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ASSESSMENT OF EFFECTIVENESS OF MODERNIZATION OF TRANSPORT ENTERPRISES IN THE CONTEXT OF ANALYSIS OF INNOVATION DETERMINANT

Abstract. The article is devoted to the generalization of arguments and scientific results in the discussion on the analysis and validity of assessment tools for the effectiveness of modernization of enterprises within the theory of innovative development of economic systems. The main purpose of the study is to formalize the impact of innovation determinant on the effectiveness of modernization of transport enterprises and the construction of economic tools for assessing the effectiveness of modernization. Systematization of scientific sources and modern approaches to the study of innovation processes and their manifestations in the economy, the specifics of modernization of transport enterprises showed that the analysis of effectiveness needs to be improved in terms of valuation and quality assessment and consideration of capitalization and accumulation of modernization potential, innovativeness of changes, intellectualization, digitalization, integration of changes, quality and safety of transport services. The urgency of solving this scientific problem is not only to assess the effectiveness of modernization, but also allows to design strategic directions for promising innovation growth. The study of the effectiveness of modernization of transport enterprises in the context of the analysis of innovation determinant was conducted in the following logical sequence: the conditions and limitations in the tools for assessing the effectiveness of modernization are formalized, then the mathematical formula is built and its components are revealed, then the authors describe each element of the formula in the criterion of the effectiveness of modernization and conduct a mathematical agreement and establishment of the weight of individual indicators, further the sequence of assessment is revealed and the analysis of a condition of functioning of the enterprises of transport sphere for the subsequent implementation of the offered criterion of efficiency of modernization is conducted. The methodological basis of the study was the methods of determining capitalized goodwill, valuation of potential, structural and temporal analysis of innovation processes; comparability of reference and actual parameters, as well as the method of determining the weighted arithmetic mean; tools for analysis of concordance, as well as standard deviation; benchmarking studies of industry trends and financial and economic analysis of the state of transport enterprises. The objects of the study were Ukrainian enterprises of railway, water, air and road transport, which allowed to comprehensively analyze the effectiveness of modernization in the transport sphere. The article presents the results of the empirical analysis of the implementation of the proposed tools for assessing the effectiveness of modernization of transport enterprises, which proved its practical expediency and compliance with the objectives. The study empirically confirms and theoretically proves the determinism of innovative development in modernization processes used in transport enterprises. The results of the study can be useful in

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substantiating the strategic guidelines of innovative development of transport enterprises as they identify problematic sectors in the management of modernization process, as well as areas of strengthening management influence on individual processes of intellectualization, digitalization, integration, ensuring quality and safety when planning modernization changes and fulfillment of modernization potential.

Keywords: innovation determinant, transport enterprises, transport sphere, modernization effectiveness, economic evaluation, marketing research, innovation of changes, intellectualization of modernization, quality of modernization, safety of modernization changes, integration of modernization changes, economic development.

Introduction Innovative development is an integral part of ensuring the adaptability and dynamism of the enterprise's performance, as well as forming competitive advantages, new market characteristics that ensure product quality and safety. Current trends in innovative economic development are the main determinant of the modernization process at enterprises, because it ensures the effectiveness of the fulfillment of accumulated economic potential, competitiveness in a market environment, efficiency and new opportunities for intellectualization, digitalization of both technology and operating processes. Despite the lack of methodological support, the analysis of the effectiveness of modernization of transport enterprises is an important scientific and practical task, the solution of which allows not only to evaluate the financial results of the modernization project, but also to comprehensively characterize further strategic directions of innovative development, changes in the values of assets, increasing competitiveness, etc.

Literature Review. Many modern publications are devoted to the study of innovation processes in the economy. Contemporary approaches to sustainable development, modernization through the introduction of digital technologies, intellectualization, social responsibility, integration and mobility are the subject of research in various fields of human economic activity. Thus, Hopkins (2020) reveals the problem of innovation through the modernization of mobility and integratedness of the tourism and transport sectors. Webster and Gardner (2019) reveal the essence of the concept of «innovation readiness», which reflects the technological and resource base for the development and implementation of innovation, the ability of the economic system to realize goals and adopt new technological innovations. The nanoeconomics of innovations as a tool for constant modernization and transformation of the economic system was substantiated by Ostapenko et al. (2021), who revealed the innovative nature of economic development of the global space of human activity. Danova et al. (2021) also studied the effects of human capital on the effectiveness of innovative development and modernization of enterprises: scientists revealed and substantiated the factors of sustainable development through the description of indicators of competitiveness, intellectualization, labor productivity and profitability. The study of competitiveness and informatization of innovation processes, which in the conditions of market relations and open communications become technologies of increasing innovation activity and investment attractiveness, deserves special attention (Kotenko et al., 2021; Liu et al., 2021; Tkachenko et al., 2021; Andriushchenko et al., 2021; Madiyarova et al., 2019; Palyvoda et al., 2018; Paulus-Rohmer et al., 2016). After all, in the context of globalization and acceleration of the development of information and digital technologies, the issues of expanding markets, regulating export and import flows and logistics of dissemination of innovations and related technologies and resources are acute (Kryvovyazyuk et al., 2015; Smerichevskiy et al., 2020; Argyres et al., 2015; Aulet, 2013; Blank, 2013). The problems of institutional regulation, financial and tax policy in stimulating innovative development by supporting digital modernization of enterprises and transport industry are revealed, in particular, in the scientific publications of Jankowska et al., 2021; Khudolei et al., 2021; Samoilkova et al., 2021; Revina et al., 2020; Blagodir and Filatova, 2020; Low, 2020; Shkarlet et al., 2019; Astanakulov et al., 2019; Bauer et al., 2019; Lester, 2018; Picken, 2017; Dovhal, 2013; Thompson, 2007. In the described scientific studies, not only institutional stimulation of innovative development is actualized, but also the essence and methodology of modernization with the use of innovative and digital technologies is separately defined (Lagodiienko and Yakushko, 2021; Vovk et al., 2021; Voytolovskiy et al., 2021; Nitsenko and Havrysh, 2016; Loebbecke and Picot, 2015).

