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Sokolova L.

DEVELOPMENT OF THE ECONOMIC MECHANISM FOR MANAGING THE RESOURCES OF RAILWAY TRANSPORT ENTERPRISES

The object of research is resource management of railway transport enterprises. One of the most problematic areas is the development of a mechanism for managing the resources of enterprises, taking into account the characteristics of individual indicators of their activities. The resource management process is implemented on the principle of «deviation management».

The analysis of modern theoretical and methodological approaches to ensuring the management process of railway transport enterprises is carried out. Certain shortcomings of existing approaches to enterprise resource management are identified, taking into account their industry specifics, shortcomings in managing their activities in a competitive environment.

In the course of the study, the approaches to modeling the process of resource management of railway transport enterprises were used. It has been determined that the theoretical basis for the formation of a resource management mechanism for railway transport enterprises is a theoretical research platform, which is a set of basic interrelated terminological concepts and categories. An important component of the enterprise resource management mechanism is the unit for assessing the integral indicator of the resource management efficiency of railway transport enterprises.

The peculiarities of the synthesized mathematical model for assessing the integral indicator is the use of temporal local indicators of stimulants and destimulants, which reflect the dynamics of changes in the aggregate of both well-known and specific for industry enterprises indicators of the effectiveness of managing various types of resources of railway enterprises.

Thanks to this, it is possible to analyze the dynamics of the numerical values of the desired indicator, which makes it possible to evaluate its trend over time – a positive (with growth) or negative (with a decrease) trend of change. A critical examination of the data obtained will provide management with important exclusive information, the use of which will contribute to increasing the level of scientific validity of decisions taken at the stage of strategic planning, when drawing up business plans for the development of railway enterprises.

Keywords: *trend watching, theoretical platform, mathematical model for assessing the integral indicator, deviation management.*

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1. Introduction

The implementation of the promising sustainable development goals of each country is based on the implementation of a number of global tasks, one of which is the modernization of infrastructure. This affects the competitiveness of business entities – industrial enterprises and, in particular, railway transport enterprises [1].

Today there is an urgent need to pay increased attention to improving the resource management mechanism of these enterprises. Therefore, at present, for the transport enterprises of the country, including railway transport enterprises, solving the problem of increasing the level of efficiency of resource management is a rather important task of the present for the national economy as a whole.

Thus, research and modeling of the resource management process of railway transport enterprises of the country and the introduction of the development into the practical activities of business entities is an urgent problem and requires further solutions.

2. The object of research and its technological audit

The object of research is resource management of railway transport enterprises. Let's consider the development of transport enterprises on the example of Ukraine, which have significant prospects both in terms of meeting domestic needs and the possibilities of expanding their presence in foreign markets for the transportation of goods and population. Railway transport is a strategic branch of the transport system, providing the largest traffic volumes and has a developed infrastructure, providing foreign economic relations [2]. However, the sustainable development of railway transport enterprises is hindered by the negative impact of a certain set of factors, both external and

internal environment [3]. Among the totality of factors of internal genesis, special attention is paid to such as an insufficiently adequate level of qualifications of top managers, which negatively affects the effectiveness and quality of management decisions on the use of resources.

So, one of the most problematic areas is the study of the aspects of modeling a rather complex process of resource management of railway transport enterprises, its effectiveness, taking into account the sectoral specifics of management at enterprises. The problem can be attributed to poorly studied, which, in turn, provides ample opportunities for further research.

3. The aim and objectives of research

The aim of research is to form an organizational mechanism for managing the resources of railway enterprises. To achieve this aim, the following objectives have been identified:

1. Conduct a trend-watch of the main indicators of the activities of railway transport enterprises.
2. Develop a theoretical research platform.
3. Form an ordered sequence of components of the economic mechanism of resource management.
4. Synthesize a mathematical model for calculating the integral indicator for assessing the effectiveness of resource management of railway enterprises.

4. Research of existing solutions of the problem

The work of many scientists is devoted to the study of theoretical and methodological aspects of resource potential management, resources of enterprises of various industry affiliation, the relationship of high-quality, efficient resource management of industrial enterprises and the level of their competitiveness. The role and importance of railway transport for the development of the national economy and meeting the needs of the population is growing, and this leads to an increased interest of scientists in solving many existing problems of the functioning of this strategic branch of the transport system.

Among the main directions of solving the problem of resource management of railway transport enterprises, identified in the resources of the world periodicals, can be distinguished [4]. However, this work does not consider approaches to the management of various types of enterprise resources, except for labor and financial resources, narrows the focus of the problem under study.

