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MODELING OF PUBLIC SAFETY ASSESSMENT IN TRANSPORT COMPANIES

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Abstract

A public safety problem is one of the most discussed scientific issues. This term includes transport, environmental, technological and technogenic safety. Public safety support in transport companies involves taking into account, when making management decisions, external components of the production system, mainly environmental and social. Transport enterprises make decisions on the basis of their commercial interests; public interests are of secondary importance. As a result, environmental degradation occurs; the constitutional rights of the country's population to a safe environment are violated. At the same time, the resources of the enterprises are used inefficiently, which leads to an increase of unproductive costs of transport companies. This management approach is neither cost efficient nor socially oriented. Of course, it is necessary to evaluate the impact of institutional factors on management decisions, to assess economic efficiency taking into account risk-adjusted environmental and social components. Assessment of public safety is impossible without the development of a model that describes the adoption of management decisions which are aimed at improving the social component of the non-transport effect, economic efficiency, corporate social responsibility of transport enterprises. The authors of the article have developed a morphological model; an assessment of the public orientation of transport companies management decisions has been made on the basis of the model. In addition, a set of economic, environmental and social risk-adjusted indicators and criteria is proposed. A set of economic, environmental, and social parameters has been identified for the criteria proposed by the authors.

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Keywords: Transport, model, assessment, safety, efficiency, indicator

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1. Introduction

Transport companies activity management is drawing on the economic criteria of assessment, a key of which is a criterion of efficiency. Assessing the results of their work, enterprises often do not take into account institutional factors - environmental and social. In fact, the enterprises' decisions are made that contradict the interests of society. One of the ways to increase the efficiency of transport enterprises production and economic activities transport enterprises is to model the assessment of public safety of the enterprises' decisions. It allows developing a set of environmental, economic and social criteria on the basis of the modeling. Such approach ensures interrelationship of corporate and social interests, creating a safe environment, contributing to corporate social responsibility principles of transport.

2. Problem Statement

The researched problem is a lack of a methodical toolbox for assessment of the influence of transport enterprises management decisions on public safety taking into account ecological and social factors. Also, there is no model of the making of management decisions which allows ensuring their economic efficiency, environmental safety and social orientation.

3. Research Questions

The object of the research in this article is transport companies, and the subject of the research is the modeling of public safety assessment. The main scientific issues that are being solved by the authors in the article are development of a morphological model using the Zwicky cube, its application in activity management of transport enterprises. The authors of the article also raise issues of environmental, economic and social criteria development for assessment of the performance of transport companies, determining their parameters.

4. Purpose of the Study

The purpose of the article is a methodical toolbox development for assessment of public safety of management decisions that are made by transport companies on the basis of modeling.

5. Research Methods

The logical-analytical method, the method of system analysis, modeling, formalization, analysis and synthesis, methods of technical and economic calculations are used in the scientific research.

6. Findings

Insurance of public safety of enterprises activity is one of the priorities of the transport industry. (Macheret & Kudryavtseva, 2016; Sokolov & Lavrov, 2015; Tereshina & Soroka, 2014). However, in practice, there are some social and environmental problems as the study shows (Drozdov et al., 2019;

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Vasilenko et al., 2018). This indicates a continuing violation of society's rights to a safe environment. On the basis of works that are written by a number of researchers (Barrientos et al., 2016; Liu et al., 2011; Malekpour et al., 2017), we can infer that the economy and society demand management approaches which include an assessment of possible losses due to the implementation of the system risks, as well as an assessment of the impact of indirect environmental effects. It is in line with the paradigm of corporate social responsibility increase and allows reducing enterprises' unproductive costs.

The public safety management system of transport companies includes three important subsystems: economic, environmental and social. Efficiency of actions that are aimed at satisfaction of the interests of society in management decisions is assessed on the basis of a set of criteria.