Special attention should be paid to the studies of transport services markets, their normative regulation, vector of innovative development. The current studies in the field of innovation determinants of renewal and development of transport enterprises include publications of Smerichevskiy and Gura, 2021; Beté et al., 2021; Borysova et al., 2019; Aulman, 2019; Arefieva et al., 2018,; Bondarenko et al., 2018; Danilova, 2012 and others. Thus, the problem of normative assessment of transport modernization is the variability of the vector of its implementation, as well as the lack of mandatory data in the reporting of enterprises on the modernization process. Only the consolidated report of state transport enterprises on the implementation of the financial plan in the section of capital investments indicates the costs planned for modernization (Revko et al., 2020). Therefore, we can say that the value in the regulation of modernization is estimated only using a cost-effective approach. The study by Holod et al. (2021), who substantiated the methodological support of spatial assessment of modernization processes, is devoted to the modernization of the transport sphere as a tool to stimulate the tourist complex. Studies by Tulchynska et al. (2021) reveal the economic essence and the impact of innovation determinants on the modernization of the enterprise to increase their competitiveness

In contemporary scientific research, there are two approaches to assessing the modernization of economic systems:

- firstly, according to Boyko (2014), the most commonly used models of sustainable development analysis are based on a system of indicators that compare the economic effect or productivity with expenses for providing them;
- secondly, Valinkevych (2014), Kasich (2017) believe that at enterprises, the definition of the integrated indicator should be based on the assessment of intermediate relative parameters and in terms of certain types of modernization.

The research team (Tulchynska et al., 2021) expanded the list with the following additions to the assessment methods that can be applied to microeconomic systems:

- analysis of revenues and expenditures for modernization or modernization projects, which is partly regulated by law, and partly related to the analysis of the effectiveness of investment and innovation activities;
- adaptation of strategic analysis methods, as modernization is a process and there is a need to assess its transformational impact on the enterprise.

Methodology and research methods. The study has substantiated the methodological tools for assessing the effectiveness of modernization of transport enterprises, taking into account the effects of innovative development of the economic environment. To substantiate the criterion of modernization effectiveness, methods of determining capitalized goodwill, cost estimation of potential, structural and temporal analysis of innovation processes, which determine the dynamics and direction of modernization, have been used. To formalize the complex indicator of modernization, a methodical approach of comparability of reference and actual parameters has been used, as well as a method of determining the weighted average arithmetic value.

Based on expert analysis, in order to harmonize the indicators, the tools of concordance analysis and standard deviation have been used to determine individual coefficients. This has allowed to determine the importance of coefficients in the structure of individual indicators, as well as to prove the economic viability and mathematical compliance of the selected coefficients and indicators for assessment by the criterion of modernization effectiveness.

The trends in efficiency of managing and criterion of efficiency of modernization process in the conditions of innovative development of transport enterprises are assessed on the basis of benchmarking researches and application of methods of economic diagnostics.

Results. Given the analysis of contemporary scientific publications, methodological support for the assessment of modernization in the transport sphere in terms of innovation determinants can be formalized according to the following terms and conditions:

- limited quantity and quality of indicators: ensures representativeness and reliability of assessment, should take into account the specifics of transport sphere, services and technologies, which consists in simultaneous provision of transport service and its consumption, absence of accumulation, dependence on energy costs and the scale of investment, etc.;
- complexity and innovativeness: the analysis should take into account both the static description of the modernization of the enterprise and the dynamics of change over time; should combine both quantitative and qualitative parameters; modernization can influence not only on the object of innovative renewal, but also on the related systems of the enterprise and its results as a whole; innovativeness determines the quality and duration of the effect of the fulfillment of modernization potential;
- application of economic-mathematical modeling: allows to integrate and harmonize different areas of modernization assessment, components of modernization potential into one indicator;
- reliability, availability and relevance of the information base: statistical and reporting data of the enterprise determine the reliability and timeliness of assessment, trends in the changes of the internal and external environment and the impact of factors on the resulting indicators, the state of resource provision of the enterprise;
- clarity of formulation of assessment objectives: the system of modernization indicators should satisfy management requests for the selectivity and effectiveness of modernization, the level of implementation of objectives, while expanding the set of indicators complicates the analysis;
- stability of the assessment system to changes in the external or internal environment of the enterprise.