The authors of works [5, 6] show how resource saving strategies are developed. But the issue of taking into account the results of resource conservation, that is, a mathematical model for assessing the dynamics of changes in various types of enterprise resources, remains unaddressed. And in [6], the development of a resource conservation management mechanism is not fully disclosed.

The authors of the work [7] show the assessment of the impact on the workers of Russian railways (labor resources) of the negative influence of the biological factor, it allows to control the deviation. But there remains the question of applying this principle in relation to other types of enterprise resources.

The authors of [8] emphasize the importance of exergy analysis of the use of energy resources at railway enterprises in China. Although such an approach to the problem of managing the preservation of this resource can be considered from the side of thermodynamic analysis of systems, the development of thermal circuits, optimization of parameters, intensification of heat transfer processes and the development of new types of heat exchange equipment.

The work [9] is devoted to the consideration of a set of management issues related to economic and legal, strategic, operational, marketing, innovative aspects of the activities of railway transport enterprises. However, specific issues of managing innovative, production, information, labor, marketing types of resources remain unresolved.

The authors of [10] emphasize the importance of evaluating the technical indicators of fixed assets - locomotives. The introduction of the methodology makes it possible to identify shortcomings in the operation of rolling stock and to formulate measures to improve the quality of operation. Although this statement can be considered from the perspective of the feasibility study for the implementation of the methodology.

According to the author of [11], there is a need to manage the balanced development of enterprises. But the question remains how to assess the effectiveness of enterprise resource management, which is an influential factor in their development.

The authors of [12] emphasize the importance of the features of the implementation of the main management functions, although this statement can be considered in more detail from the standpoint of resource management of railway enterprises.

The features of human resource management at railway transport enterprises are shown in [13]. However, the proposed measures relate to theoretical proposals, which are undefined parameters, do not allow for deviation control.

The work [14] considers quality management as a factor in ensuring the competitiveness of enterprises. But the question remains, how and by managing what resources this is possible.

The authors of [15] show that the resource strategy of enterprise management acts as a tool for ensuring competitiveness. However, this work does not fully disclose the mechanism for effective management of all types of enterprise resources.

An alternative solution to the problem, set out in [16], does not provide for the formation of a resource management mechanism at railway transport enterprises, as well as an assessment of the effectiveness of resource management.

So, the main studies on the topic of resource management at railway transport enterprises are considered, the features of enterprise management in this industry, the main problems that occur in the real conditions of enterprise management, are determined. But many applied issues related to the development of a modern, effective mechanism for managing the resources of railway transport enterprises, modeling an integral indicator for assessing the effectiveness of resource management of these enterprises still require a constructive solution. They acquire special attention in the context of heightened competition in the transport services market in the country and abroad.

5. Methods of research

General scientific and special research methods were applied during the research:

– analysis and synthesis – for preliminary analysis with the formation of a problem and definition of goals, research approaches to assessing the level of efficiency of resource management of enterprises;

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– trend-watching – to analyze trends in the main indicators of the activities of railway transport enterprises;
– expert method – for constructing an integral indicator for assessing the level of an integral indicator of the management efficiency of railway transport enterprises;
– graphic method – for visual presentation of the results of the analysis of the main indicators of the activities of railway transport enterprises;
– decomposition method – for decomposition of the development of a resource management mechanism for railway transport enterprises, including both basic and additional resource management functions.

6. Research results

It should be noted once again that, firstly, the efficiency of economic development of railway enterprises of the country is inextricably linked with the effective management of resources. Only those decisions that are made on the basis of relevant, reliable, scientifically processed information can be justified. Secondly, the most important indicators of efficiency of economic development of railway transport enterprises of Ukraine, and these are first of all indicators that form the profit of these enterprises and are key factors of their success in a competitive environment [17], are characterized by a negative trend over time. To fulfill the tasks set in the work, it is necessary to develop both an effective mechanism for resource management based on a theoretical research platform and a mathematical model of an integrated indicator for assessing the level of efficiency of resource management of railway transport enterprises. In the Table 1 according to the State Statistics Service of Ukraine [18] provides data on the change in time of cargo volumes and changes in the number of passengers who were transported by rail of Ukraine.

According to the results of data analysis Table 1, it can be stated that the numerical values of the required indicators of the volume of freight traffic and the number of passengers transported, since 2012, are constantly decreasing. Such a tendency is characterized as shown in Fig. 1 the rate of increase in the volume of goods transported in Ukraine for the period 2002–2019.

