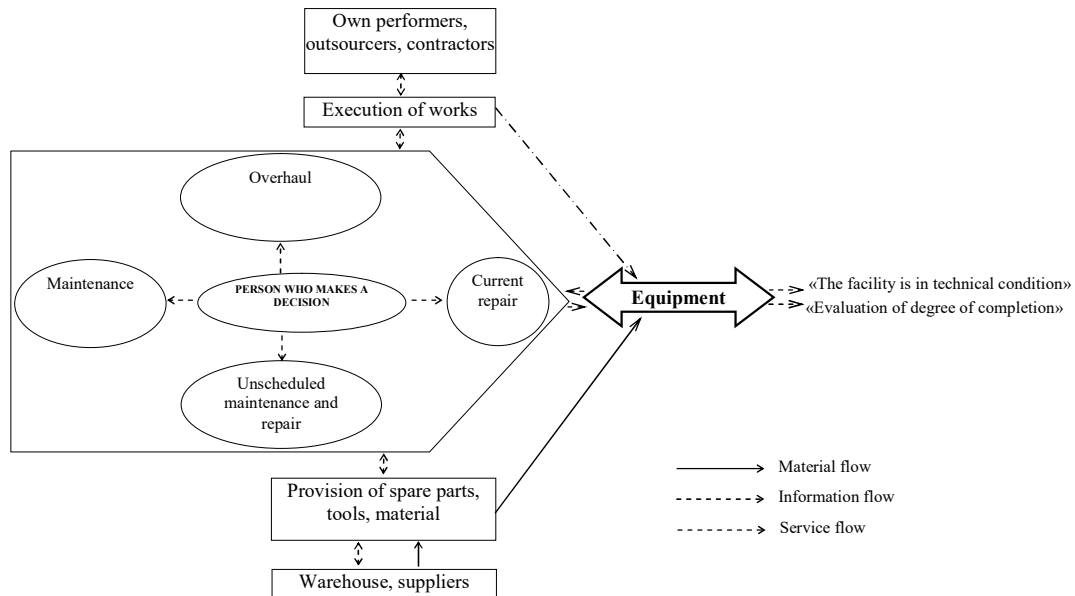


Fig. 5. Equipment repair and maintenance subsystem

– information on spare parts (manufactured in own mechanical workshops of the chief mechanic department, typical ones purchased through the material and technical supply department, typical ones purchased through the chief mechanic equipment department), their quantity and delivery terms;

– information on the provision of technological equipment: its acquisition, design, manufacture, reproduction and repair, accounting, storage and delivery to workplaces;

- information on the execution of repair works: by own forces, contractors, or this business process is outsourced.

Output information flows are presented in the form:

- "Object in technical conditions", i.e. determines the result of the repair service fulfilling its obligations to the customer;

- "Assessment of the degree of completion", which determines the deficit of technical and material support of the repair service in the proper performance of its functions.

The material flow is the spare parts and technological equipment necessary for the repair effect on the equipment.

The service flow is the flow of services of repair personnel, which performs a repair effect on the equipment in the form of capital, ongoing repair, technical maintenance or unscheduled maintenance and repair.

The main function of the repair service of the enterprise is to provide a resource of time for operational equipment, the product of the repair service is the guaranteed operational time of the equipment provided to production. The interests of the repair service must be in accordance with the interests of production.

The relevance of the problem of improving the efficiency of maintenance and repairs is substantiated by leading management specialists. One of the main factors of operational excellence is the efficient operation of equipment. Many post-Soviet companies are noticeably lagging behind Western companies in terms of this indicator: equipment breaks down too often, is idle, and is used unwisely. The reason for such a situation should be sought in the sphere that is on the periphery of the managers' attention. These are repairs and maintenance. It is not easy to reorganize it taking into account modern requirements, but the need for transformation will be felt more acutely every year.

Planning of repairs, maintenance of equipment and costs for their implementation includes the following areas:

- a) detailing and selection of maintenance and repair positions when planning title lists with given resource limitations for the implementation of these measures;
- b) assessment of the actual condition of units and accounting of costs for maintenance and repair;
- c) analysis of the state of objects and the choice of an option for their reproduction.