As mentioned above, the cost assessment of the modernization process in the transport sphere is represented only by determining the planned costs for its implementation. However, the enterprise of any sphere needs to assess the impact of modernization on the efficiency of activities, separately – to decide on the expediency of modernization projects, and so on. Therefore, we propose to assess the modernization of the transport sphere by the criterion of «modernization effectiveness», which is based on the comparability of capitalized results of modernization changes with the adjusted value of functional potential and takes into account the impact of quality parameters of the modernization process:

$$R_m = \frac{G_m}{\sum_{i=1}^n V p_i \times q_i} \times I_{inov} \times I_{intel} \times I_q \times I_s \times I_d \times I_{int} \quad (1)$$

where R_m – criterion of modernization effectiveness; G_m – cost of capitalized goodwill of the enterprise; Vp – cost of fulfillment of functional potentials in the modernization process; i – type of potential; n – number of types of potentials; q_i – share of potential in the cost of the modernization project; I_{inov} – coefficient of innovativeness of modernization changes; I_{intel} – coefficient of intellectualization of modernization changes; I_q – quality factor of modernization changes; I_s – safety coefficient of modernization changes; I_d – coefficient of digitization of modernization changes; I_{int} – coefficient of integratedness of modernization changes.

The proposed formula (1) for assessing the effectiveness of modernization of transport enterprises is based on the valuation of the resulting indicators by functional types of potentials of transport enterprises and is revealed in the diagnostics of strategic management coefficients by direction, forms and sources of resource provision of innovative development.

Goodwill of enterprises in today's competitive terms of transport companies shows their market position and increased potential value, and therefore reflects the impact of modernization on such effects as changes in stock prices, the dynamics of renewal of assets and their value, trends in market share variability, innovation attractiveness and more. When estimating the value of goodwill, the product of the estimated rate of profitability of the enterprise on the average market profitability in relation to the

capitalization rate is taken into account. Therefore, in assessing individual transport companies that are monopolists in the sector providing technology-specific services (rail transport, port services, air navigation services, etc.), their impact on the cost of goodwill is either taken into account in the quadratic elevation or through the overall profitability of all transport companies. For the purposes of forecasting or taking into account the impact of development processes on the effectiveness of increasing the market value of capital of the transport sphere enterprise in determining the capitalization rate, the deduction method is used. The tools for determining the capitalization rate under this approach lies in taking into account the interest rate discount, which corresponds to the rate of change in the value of income or capital. That is, from the rate that determines the percentage change in future value, the percentage of the future growth allowance is deducted, which is calculated by multiplying the growth rate by the factor of return of capital. In formula (1), the cost of capitalized goodwill of the enterprise refers to the cost of accumulated potential. Thus, the management tools for regulating resource capacity and, consequently, resource effectiveness of modernization of transport enterprises are formed. Monitoring the indicator of innovativeness of modernization of the transport enterprise is based on determining the level of innovation and the ability of the enterprise to appropriate new innovations or develop their own creative technologies. The main coefficients used to formalize the integrated indicator of innovation of transport enterprises include:

- the share of costs for innovation activity in total expenses or production costs;
- the profitability of innovations, which is calculated as the ratio of income from innovation activities to the costs of its implementation;
- the parameter of technology update or part of innovative technologies in the total cost of the technological complex of the enterprise;
- the parameter of updating the range of transport services or the share of innovative products in the total number of its types;
- the share of staff with innovative competencies; the share of staff involved in innovative research; the share of staff with higher education, etc.;
- the parameter of intensity or innovativeness of investments, which is disclosed as the percentage of investments aimed at the introduction of innovations or the ratio of the results of innovation to the investment spent on its implementation, etc.

We believe that in assessing the level of innovativeness in the modernization of transport enterprises, in addition to the variable adaptation of these parameters, it is necessary to take into account the risk of venture funding and time effects on changes in the value of financial resources. The integrated indicator of innovation of modernization of transport enterprises is calculated by summing the following coefficients, adjusted for the relevance of their impact on the innovation of modernization:

- the ratio of discounted profits from innovative products to discounted costs for the development and commercialization of innovative products;
- the ratio of the discounted value of innovative technologies and updated assets to the attracted investment resources;
- the parameter of innovative renewal of productive capital, which is determined by the share of implemented technological innovations in the total number (or value) of updated fixed assets, working capital;
- the parameter of innovative renewal of the management system is estimated through the ratio of the average arithmetic value of the results of innovation activity to the planned figures.

In the process of ensuring the effectiveness of the modernization process in the transport sphere, innovation activity does not fully reveal the continuity and prospects for change. To avoid this problem, the strategic analysis examines the capabilities and competencies of staff in terms of ability to self-development and the impact of the employee on performance. Therefore, in the system of indicators of the criterion of efficiency of enterprise modernization, we propose to single out intellectualization as a

separate factor. In our research we will consider the impact of intellectualization on the development and effectiveness of modernization of transport enterprises through the coefficients of efficiency of intellectual potential, namely:

- profitability of the sale of intellectual capital, which is assessed through income from the use or sale of own technologies or intangible assets;
- productivity of performance of the staff involved in the creation of intellectual products or new technologies for their use in the provision of transport services.