Table 1

Dynamics of the volume of cargo transportation and the number of passengers by rail in Ukraine

Year	Cargo volume, million tons	Number of passengers, thousand people
2002	391	464810.4
2003	443.5	476742.4
2004	460	452225.6
2005	448.7	445553.1
2006	476.8	448421.7
2007	512.5	447093.7
2008	498.8	445465.7
2009	391.2	425974.8
2010	432.5	427240.6
2011	468.4	429784.9
2012	457.5	429115.3
2013	441.8	425216.9
2014*	387	389305.5
2015*	350	389794.1
2016*	344.1	389057.6
2017*	339.5	164941.6
2018*	322.3	157962.4
2019*	312.9	154811.8

Note: developed based on data from [18]; * – excluding the temporarily occupied territory of the Autonomous Republic of Crimea. Sevastopol and parts of the temporarily occupied territories in Donetsk and Luhansk regions

The trend lines for the volume of cargo transportation and the number of passengers transported by rail in Ukraine are shown in Fig. 2 and Fig. 3 respectively.

The graph of dynamics and the trend line of the number of passengers carried by rail in Ukraine are shown in Fig. 3.

Railway transport is a branch of the economy, which is located at the junction of the manufacturing and service sectors. The work of transport is characterized by freight and passenger transportation, freight and passenger traffic. From the graphs in Fig. 2, 3 it is possible to see that the volume of cargo transportation and the number of passengers in Ukraine in 2002–2019 in Ukraine decreased. Trend lines (trend watching) are characterized by a steady downward trend over time.

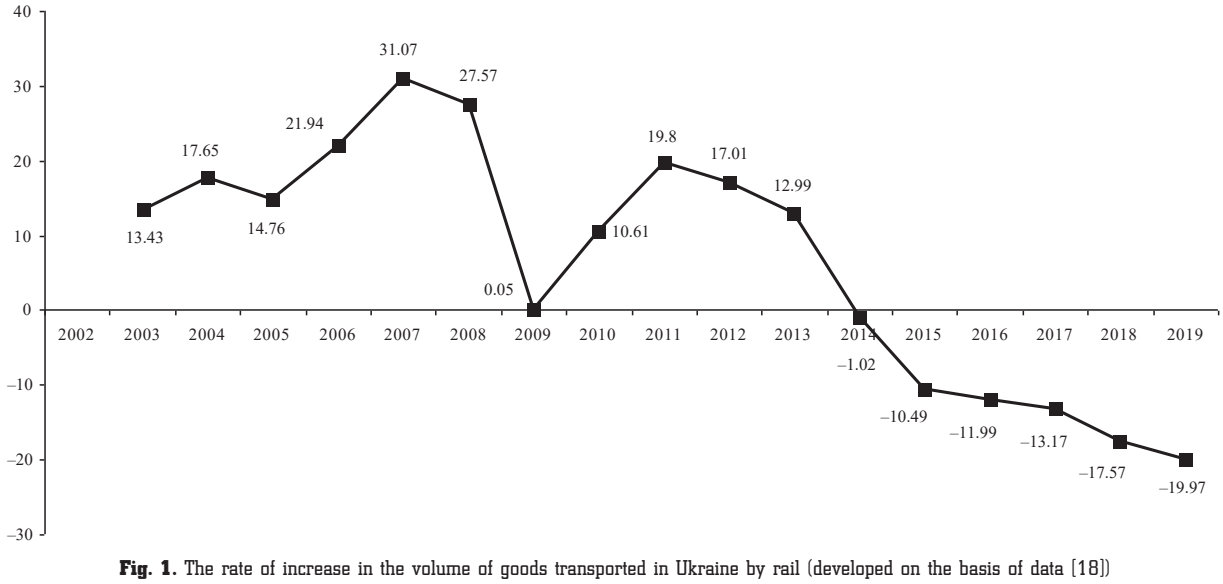

Fig. 1. The rate of increase in the volume of goods transported in Ukraine by rail (developed on the basis of data [18])