Systemically, the management of public safety of transport enterprises activity must include the identification of environmental aspects according to ISO 14001 principles, consideration of environmental risks. It is necessary to take into account ecological, economic and social components for different levels of corporate management such as day-to-day management, tactical and strategic ones. There is an open problem of the formation of management decisions in the aspect of corporate social responsibility.

The transport enterprise should be considered from a position of interconnected and interacting production processes as a part of management approaches to ensure public safety. It means that we should take into account the following elements:

1. Enterprises' production processes (an economic component of the system).
2. Enterprises' production processes elements (an economic component of the system).
3. Environmental component (an ecological component of the system).
4. Social orientation (a social component of the system).

Obviously, management decisions include those four elements. Thus, management decisions which are taken in the framework of public safety can be represented as a morphological model on the basis of the Zwicky cube. Three faces of the cube are different sets of economic, ecological and social components of the system. The decision which does not include these components cannot be considered as socially oriented, environmentally safe, and economically efficient. In this case it does not meet the requirements and therefore cannot be taken into account. The morphological model of public orientation of decisions of transport industry management is depicted in Figure 01.

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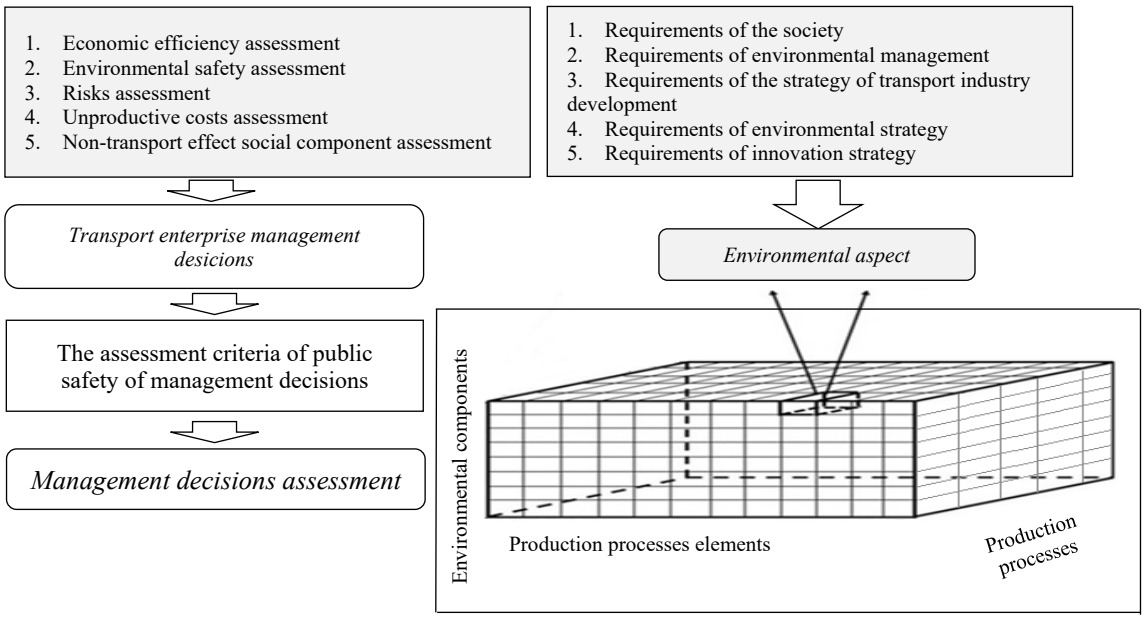

Figure 1. The morphological model of assessment of the public orientation of management decisions in transport industry

The economic component of public safety includes decrease of unproductive costs of transport enterprises (Marchetti & Wanke, 2019). To date, transport organizations have a methodology of the identification of unproductive costs, their classification and reduction. In our opinion, the term "unproductive costs" must be supplemented in the aspect of public safety of transport enterprises activity.