Quality as a relative indicator is studied at the enterprises of the transport sphere to determine the demand or price of services, the cost of their creation, compliance with technical characteristics. In qualimetric assessment of the impact of management quality and quality of transport services on the effectiveness of modernization, we consider it necessary to focus the analysis on the following parameters:

- the ratio of retained reserves formed to cover losses from shortages to the total cost of shortages of products;
- the parameter of certification of products / services in the general assortment of enterprises of transport sphere;
- profitability of certification of new technologies developed by the enterprise (in the absence, the value of the coefficient is one);
- the parameter of compliance of changes with the strategic goals of enterprise modernization.

Diagnosis of the safety of modernization transformations is aimed at determining the effectiveness of the resources invested in its provision, structural consistency between the functional components and their direction. Therefore, the safety factors of modernization include:

- the parameter of legal protection, which is determined by the ratio of the cost of implemented innovative technologies, which are protected by patents and licenses, to the total cost of modernization projects;
- the parameter of ecological safety, which is estimated as the ratio of environmental costs to the amount of losses and compensations due to violations of environmental legislation;
- the parameter of innovation security, which is defined as the ratio of the value of implemented innovations to the cost of capital of the enterprise;
- the parameter of efficiency of financial and economic security is defined as the ratio of insurance costs to the value of insurance contracts with adjustment for profitability of transport enterprises;
- the cybersecurity parameter is calculated as the ratio of costs for innovative information protection technologies to the total costs for informatization;
- the parameter of physical security of modernized assets is calculated as the ratio of revenues from implemented technologies to the costs for physical and legal security.

Digitalization in the process of modernization of transport enterprises is currently the catalyst for sustainable competitive advantage, characterized by the following parameters:

- the share of computerized workstations,
- the share of the use of Internet information sources for the promotion and implementation of transport services, benchmarking, strategic communications;
- the share of licensed software and content in the total value of intangible assets.
- cost-effectiveness of information and digital communications and software.

Forming a composite indicator of modernization effectiveness, we use mathematical tools to compare the obtained estimated value with the reference / average sectoral / target value (Fig. 1).

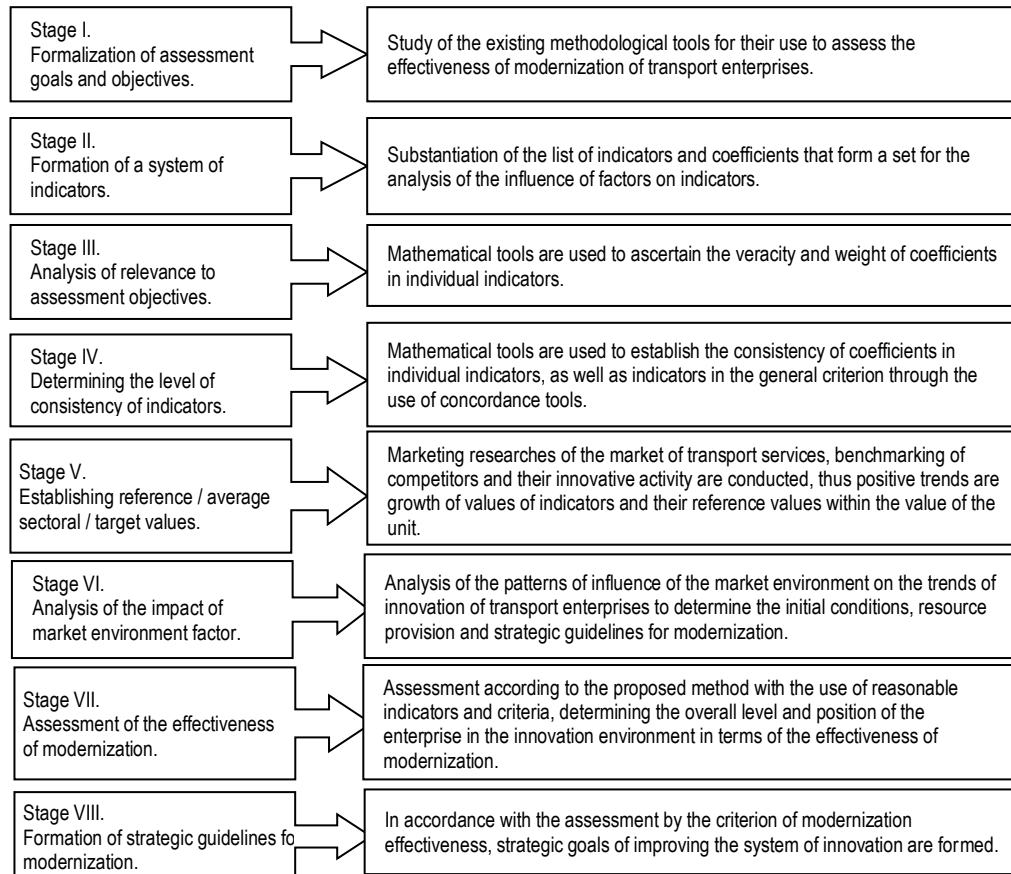


Figure 1. The sequence of analysis of the effectiveness of modernization of transport enterprises in conditions of an innovative environment

Sources: developed by the authors.

The initial stage of forming a methodological approach to evaluating the effectiveness of modernization of transport enterprises is to formalize the purpose, goals and objectives of the analysis, which includes research of existing methodological support for its application or adaptation to the objectives of transport enterprises. At the second stage of modeling the criterion of modernization effectiveness of transport enterprises we will form a list of key indicators for each coefficient.