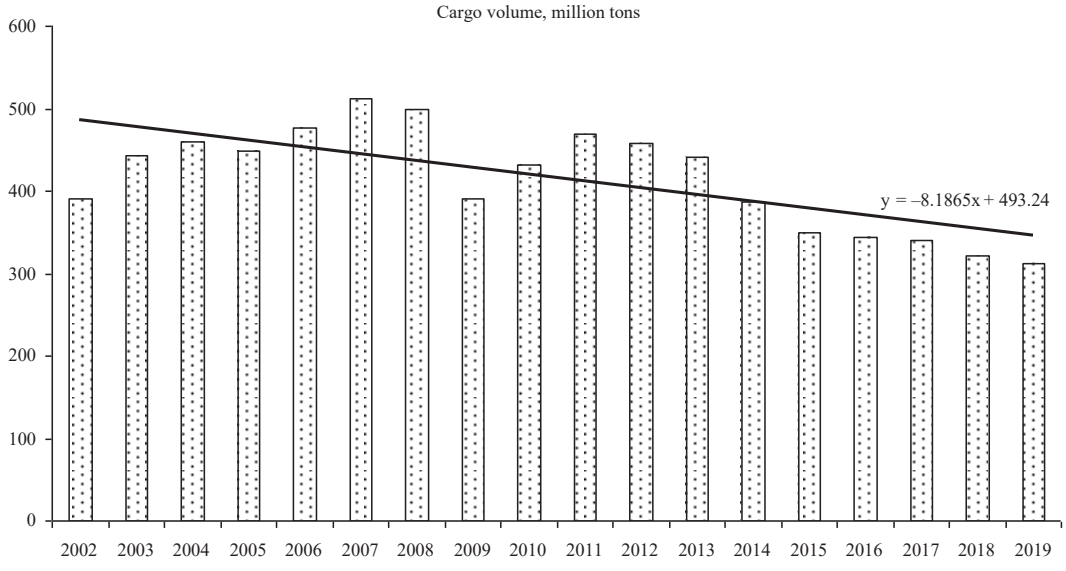

Fig. 2. The trend line of the volume of cargo transportation by rail in Ukraine (developed by the author based on the data [18])

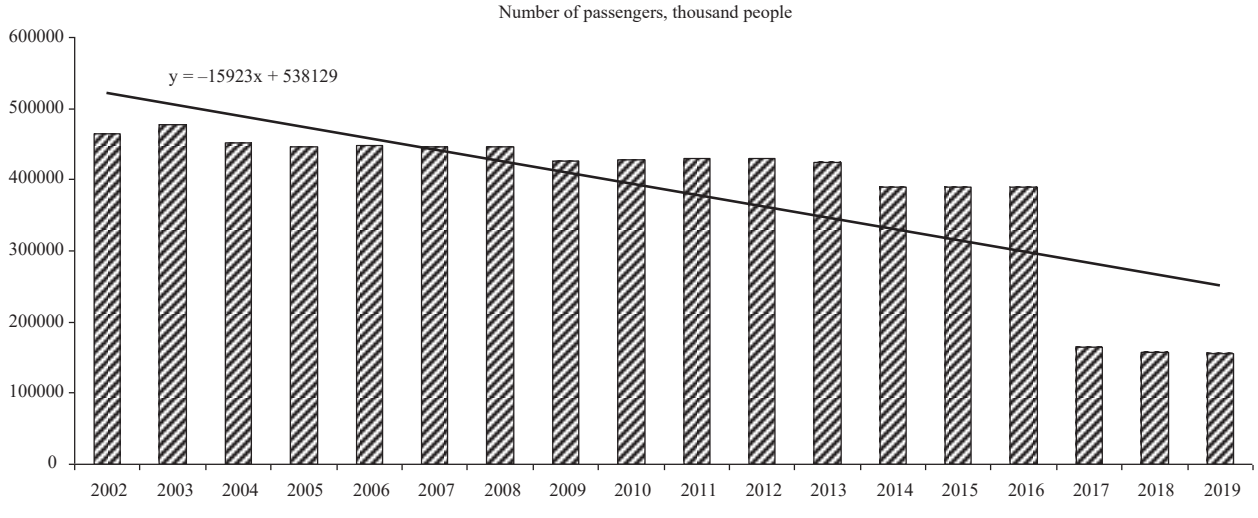

Fig. 3. The trend line of the number of passengers transported by rail in Ukraine (developed by the author based on the data [18])

It goes without saying that such an unsightly state in the region is influenced by both external and internal factors. Internal factors require primary attention, which can and should be influenced. In accordance with the Law of Ukraine «On Railway Transport», Ukrzaliznytsia carries out centralized management of the transportation process in domestic and international traffic and regulates the production and economic activities of railways in the organization of this process. Railways and other state-owned enterprises of railway transport are part of the management of Ukrzaliznytsia [19]. To assess the lack of governance in this area, the following examples are given. According to [19], the following violations were previously identified: a sharp decrease in the level of profitability of railway transportation in Ukraine; critical situation with own circulating assets; a sharp decline in the level of profitability of railway transportation across Ukraine. In addition, manual adjustments of the income of railway transport enterprises, which is detrimental to both the budget and the enterprises themselves. And also non-fulfillment of the target for income from freight traffic; their investment activity negative for railway transport enterprises. Attention is focused on the inefficiency of using the resources of enterprises, over-standard write-off of material resources, incorrect determination of the fair value of fixed assets, a significant increase in the costs of railway transport enterprises, etc. According to the results of the audit of Ukrzaliznytsia and its 24 branches for the period 01.01.2018–30.09.2019, a number of shortcomings in the management of various types of resources were also identified:

1. Lack of income (understatement of tariffs, rent, non-collection of penalties and guarantees for the performance of contracts, etc.) in the amount of 210.1 million UAH.