Thus, the economic component assessment is the assessment of transport unproductive costs reduction, taking into account environmental and social components. The developed indicator of unproductive costs assessment of transport enterprises is represented in Formula 1.

$$\Delta UC = \Delta \mathrm{P} + \Delta \mathrm{SV} + \Delta \mathrm{CL} \quad (1)$$

$\Delta UC -$ reduction of unproductive costs of transport enterprises, in rub.

$\Delta \mathrm{P} -$ reduction of excessed emissions payments of transport enterprises, in rub.

$\Delta \mathrm{SV} -$ a synergistic effect which is obtained as a result of increase of public safety in management decisions and reducing emissions by a transport company, in rub.

$\Delta \mathrm{CL} -$reduction of transport enterprise costs for elimination of environmental pollutions consequences, including the costs for noise reduction, vibration, electromagnetic radiation, in rub.

A functional scheme of the unproductive costs emergence, their social and environmental consequences is represented in Figure 2.

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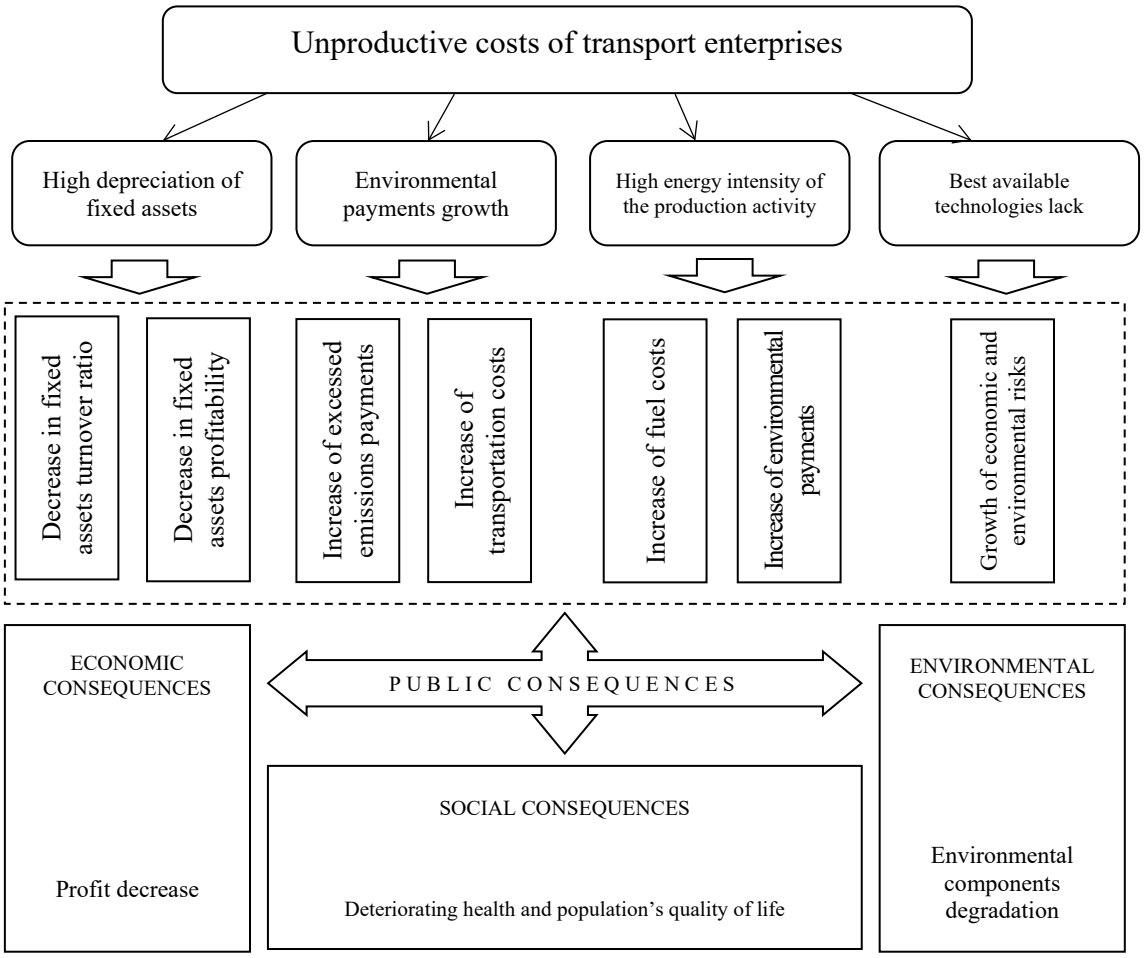