The third stage of formalization of the model is to establish the weight of indicators in the evaluation system. At this stage, the tools of expert evaluations are used, as well as the conditions of relevance of the results are fulfilled:

- values of indicators are assigned within 0-1;
- the sum of estimates of indicators in one parameter should be equal to one (100%);
- the results of the evaluations must be consistent and reliable;
- the number of variations of estimates will be accepted in accordance with the obtained results.

The given conditions of modeling also include:

- the need for multiplicity of indicators (in total should be from 10 to 30);

- the weight of the coefficients in the indicator is equal to one;
- the use of expert evaluations should be consistent between the cognitive judgments of experts, provided by the application of the concordance coefficient, as well as be within the permissible errors, which is estimated on the basis of the mathematical instrument of standard deviation;
- reference/average sectoral/target values of indicators are set.

Coefficients that adjust the cost ratios are qualitative parameters, and therefore we determine them using the method of expert evaluation, as well as checking the consistency of expert evaluations using the calculation of the concordance coefficient and reliability of estimates with the application of mathematical tools to calculate standard deviation. Consistency of expert evaluations is established by applying the concordance coefficient. In this case, we will consider acceptable the value of the coefficient close to 1, and less than 0.4 is unacceptable. To calculate the consistency of the statements of experts, a rank gradation of their estimates is performed. The article presents the results of a study on the establishment of the weight and consistency of indicators (Table 1).

Table 1. Gradation of ranks of estimations of weight and coherence of indicators in parameters of factor on criterion of effectiveness of modernization, numerically*

Indicators	The weight of the indicator in the structure of the criterion	Concordance coefficient
1.1. Coefficient of innovativeness of modernization changes	0,2948	0,9119
1.2. Coefficient of intellectualization	0,1720	0,8953
1.3. Coefficient of quality of modernization changes	0,1218	0,7325
1.4. Coefficient of safety of modernization changes	0,1187	0,9821
1.5. Coefficient of digitization	0,1823	0,8742
1.6. Coefficient of integratedness	0,1098	0,9141

Sources: developed by the authors.

The consistency of expert research falls in the range of 1-0.7, so we can reasonably say about the economic expediency and mathematical relevance of the proposed model. The fifth stage of modeling the process of diagnosing the innovative impact on the effectiveness of modernization of the enterprise is to establish reference/average sectoral/target values of selected indicators. Since all the proposed indicators for each parameter reflect the relative dynamics of change, we will consider their growth as a positive assessment, and the reference value will be more than one. Marketing studies of the effectiveness of transport enterprises have shown high rates of the effectiveness of innovation activity and increase in modernization at the enterprises SE «UkSATSE», SE «Ukrainian Sea Ports Authority» and SE «Boryspil International Airport». The following trends, considering domestic incentives and financial results, are provoked by the following patterns of market behavior and competitive positions:

- monopoly or dominant position in the sector of providing certain types of services (for example, «UkSATSE» is the only operator for the provision of air navigation services);
- high level of professional and specialized training of staff, as well as high regulatory requirements for the level of education, experience and continuing professional development;
- involvement of state funding in the implementation of plans for modernization changes, as well as subvention grants for the modernization of individual transport facilities that are part of the property complex of enterprises;
- high technological requirements for the technical condition of assets and transport facilities, constant monitoring of the technical condition, which is the cause of low physical wear and investment direction and focus on improving technologies and management systems;

- high level of integration and interaction in the international economic space and formed logistics systems within enterprises;
- the presence of corporate responsibility, a stable team and competitive selection of staff, their access to commercial infractions, which marks a positive impact on economic security and safety of technology.

At the same time, we should note the impact of the crisis characteristic of all enterprises in the transport sphere:

- the financial condition of transport enterprises mainly shows the loss of current activities, which is an obstacle to innovative renewal or modernization;
- the technological wear of vehicles that leads to high energy consumption, coverage of repair costs and investment to replace equipment;
- social orientation, which should have been provided with institutional support, but falls to the budget of the company's costs, which complicates the provision of profitability, capitalization of profits;
- the lack of optimization reforms in the organizational structure of the enterprise, excessive administrative costs, which negatively affects the accumulation of investment opportunities, low investment attractiveness;
- grant nature, which does not motivate the search for solutions to improve efficiency, investment activity;
- the global crisis caused by Covid-2012 also had a negative impact on the accumulation of financial resources to ensure modernization through reduced traffic and, consequently, reduced net income.

Investigating endogenous factors of ensuring the effectiveness of modernization of transport enterprises, the following basic intrinsic system features (Fig. 2) should be taken into account.

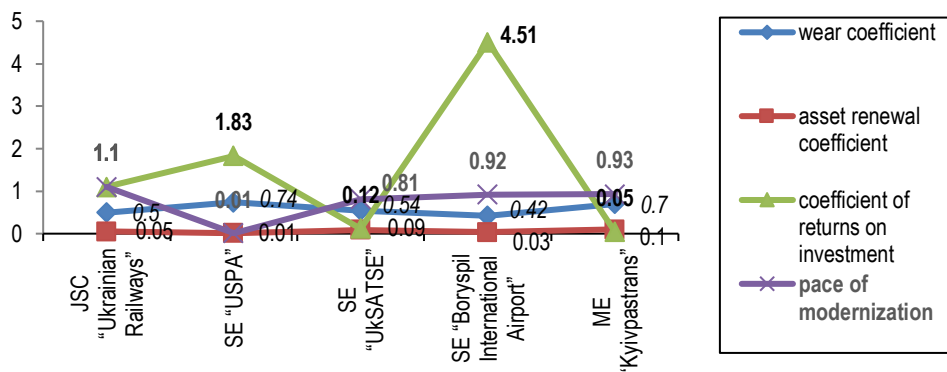


Figure 2. The average annual value of indicators of modernization changes at the enterprises of the infrastructure sphere for the period 2015-2020

Source: calculated by the authors.