2. Violations in the field of remuneration – 55.4 million UAH; overestimation of the cost of work, services received and purchased goods, excess material write-off, etc. in the amount 184.6 million UAH.

3. Failure to fulfill contractual obligations, which led to the payment of financial sanctions in the amount of 50.8 million UAH.

4. Loss of assets for not carried out claim work – 9.7 million UAH; other violations (violation of accounting, balances, deficiencies, etc.) – 282.8 million UAH.

In addition, the audit found violations in the field of public procurement in the amount of 8.9 billion UAH [20].

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Scientists in Ukraine are responding to the existing shortcomings in the management of railway enterprises. The work [21] substantiates the need to improve the railway transport management system and provide state support for its reform, which will increase the competitiveness of Ukrainian railways in the transport services market.

Exploring the assessment and development prospects of the railway industry in Ukraine, the author of this work substantiated the need to improve the railway transport management system and provide state support for its reform, which will increase the competitiveness of Ukrainian railways in the transport services market. Also, the attention of scientists is focused on the adoption of drastic measures to improve the management system of railway transport [21, 22].

Based on the results of the analysis of structural changes in the management system of enterprises and organizations of railway transport in Ukraine, the author of [23] made the following conclusions:

1. The problem of reforming railway transport is urgent.
2. This problem is dealt with by both scientists and transport workers who strive to ensure its high level of competitiveness, to increase the quantitative and qualitative performance indicators.
3. In the modern scientific and practical achievement, there is enough research on the transformation of the management system of enterprises and organizations of railway transport, taking into account their specifics.

Therefore, there are sufficient grounds to state that qualified resource management affects the effectiveness of resource management. So, it is possible to assume that the need for further research towards the formation of an effective resource management mechanism based on the developed theoretical platform is justified. An important prerequisite for ensuring the sustainable development of railway transport enterprises in Ukraine in the future is not only the formation of a sufficient amount of necessary resources, but their effective management in conditions of severe wear and tear of the material and technical base and an insufficiently high level of competence of top managers and the level of intellectual capital.

Fig. 4 shows a structured theoretical platform for this study, which contains a certain ordered list of basic concepts and categories. The need to develop such a scientific, theoretical platform is due to the fact that among scientists there is still no single view of certain concepts and categories in the field of enterprise management, its resource potential, types of enterprise resources. After analyzing the existing approaches, definitions of the basic concepts and individual categories for this study, such a platform is developed.

To achieve the set aim of research, an ordered sequence of components of the economic mechanism for managing the resources of railway enterprises was formed, which is shown in Fig. 5. To ensure sustainable development of railway transport enterprises, the process of resource management should concern all its types, which together form the resource potential. One of the main tasks of resource management of railway transport enterprises is to determine the required level of its effectiveness. For this, it is proposed to calculate the integral indicator according to the following formula:

$$IIA = \sqrt[m]{\prod_{i=1}^{m} \left| \alpha_q \left(1 + \frac{\Delta R_{iq}}{R_{iq}^t} \right) \right| \cdot \left| \beta_f \left(1 - \frac{\Delta R_{if}}{R_{if}^t} \right) \right|}, \quad (1)$$

where IIA – integral indicator for assessing the effectiveness of resource management of railway transport enterprises; $\Delta R_{iq}, \Delta R_{if}$ – absolute deviation of the value of the q-th indicator-stimulator and the f-th indicator-destimulants of the i-th type of resource, respectively; $i = \overline{(1,m)}$; $q = \overline{(1,d)}$; $f = \overline{(1,s)}$; m – the number of resource types of the enterprise are estimated; d, s – respectively, the number of indicators-stimulants and indicators-destimulants of the evaluated goods; k – total number of local estimated indicators:

$$q + f = m, \quad (2)$$

$$k = d + s, \quad (3)$$

$$\Delta R_{iq} = P_{iq}^t - P_{iq}^{t-1}, \quad (4)$$

where R_{iq}^t, R_{iq}^{t-1} – value of the q-th local indicator-stimulator of the i-th type of resource for the t-th and $(t-1)$-th years, respectively:

$$\Delta R_{if} = P_{if}^t - P_{if}^{t-1}, \quad (5)$$

where R_{if}^t, R_{if}^{t-1} – the value of the f-th local indicator-destimulants of the i-th type of resource for the t-th and $(t-1)$-th years, respectively; α_q, β_f – expert assessments of the significance of the q-th and f-th indicators, respectively:

$$\alpha_q + \beta_f = 1. \quad (6)$$

Experts select indicators that are the basis for constructing an integral indicator of the effectiveness of enterprise resource management. For railway transport enterprises, experts can choose, for example, indicators such as:

– return on assets;
– return on equity;
– annual volume of transported goods;
– the number of passengers carried;
– net financial result (net profit);
– level of qualifications of managers;
– coefficient of profitability for transportation;
– innovative activity;
– return on assets;
– capital investments;
– investments in infrastructure overhaul;
– investments for overhaul of traction rolling stock, etc.