Figure 2. Unproductive costs of transport companies and public consequences

In the framework of ensuring corporate social responsibility of transport enterprises, it is necessary to notice the social component of the transport industry. It is expressed in reducing the pressure of transport on human health, workability, and the attractiveness of the areas in which people live. Thus, the production activity of a transport enterprise also influences non-transport effect and its social component. The indicator of the social component of the non-transport effect can be represented in Formula 2.

$$\Delta SCNTE = \Delta I_d + \Delta SP \quad (2)$$

$\Delta SCNTE$ – increase of the social component of the non-transport effect, in rub.

ΔI_d – decrease of indirect environmental damage, in rub.

ΔSP – additional benefits of the society of innovation and improved transport services, in rub.

The indirect environmental damage indicator is one of the most controversial indicators that form the social component of the non-transport effect of transport enterprises, taking into account environmental requirements. The ambiguity of the approach to the indirect damage assessment by the above method lies in the fact that the most of the assessment indicator components are considered by enterprises as cost-based. It means that as part of a conservative approach to economic efficiency assessment, they should be minimized, and ideally should be zero. Without control mechanisms of the

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state and society, transport enterprises have opportunity to reduce all the costly components of this indicator (Kyriacou et al., 2019).

We suggest assessing the indirect environmental damage qualitatively if transport enterprises have no opportunity to assess it quantitatively. The qualitative assessment implies determination of the indicator dynamics: it is decreasing or growing.

The ecological component of public safety is to be assessed on the basis of the indicator of the environmental damage reduction. We suppose that the indicator will decrease owing to preventive and post-damage environmental actions. The assessment indicator is represented in Formula 3.

$$\Delta S = S_1 - S_2 \quad (3)$$

$\Delta S -$ environmental damage reduction, in rub.

$S_1 -$ environmental damage before a planned organizational and technical action implementation, in rub.

$S_2 -$ environmental damage after a planned organizational and technical action implementation, in rub.

An integral indicator of public efficiency assessment is the public safety criterion. It is represented in Formula 4.

$$C^{PS} = \sum(\Delta UC + \Delta SCNE + \Delta S) \times (1 - \sigma) \quad (4)$$

$C^{PS} -$ the public efficiency assessment indicator.

$\sigma -$ the risk assessment indicator calculated on the basis of the Delphi method.

The criterion represented in Formula 4 indicates the public safety only if each component of the criteria grows. Otherwise, it means lack of efficiency (for cases when some components grow) or inefficiency (when all the components do not grow). This criterion is risk-adjusted for public safety risks, which can be calculated as a mathematical expectation of experts' rates of risks weights and their probabilities (Qing et al., 2014).

These indicators and criterion of public safety assessment include a set of ecological, social and economic assessment parameters. The information about the parameters, their dynamics in the public safe and efficient approach is revealed in Table 1.