- to ensure the functioning of the means of providing services or creating conditions for its receipt, enterprises need to invest in technical upgrades of fixed assets – rolling stock, transport facilities, logistics network;
- staff should have special technical skills and, providing services or working in service departments, ensure the timeliness and complexity of the development of new technologies;
- most services are created and consumed simultaneously, so the perception of quality and safety of transport services depends on preventive conditions: aesthetics and safety, awareness and formed

expectations of the consumer, the technical condition of vehicles and infrastructure, the availability of related services;

- organizational structure and its optimality: as the practice of monopolists in the transport sphere shows, not only the effectiveness of modernization, but also the profitability of the whole enterprise depends on the effectiveness and rationality of administrative costs;
- the provision of transport services is connected with the previously formed logistics system of resource provision, routes, information and staff support, the financial condition of the enterprise;
- the processes of intensification of innovative changes depend on the ability of the personnel of transport enterprises to create and master innovative technologies, apply them effectively, as well as collectively create new competitive advantages for the enterprise. This endogenous property requires constant motivation and stimulation of staff, but the effectiveness of its implementation ensures the sustainability and leadership of modernization technologies.

The described internal conditions of the modernization process at the enterprises of the transport sphere are confirmed by the calculations of the criterion of modernization effectiveness. The dynamics of changes in the effectiveness of the modernization process in the studied enterprises has shown no dependence on the scale of services and priority of a linear dependence on investment and innovation activity, assets and profitability in the outcomes (Fig. 3).

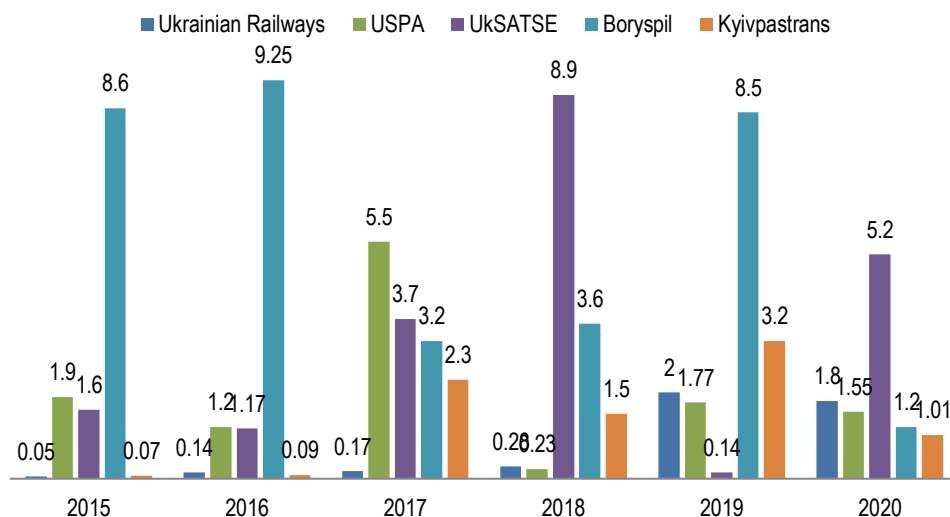


Figure 3. Dynamics of the calculated value of the criterion of «modernization effectiveness» at the enterprises of the transport sphere for 2015-2020, numerically*

Source: developed by the authors on the basis of data from the analyzed enterprises.

As we can see, the high values of the criterion are demonstrated by SE «Boryspil International Airport», SE «UkSATSE», and low values of the modernization criterion are present at the enterprises of JSC «Ukrainian Railways». The dynamics of growth has been shown by the SE «Ukrainian Sea Ports Authority», as well as, starting in 2017, by ME «Kyivpastrans».

The State Enterprise «Ukrainian Sea Ports Authority» (hereinafter SE «USPA»), which regulates the activities of all seaports of Ukraine, currently operates in the direction of ensuring the efficiency and profitability of the use of port facilities. In fact, as transit logistics hubs for import and export cargo, seaports

depend on the volume of trade agreements, consumption of imported products and domestic exports. That is, the agricultural and industrial complexes of the domestic economy, as well as the activity of international markets have a significant impact on the efficiency of the use of port facilities of the SE «USPA». The assessment of the effectiveness of modernization in the conditions of innovation determinant shows a high level of innovation activity and the scale of investment in the modernization of port infrastructure. Thus, during the period under study, SE «USPA» increased the amount of funding for innovations in modernization processes, including the fact that the effectiveness of modernization tripled in 2017 compared to 2015. These positive trends are due to balanced and consistent innovation and investment activities, which consist in the following steps:

- after the creation of a single enterprise in 2013, all state property in the port economy was accumulated, while the management functions and ship ownership of ports were preserved, which preserved their profitability;
- intensification of investment activities, including on the terms of the concession;
- compliance with international standards on the condition of ports and their waters, ensuring the quality and safety of port services, including and related services;
- implementation of large-scale investment projects to expand delta ports, modernize and build new ones, use advanced technologies.