The effectiveness of the maintenance and repair system, as well as any other system, is determined by the results of activities before costs. The result is a comprehensive indicator of the results of the work of the enterprise (natural, natural, intellectual-natural, etc.). The calculation of costs for technical maintenance and repairs ensures the choice between costs to maintain the efficiency of the business and the size of the risk of unexpected repairs. Expenditures on technical maintenance and repairs must be such as to ensure maximum efficiency of the organization's activities while ensuring market demand (product type, price, services, etc.). Spend your work to the minimum, in order to ensure that you achieve the maximum result. Frequently, the maintenance of the enterprise significantly reduces the amount of

expenses for repairs and maintenance of equipment. Failure to carry out repairs in a timely manner can lead, at a minimum, to an unplanned repair, and at most to an emergency. In case of scheduled repairs, the following factors are at fault:

- increased availability of repairs (it is necessary to purchase spare parts in an emergency order);
- increased trouble with downtime during repairs (starting from preparation to repair, so that in normal mode you get to the point of repair; in case of unscheduled repairs, you have to work even after that point);
- under-delivery of products (repair of this equipment could be combined with the repair of another equipment on the same technological line);
- wastage of raw materials, finished products, and finished products (when the technology transfers the continuity of the production process, this unplanned step can lead to the rejection of raw materials, finished products, and finished products).

In case of emergency repairs, in addition to overinsurance risks, there are risks related to the loss of additional maintenance or property, environmental risks, risks to the health and life of people, etc. As a rule, the total cost of a repair program outweighs the capabilities of the business, and it is necessary to make decisions about the entire part of the work in order to contribute to the budget. The criterion for such a decision is the assessment of technical risks.

Conclusions from this study and prospects for further research in this direction. Today, a large number of specialized software products are used, integrated information systems (ERP, MES, EAM, SCADA, DCS, ASKOE, LIMS) or their individual components are implemented at some large enterprises, but a systematic approach to the management of technical risks and their economic consequences does not exist. These information systems are built into ferrous metallurgy enterprises. They are based on publicly available information from all levels of enterprise management, which implement the functions of achieving a common goal, taking into account the multi-criteria assessment of its activity. The monitoring function, which can be implemented within these systems, is an effective tool for managing all business processes of the enterprise and its divisions, and in particular, managing the economic consequences of technical risks.

Thus, with the development of modern information technologies, it became possible to create complexes capable of assisting the tasks of managing both large engineering networks and performing the functions of managing the economic consequences of technical risks based on monitoring. In turn, it is possible to avoid or overcome technical risks and their economic consequences with the help of the logistics system, by establishing activities in technological chains and predicting possible economic losses of the occurrence of technical risks in one of the elements of this chain.

The implementation of the risk management system requires the use of monitoring and improvement of the database for production and service subsystems of the enterprise and the creation of a knowledge base that will allow assessing the risks of interconnected production and service flows, as well as forecasting economic consequences and optimizing the costs of measures to settle losses in the event of a risk event.

Literature

1. Bowersox Donald J., Kloss David J. Logistical management. The integrated supply chain process. 2017. 640 p. DOI: <https://kniga.biz.ua/pdf/2070-logistika.pdf>
2. Василевський М., Білик І., Дейнега О. Економіка логістичних систем: монографія. Львів. Національний університет «Львівська політехніка», 2018. С. 534-549.
3. Гуменюк А. В., Гарматюк О. В. Формування та організація логістично-збутових систем для підприємств АПК. Приазовський економічний вісник. 2020. Випуск 3(20). С. 99-103.
4. Ковальова М. Л. Логістичне управління: особливості та принципи. Інтелект XXI. 2019. № 5. С. 45-48. URL: http://nbuv.gov.ua/UJRN/int_XXI_2019_5_10.
5. Очеретенко С.В., Кудріна В.Ю. Використання знижок в логістичних системах підприємствах. Системи управління, навігації та зв'язку. Вип. 3. С. 72-75, 2019.
6. Трифонова О.В., Кравець О.Ю. Формування оптимальних логістичних систем у процесі стратегічного управління стійким розвитком підприємства.

Економічний простір. 2019. № 142. С. 217-226.

7. Wallenburg Carl Marcus. Der differenzierte Einfluss unterschiedlicher Performance-Level auf die Kundenbindung bei Logistikdienstleistungen. Zeitschrift für Betriebswirtschaft. Forschungsperspektiven der betriebswirtschaftlichen Logistik. 2008. № 4. Special Issue. P. 55-82.