The list of local indicators-destimulants includes such as:

– degree of wear of the fixed assets of the enterprise;
– costs of goods movement (as a percentage of the volume of goods or the number of transported passengers);
– unit costs of fuel and energy resources;
– degree of environmental pollution;
– reduction of operating costs due to the prudent use of material resources;
– duration of the turnover of working capital, etc.

The sources of information for calculating indicators for assessing the effectiveness of resource management are the annual financial statements of issuers –railway transport enterprises, as well as information on annual business plans, expert data, the results of marketing research in recent years, and the like.

The features of the synthesized mathematical model are as follows:

a) the use of tempo indicators of stimulants and destimulants was proposed. They reflect the dynamics of changes in the aggregate of both well-known and specific for the enterprises of the industry indicators of the effectiveness of managing various types of resources of railway enterprises;

b) a critical study of the dynamics of the numerical values of the desired indicator *IIA* allows one to estimate its trend over time – a positive (with growth) or negative (with a decrease) trend of change. The analysis of this indicator will provide shareholders and top managers with important information (for example, at the stage of strategic planning) necessary for making scientifically sound management decisions.

It should be noted that recently there has been a steady tendency for scientists to develop an integral investigated indicator and the predominant use of such indicators by representatives of enterprises for the purpose of analyzing, for example, the production situation or making management decisions.

The authors of [28] substantiated the feasibility and need to assess the quality level of management of the development of industrial enterprises using an integrated indicator, which is calculated on the basis of 78 local indicators. The author of [29] proposed to calculate the integral indicator of assessing only the financial condition of the corporation of industrial enterprises of railway transport using 18 local indicators.