Collectively, this ensures high efficiency of management and modernization of SE «USPA» and its competitiveness. «UkSATSE» is the only certified air traffic operator in Ukraine. High standards of aviation and flight safety require constant updating of technical equipment and air navigation equipment to service all aircraft entering the sky in Ukraine. Therefore, today the air transport enterprise has the necessary equipment and constantly monitors international markets and technologies. Remaining a monopolist and having a high level of technological equipment, «UkSATSE» also has a highly educated staff. Not only historically established standards of collective integrity and high standards for the entry of new professionals in the field of air navigation, but also high specificity, competition in the labor market of such professionals provoke innovative and scientific activity of air navigation staff. In addition, «UkSATSE» expands professional standards for employees, involving them in the teaching practice of training and internships for young specialists-air controllers. The availability of intelligent and innovative technologies makes «UkSATSE» a leader not only in the segment of aeronautical infrastructure, but also in the field of advanced training and retraining of aeronautical staff. These management conditions are reflected in the results and dynamics of their change. Thus, for the study period 2015-2016 were not the best in the management of the enterprise, which was provoked by the loss of control over part of the assets due to the seizure of the territory of Ukraine, including revenue from navigation to popular destinations. However, since 2017, the company has demonstrated a high rate of modernization, which exceeds the level of absolute modernization and shows leadership in the field. Obtained values for the period 2017-2019 testify to innovation activity and the formation of own sources of profitability through developed modernization technologies, intellectual capital and monopolization of the innovation market in the field of air navigation. A positive factor for increasing the modernization potential is receiving large payments on court decisions, which the management will also direct to innovation and investment activities.

«Boryspil International Airport» was modernized in 2012 as part of an infrastructure upgrade for the Euro 2012 football championship. For today, remaining the largest hub airport in Ukraine, in 2019, «Boryspil» expanded the service space for airlines and passengers by opening the renovated Terminal F, retaining high shares of air transportation markets (about 62% of all air passengers served, with about 30% of transfer passengers of international transit flights). In accordance with the goals of the airport development, modernization is conducted in the areas of technological renewal, introduction of innovations in security systems, passenger and baggage service, spatial optimization to ensure the management of other airlines in the area. Another important area was the expansion of services and operation of terminals. But due to the decrease in traffic due to the pandemic in 2020, the airport has reduced investment

programs and introduced anti-crisis policies. Despite the negative effects of the pandemic, we note the factors that ensure the leadership of «Boryspil International Airport» in the context of modernization:

- as calculations have shown, in 2017-2020 the airport had the highest competitive position in terms of efficiency of modernization potential, while maintaining leadership status;
- the leadership of «Boryspil International Airport» is provoked not only by large-scale modernization projects, but also by the profitability of aviation and related activities, because after the introduction of visa-free regime for Ukraine, air traffic has grown steadily, except for the crisis of 2020, when the airport suffered net losses due to lockdowns and reduction of air traffic;
- availability of long-term agreements with air carriers, which provides the airport with revenue and provokes constant monitoring of suitability and modernization activity;
- availability of investment support and targeted financial infusions for the modernization of airport infrastructure.

The estimated effectiveness of modernization of «Kyivpastrans» company in terms of innovative development shows the lack of resilience of the company to negative impacts, because from the level of intensive modernization, the company in 2019 reduced the value of effectiveness to a sustainable modernization position. Such trends indicate either a reallocation of resources to other types of capacity or a decrease in profitability. Having strong competitors in the form of private road carriers, «Kyivpastrans» company maintains the volume of traffic and the cost of services. At the same time, unlike competitors, it implements programs for rolling stock renewal, energy saving, and introduces digitalized technologies to ensure the safety of transportation, payment for services and passenger service. The main modernization factors for «Kyivpastrans» are:

- the need to ensure social standards provokes the modernization of rolling stock and passenger services;
- profitability depends on the volume of traffic and state financial support of the municipal owner;
- investments are made mainly from own funds, but there are programs and grant projects that are implemented in social projects of the enterprise;
- the increase in the effectiveness of modernization processes is directly proportional to the growth of enterprise revenues and traffic volumes;
- the innovative nature of modernization is not developed due to the low level of scientific and research work;
- the company has a system of social standards for employees, but their financing creates additional administrative costs.

Thus, «Kyivpastrans» implements a stable modernization policy and increases its economic potential. The enterprise also needs to research global standards and innovation markets to implement better ideas in operating and passenger services.

The calculations show that all surveyed enterprises in the infrastructure sector have high modernization capabilities, but «Kyivpastrans» uses them inefficiently (see Fig. 3). We can also say that the assessment of the effectiveness of modernization has shown the monopoly position of aviation companies in the market, which is due to the priority of state support of «UkSATSE» and «Boryspil». At the same time, JSC «Ukrainian Railways», being the monopolist in the market of railway transportation, has a low level of effectiveness of modernization, which is due to the focus on technological renewal of fixed assets. In summary, we note that companies that are mastering digital technologies in customer service, asset management, have a high level of effectiveness of modernization, the main reasons for which, in our opinion, are:

- the impact of profitability (because there is a reduction in administrative costs);
- the intellectualization and increase in the level of competence of employees;
- improving the perception of quality and safety of transport services by consumers;

- the application of international technologies and integration into competing markets.