8. Winkelhaus S., Grosse E. Logistics 4.0: a systematic review towards a new logistics system. International Journal of Production Research. 2020. Vol. 58(1). P. 18-43. DOI: <https://doi.org/10.1080/00207543.2019.1612964>.

9. Бодрецький М.В. Логістичне управління позиковим потенціалом підприємств [Текст] : автореф. дис. ... канд. екон. наук / М.В Бодрецький. К., 2011. - 20 с.

10. Герасимчук З.В. До питання розробки концептуальних засад формування та розвитку логістичних систем [Текст] / З.В. Герасимчук та Н.Є. Циганюк // Вісник СевНТУ: зб. наук. пр. Вип. 122/2011. Серія: Машиноприладобудування та транспорт. — Севастополь, 2011. – С. 175-179.

11. Железняк Валерія Юріївна. Логістичний підхід в управлінні матеріальними запасами на машинобудівному підприємстві : Дис... канд. екон. наук: 08.06.01 / Донбаська держ. машинобудівна академія. Краматорськ, 2005.

12. Борзенков Сергій Валерійович. Формування системи внутрішньовиробничої логістики підприємства з безперервним характером виробництва: дис... канд. екон. наук: 08.06.01 / Східноукраїнський національний ун-т ім. Володимира Даля. - Луганськ, 2004.

References

1. Bowersox, D.J. and Kloss, D.J. (2017), Logistical management. The integrated supply chain process, Moscow, Russia, available at: <https://kniga.biz.ua/pdf/2070-logistika.pdf> (Accessed 15 Feb 2024).

2. Vasylevs'kyj, M. Bilyk I. and Dejneha O. (2018), Ekonomika lohistychnykh system [Economics of logistics systems], Natsional'nyj universytet «L'vivs'ka politekhnik», L'viv, Ukraine, pp. 534-549.

3. Humeniuk, A.V. and Harmatiuk, O.V. (2020), “Formation and organization of logistics and sales systems for agribusiness enterprises”, Pryazovs'kyj ekonomichnyj visnyk, vol. 3 (20), pp. 99-103.

4. Koval'ova, M.L. (2019), "Logistics management: features and principles", *Intelekt XXI*, vol. 5, pp. 45-48, available at: http://nbuv.gov.ua/UJRN/int_XXI_2019_5_10 (Accessed 15 Feb 2024).

5. Ocheretenko, S.V. and Kudrina, V.Yu. (2019), "Use of discounts in logistics systems of the enterprise", *Systemy upravlinnia, navihatsii ta zv'iazku*, vol. 3, pp. 72-75.

6. Tryfonova, O.V. and Kravets', O.Yu. (2019), "The formation of optimal logistical systems in the strategic management process of sustainable development of the enterprise", *Ekonomichnyj prostir*, vol. 142, pp. 217-226.

7. Wallenburg, C.M. (2008), "Der differenzierte Einfluss unterschiedlicher Performance-Level auf die Kundenbindung bei Logistikdienstleistungen", *Zeitschrift für Betriebswirtschaft. Forschungsperspektiven der betriebswirtschaftlichen Logistik*, vol. 4. Special Issue, pp. 55-82.

8. Winkelhaus, S. and Grosse, E. (2020), "Logistics 4.0: a systematic review towards a new logistics system", *International Journal of Production Research*, vol. 58 (1), pp. 18-43. DOI: <https://doi.org/10.1080/00207543.2019.1612964>.

9. Bodrets'kyj, M.V. (2011), "Logistics management of the loan potential of enterprises", Abstract of Ph.D. dissertation, Economy, Kyiv, Ukraine.

10. Herasymchuk, Z.V. and Tsyhaniuk, N.Ye. (2011), "To the issue of developing the conceptual foundations of the formation and development of logistics systems", *Visnyk SevNTU: zb. nauk. pr. Serii: Mashynopryladobuduvannia ta transport*, vol. 122, pp. 175-179.

11. Zhelezniak, V.Yu. (2005), "Logistic approach in managing material stocks at a machine-building enterprise", Ph.D. Thesis, Economy, Donbas'ka derzh. mashynobudivna akademiia, Kramators'k, Ukraine.

12. Borzenkov, S.V. (2004), "Formation of a system of internal production logistics of an enterprise with a continuous nature of production", Ph.D. Thesis, Economy, Skhidnoukrains'kyj natsional'nyj un-t im. Volodymyra Dalia, Luhans'k, Ukraine.

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