Table 1. Dynamics of the assessment parameters of public safety of decisions in transport companies

The parameters of public safety assessment	Dynamics of the parameters in conditions of public safety increase
Additional benefits of the society of innovation and improved transport services	$\Delta SP \rightarrow max$
Reduction of excessed emissions payments of transport enterprises	$\Delta P \rightarrow min$
Decrease of indirect environmental damage	$\Delta I_d \rightarrow min$
The synergistic effect which is obtained as a result of increase of public safety in management decisions and reducing emissions by a transport company	$\Delta SV \rightarrow max$
Environmental damage before a planned organizational and technical action implementation	$S_1 = Const.$
Environmental damage after a planned organizational and technical action implementation	$S_2 \rightarrow min$

Reduction of transport enterprise costs for elimination of environmental pollution consequences, including the costs for noise reduction, vibration, electromagnetic radiation	$\Delta CL \rightarrow \min$

Thus, the costs content values are minimizing after realization of those management decisions, which are targeted toward economic efficiency, environmental safety, and social orientation. At the same time, the parameters which are oriented to public safety demonstrate increasing. It is satisfying public interests.

7. Conclusion

The scientific article proposes the assessment method of public safety of management decisions at transport enterprises. A set of assessment indicators is developed on the basis of the morphological model. These indicators allow assessing the influence of management decisions on economic, environmental and social aspects of the enterprises management system. The integral criterion of assessment of management decisions efficiency in transport companies is created. Dynamics of the parameters of public safety is represented.

References

Barrientos, F., Moral, A., & Rodríguez, J. (2016). Knowledge-based minimization of railway infrastructures environmental impact. *Transportat. Res. Procedia*, *14*, 840–849. https://doi.org/10.1016/j.trpro.2016.05.032

Drozdov, N. A., Kuzina, E. L., Vasilenko, M. A., & Tagiltseva, A. (2019). Algorithm For Assessing The Extra-Sectoral Effect Of Improving Organization Quality. *European Proceedings of Social and Behavioral Sciences, 76*, 789–797. https://doi.org/10.15405/epsbs.2019.12.04.105

Kyriacou, A. P., Muinelo-Gallo, L., & Roca-Sagalés, O. (2019). The efficiency of transport infrastructure investment and the role of government quality: An empirical analysis. *Transport Policy, 74*, 93–102. https://doi.org/10.1016/j.tranpol.2018.11.017

Liu, G. Y., Yang, Z. F., Chen, B., & Zhang, Y. (2011). Ecological network determination of sectoral linkages, utility relations and structural characteristics on urban ecological economic system. *Ecolog. Modell., 222*, 2825–2834.

Macheret, D. A., & Kudryavtseva, A. V. (2016). On assessment of investments efficiency in innovation projects. *Railway econ., 12*, 21–26.

Malekpour, S., Brown, R. R., & de Haan, F. J. (2017). Disruptions in strategic infrastructure planning–What do they mean for sustainable development? *Environ. and Plann. C: Politics and Space, 35*, 1285–1303. https://doi.org/10.1177/2399654417690735

Marchetti, D., & Wanke, P. F. (2019). Efficiency in rail transport: Evaluation of the main drivers through meta-analysis with resampling. *Transportat. Res.*, *part A: Policy and Pract., 120*, 83–100. https://doi.org/10.1016/j.tra.2018.12.005

Qing, L., Rengkui, L., Jun, Z., & Quanxin, S. (2014). Quality Risk Management Model for Railway Construction Projects. *Procedia Engineer., 84*, 195–203. https://doi.org/10.1016/j.proeng.2014.10.426

Sokolov, Y. I., & Lavrov, I. M. (2015). Transport service quality enhancement. *Railway econ.*, *8*, 76–81.

Tereshina, N. P., & Soroka, I. Y. (2014). Cost management of the transport company on the basis of a process-oriented approach. *Transport busin. in Russ., 1*, 55–58.

Vasilenko, M. A., Drozdov, N. A., Kuzina, E. L., & Tagiltseva, Y. A. (2018). Directions of Transport Development in Advanced Marketing. *2018 IEEE Int. Conf. Quality Management, Transport and Information Security, Information Technologies (IT&QM&IS)*, *1*, 172–176. https://doi.org/10.1109/itmqis.2018.8525106