Conclusions. In order to substantiate the methodology of analysis of the effectiveness of modernization of transport enterprises, an approach based on the comparison of capitalized economic results of modernization changes with the adjusted cost of realization of functional potentials was proposed. The proposed methodological approach takes into account the influence of qualitative parameters of innovation impact on the modernization process, namely, the coefficients of innovativeness, intellectualization, quality and safety of modernization changes, digitalization and integration of innovation processes have been substantiated. The calculations of consistency in the individual coefficients of the model have shown the acceptability of many selected indicators and their weight, as well as the consistency of expert evaluations.

The analysis has shown that high values of the criterion of modernization effectiveness are demonstrated by SE «Boryspil International Airport», SE «UKSATSE», low values of the criterion of modernization are present at the enterprise JSC «Ukrainian Railways». Dynamics of growth was shown by the SE «USPA» and also, starting from 2017, the Municipal Enterprise «Kyivpastrans», which was provoked by their intensification of innovation potential and reorientation to new technologies of providing transport services.

Further studies on the effectiveness of modernization in the context of innovative development of transport enterprises should be aimed at building a system of strategic guidelines that will take into account problematic sectors in the management of modernization potential, and will be aimed at intensifying innovations in ensuring the quality and safety of transport services, intellectualization and integration, digitalization of transportation processes. The implementation of the hypothesis regarding the impact of innovation determinants by formalizing the theory of modernization is also a promising development of the proposed methodological support for defining the effectiveness of modernization.

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Оцінювання ефективності модернізації транспортних компаній у контексті аналізу інноваційних детермінант

Стаття присвячена узагальненню аргументів та наукових результатів у дискусії щодо аналізу й обґрунтованості оціночного інструментарію ефективності модернізації підприємств у межах теорії інноваційного розвитку економічних систем. Основною метою проведеного дослідження є формалізація впливу інноваційної детермінанти на результативність модернізації транспортних підприємств та побудова економічного інструментарію оцінювання ефективності модернізації. Систематизація наукових джерел та сучасних підходів до дослідження інноваційних процесів і їх проявів у економіці, специфіки модернізації транспортних підприємств засвідчили, що проблематика аналізу ефективності потребує удосконалення в напрямках вартісної та якісної оцінки і врахування процесів капіталізації та акумулювання модернізаційного потенціалу, інноваційності змін, інтелектуалізації, цифровізації, інтегрованості змін, якості й безпеки транспортних послуг. Актуальність вирішення зазначеного наукового завдання полягає не лише у оцінюванні ефективності проведеної модернізації, а й дозволяє проектувати стратегічні напрями перспективного інноваційного зростання. Дослідження ефективності модернізації транспортних підприємств в контексті аналізу інноваційної детермінанти здійснено у наступній логічній послідовності: формалізовано умови та обмеження в інструментарії оцінювання ефективності модернізації, далі побудовано математичну формулу та розкрито її складові, потім автори описали кожен елемент формули в критерії ефективності модернізації та провели математичне узгодження і встановлення вагомості окремих показників, в подальшому розкрито послідовність оцінювання та проведено аналіз стану функціонування підприємств транспортної сфери для наступної імплементації запропонованого критерію ефективності модернізації. Методичним базисом проведеного наукового дослідження стали методи визначення капіталізованого гудвілу, вартісного оцінювання потенціалу, структурного та часового аналізу інноваційних процесів; співставності еталонних та фактичних параметрів, а також методика визначення середньозваженої арифметичної величини; інструментарій аналізу конкордації, а також середньоквадратичного відхилення; бенчмаркетингові дослідження галузевих трендів та фінансово-економічного аналізу стану підприємств транспортної сфери. Об'єктами дослідження стали українські підприємства залізничного, водного, авіаційного та автомобільного транспорту, що дозволило комплексно проаналізувати ефективність модернізації у транспортній сфері. В статті представлено результати

емпіричного аналізу імплементації запропонованого інструментарію оцінювання ефективності модернізації підприємств транспортної сфери, що засвідчив його практичну доцільність та відповідність поставленим завданням. Дослідження емпірично підтверджує та теоретично доводить детермінізм інноваційного розвитку у модернізаційних процесах застосовані на підприємствах транспортної сфери. Результати проведеного дослідження можуть бути корисними при обґрунтуванні стратегічних орієнтирів інноваційного розвитку підприємств транспортної сфери оскільки дозволяють виявити проблематичні сектори в управлінні модернізаційним процесом, а також напрями посилення управлінського впливу на окремі процеси інтелектуалізації, цифровізації, інтегрованості, забезпечення якості та безпеки при плануванні модернізаційних змін і реалізації модернізаційного потенціалу.

Ключові слова: інноваційна детермінанта, транспортні підприємства, транспортна сфера, ефективність модернізації, економічна оцінка, маркетингові дослідження, інноваційність змін, інтелектуалізованість модернізації, якість модернізації, безп. безпековість модернізаційних змін, інтегрованість модернізаційних змін, економічний розвиток.