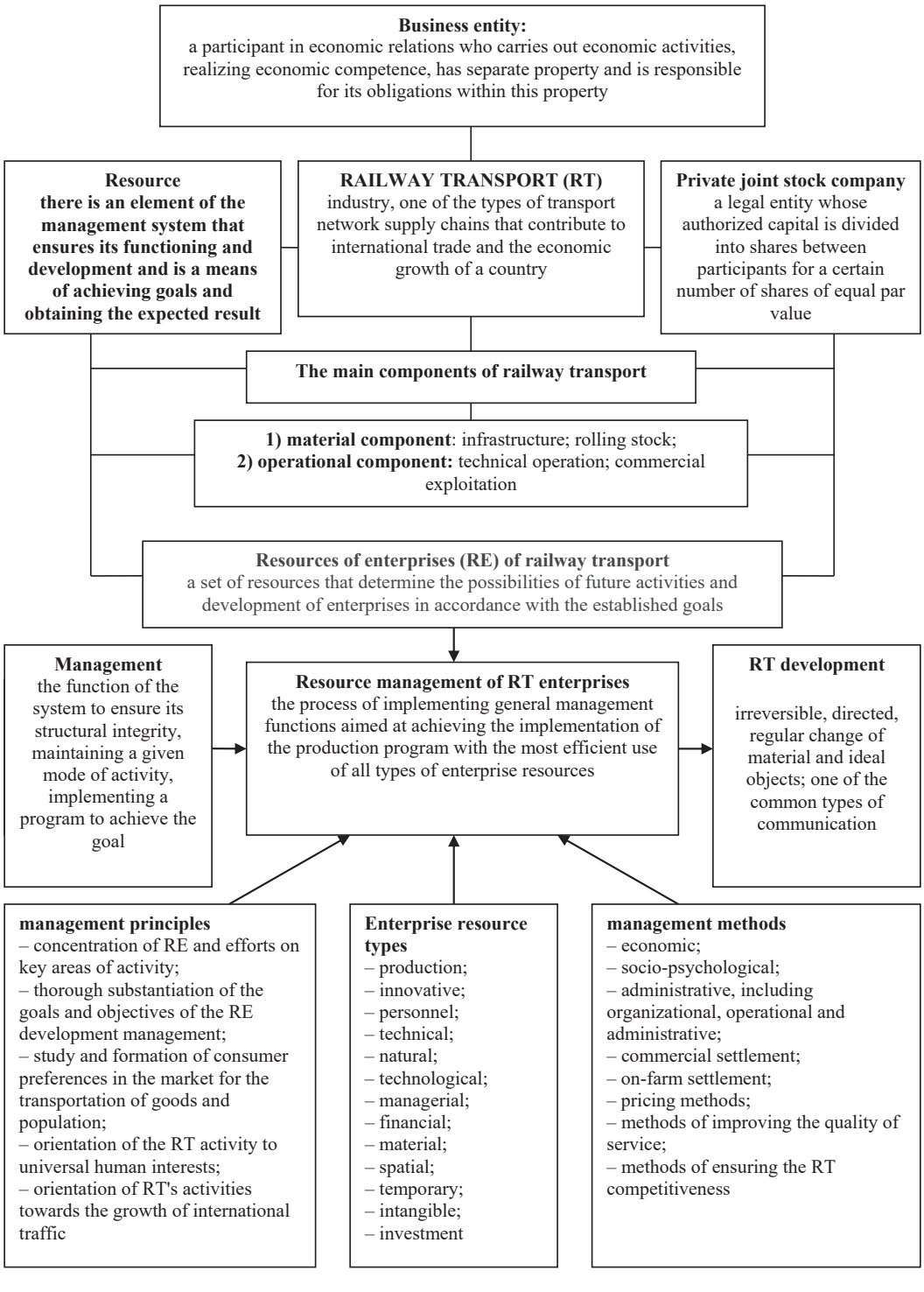

Fig. 4. Theoretical research platform (developed by the author based on the data [17, 24–26])

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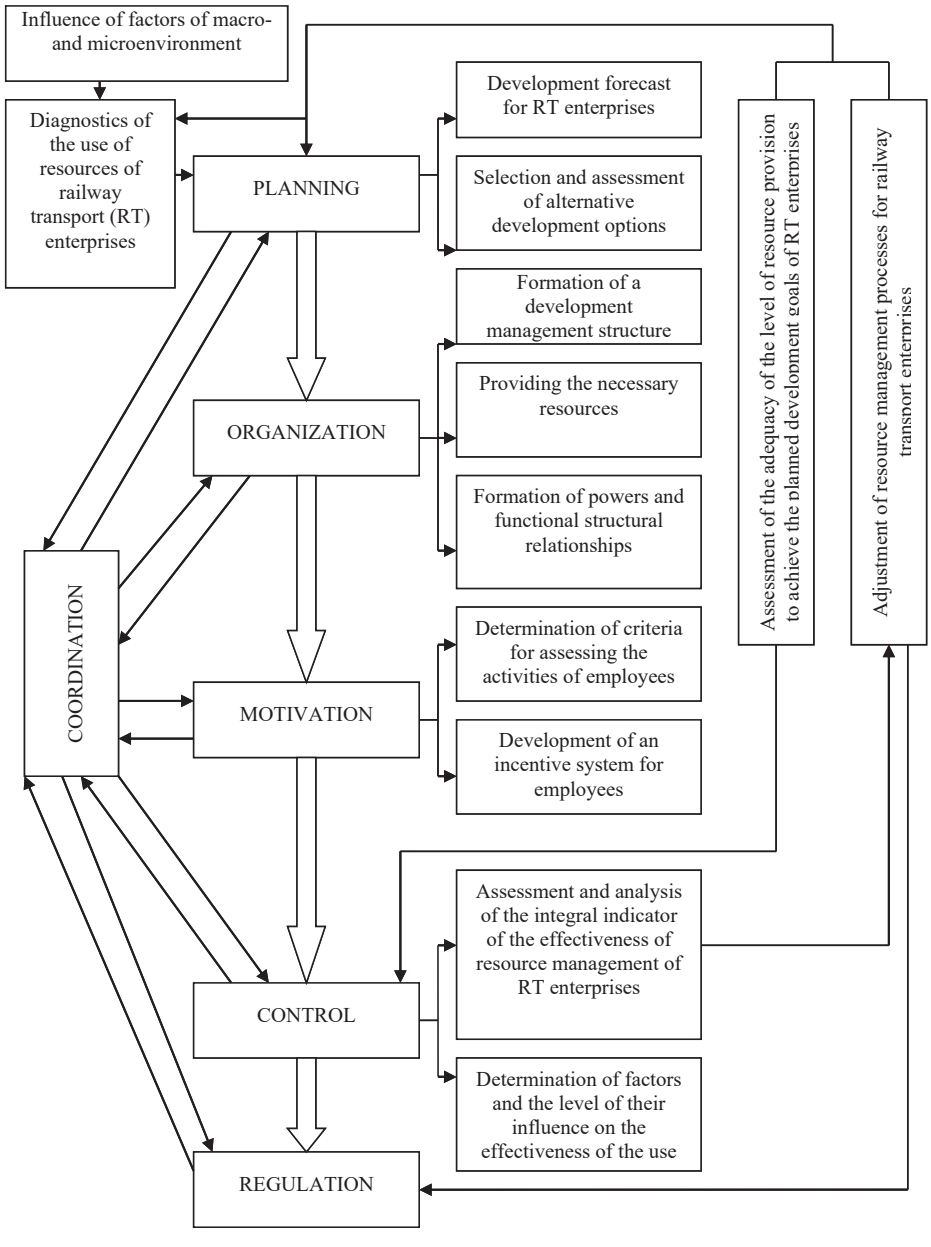

Fig. 5. The economic mechanism of resource management of railway transport enterprises (taking into account [27])

Therefore, let's believe that the choice of the most significant types of resources and the number of estimated local indicators behind them depends on such circumstances as:

– the specifics of the enterprise (Fig. 4 and Art. 22 of the Law of Ukraine «On Transport» regarding various types of railway transport enterprises);

– the level of enterprise management (top, middle, lower), since the aggregation of indicators for managers of a particular level should be different both in the list of local indicators and in the set of types of resources;

– the qualification level of executive managers, since it is they who, first of all, should act as experts in the implementation of the proposed model (Formula (1)) and the implementation of the economic mechanism for managing the resources of a particular railway transport enterprise or Ukrzaliznytsia of Ukraine as a whole;

– the consistency level of opinions of experts, which are specialists of enterprises (managers).

7. SWOT analysis of research results

Strengths. The strengths of the study and application of modeling the resource management process of railway transport enterprises is that, in comparison with other approaches to the implementation of the proposed methodology, it allows to operate with tempo local indicators. On their basis, an integral indicator of the effectiveness of resource management was synthesized. The advantages of using tempo indicators in the process of applied analysis of economic data are as follows:

– increasing the reliability of the information received, has a strategic focus in the activities of enterprises;

– a simplified procedure for calculating both local rate indicators and the desired integral indicator of the effectiveness of enterprise resource management.

In comparison with existing similar developments, where the ultimate goal is selected performance indicators, which most often essentially characterize the effect, and not effi-

ciency, the proposed methodology is focused on calculating the integral indicator of the effectiveness of resource management. This is in line with the principle of «deviation control».

Weaknesses. The weaknesses of the implementation of this development are seen in the following. There is a high probability of voluntaristic selection of local estimates. These are indicators that reflect the specifics of the activities of railway transport enterprises. Specificity concerns both the material component (infrastructure, rolling stock) and the operational component (technical operation, commercial operation).

Opportunities. The functional purpose of the study is to assess the level of effectiveness of resource management of railway enterprises. Structural affiliation – higher and middle management level, the composition of users – management of enterprises, shareholders, top managers. However, the uniqueness of the proposed development opens up the possibility of introducing industrial enterprises into the sphere of management, regardless of ownership and size, subject to a careful selection of estimated local indicators that are specific to enterprises of a particular industry affiliation.

Threats. Threats to resource management of railway enterprises include the following:

– the risk of a low level of professionalism of enterprise managers may have a negative impact on the implementation of the research results;

– the qualitative result of the implementation of the proposed development depends on the scientifically grounded selection of experts for calculating estimates of the significance of local indicators. This means that the coefficient of concordance must correspond to the condition $W>0.5$. Otherwise, the results of assessing the integral indicator of the effectiveness of resource management are not adequate.

All this can influence the false strategic orientation of enterprises in a competitive unstable environment.

8. Conclusions

1. Trend-watching of the main indicators of the activities of railway transport enterprises is conducted. It is shown that the dynamics of changes in the main indicators – the volume of freight traffic and the number of transported passengers over the years is characterized by a negative trend. Such dynamics is an indicator of the need to make managerial decisions to improve the situation in managing the resources of railway transport enterprises.

2. A theoretical platform is developed, which constitutes the theoretical basis of the study and is the basis for the formation of an economic mechanism for managing enterprise resources.

3. An ordered sequence of components of the economic mechanism of enterprise resource management is formed. It provides for the calculation of an integral indicator of the effectiveness of resource management of railway transport enterprises. The success of the implementation of the economic mechanism depends on the competence of executive managers.

4. A mathematical model is developed for calculating the integral indicator for assessing the effectiveness of resource management of railway enterprises. This simplifies the procedure for assessing the integral indicator – a criterion for assessing the effectiveness of managing the totality of resources of each enterprise. This indicator is one of the key success factors for business entities. Its use in strategic management is recommended.

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Sokolova Lyudmyla, *Doctor of Economic Sciences, Professor, Department of Economic Cybernetics and Economic Security Management, Kharkiv National University of Radio Electronics, Ukraine, e-mail: liudmyla.sokolova@nure.ua, ORCID: http://orcid.org/0000-0001-8106-1523*