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**ECONOMIC AND ENVIRONMENTAL SUSTAINABILITY  
MANAGEMENT OF RAILWAY ENTERPRISES OF UKRAINE:  
STRATEGIC DIRECTIONS AND ENVIRONMENTAL IMPACT  
ASSESSMENT**

*A complex analysis of economic and environmental sustainability management of railway enterprises of Ukraine in terms of its strategic direction and evaluation of the impact on the environment was performed. The algorithm for evaluating the impact on the environment of the object on the basis of competent balance (sustainable development) was improved for the railways of Ukraine as railway enterprises according to the principles of sustainable development.*

*There were determined the main strategic directions of economic and environmental sustainability management of railway enterprises that provide their scientific and technical prerequisites; a scientific and technical complex which is a set of enterprises engaged in scientific, technical activities and training employees; highly qualified personnel, information infrastructure, transport, logistics and research and experimental base of the railway; focus on solving complex scientific, technical and technological problems; providing them with the necessary resources and advanced communication infrastructure.*

*Based on the theoretical, methodological and practical developments on the economic and environmental sustainability management of railway enterprises, a strategic economic and ecological management of railways of Ukraine was proposed. Such management involves consideration of environmental factors of direct and indirect actions and internal environment factors. It also includes the necessary elements as subjects and objects of management, principles, approaches (models), management methods, functions, organizational structure management, competence, culture, tools and integrated efficiency. The result of this long-term management is the balanced functioning strategies on the principles of sustainable development.*

*Keywords: economic and ecological management, railway transport enterprises, sustainable development, environment.*

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**ЕКОНОМІКО-ЕКОЛОГІЧНЕ УПРАВЛІННЯ СТАЛИМ РОЗВИТКОМ  
ПІДПРИЄМСТВ ЗАЛІЗНИЧНОГО ТРАНСПОРТУ УКРАЇНИ:  
СТРАТЕГІЧНІ НАПРЯМИ ТА ОЦІНКА ВПЛИВУ НА ДОВКІЛЛЯ**

*Здійснено комплексний аналіз економіко-екологічного управління сталим розвитком підприємств залізничного транспорту України в частині його стратегічних напрямів та оцінки впливу на навколишнє природне середовище. Удосконалено алгоритм здійснення оцінки впливу на навколишнє природне середовище об'єкта на принципах компетентної збалансованості (сталого розвитку) саме для залізниць України як підприємств залізничного транспорту за принципами сталого розвитку.*

*Визначено основні стратегічні напрями економіко-екологічного управління сталим розвитком підприємств залізничного транспорту, які передбачають їх науково-технічні передумови; науково-технічний комплекс, який становить сукупність підприємств, що здійснюють наукову, науково-технічну діяльність та підготовку працівників; висококваліфіковані кадри, інформаційну інфраструктуру транспорту, матеріально-технічну та дослідно-експериментальну базу залізниці; концентрацію зусиль на вирішення складних науково-технічних і технологічних проблем; забезпечення їх необхідними ресурсами та розвиненою комунікаційною інфраструктурою.*

*На підставі теоретичних, методологічних та практичних напрацювань щодо економіко-екологічного управління сталим розвитком підприємств залізничного транспорту, було запропоновано стратегічне економіко-екологічне управління залізниць України. Таке управління передбачає обов'язкове врахування факторів зовнішнього середовища прямої та непрямої дії і факторів внутрішнього середовища. А також включає такі необхідні елементи, як: суб'єкти та об'єкти управління, принципи, підходи (моделі), методи управління, функції, організаційна структура управління, компетентність, культура, засоби та інтегральна ефективність. Як результат такого довгострокового управління, виступають стратегії збалансованого функціонування на засадах сталого розвитку.*

*Ключові слова: економіко-екологічне управління, підприємства залізничного транспорту, сталий розвиток, довкілля.*

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**ЭКОНОМИКО-ЭКОЛОГИЧЕСКОЕ УПРАВЛЕНИЯ УСТОЙЧИВЫМ  
РАЗВИТИЕМ ПРЕДПРИЯТИЙ ЖЕЛЕЗНОДОРОЖНОГО  
ТРАНСПОРТА УКРАИНЫ: СТРАТЕГИЧЕСКИЕ НАПРАВЛЕНИЯ  
И ОЦЕНКА ВЛИЯНИЯ НА ОКРУЖАЮЩУЮ СРЕДУ**

*Осуществлен комплексный анализ экономико-экологического управления устойчивым развитием предприятий железнодорожного транспорта Украины в части его стратегических направлений и оценки воздействия на окружающую среду. Усовершенствован алгоритм проведения оценки воздействия на окружающую среду объекта на принципах компетентной сбалансированности (устойчивого развития) именно для железных дорог Украины как предприятий железнодорожного транспорта на принципах устойчивого развития.*

*Определены основные стратегические направления экономико-экологического управления устойчивым развитием предприятий железнодорожного транспорта, которые предусматривают их научно-технические предпосылки; научно-технический комплекс, который представляет собой совокупность предприятий, осуществляющих научную, научно-техническую деятельность и подготовку работников; высококвалифицированные кадры, информационную инфраструктуру транспорта, материально-техническую и опытно-экспериментальную базу железной дороги; концентрацию усилий на решение сложных научно-технических и технологических проблем; обеспечение их необходимыми ресурсами и развитой коммуникационной инфраструктурой.*

*На основании теоретических, методологических и практических наработок по экономико-экологическому управлению устойчивым развитием предприятий железнодорожного транспорта, было предложено стратегическое экономико-экологическое управление железных дорог Украины. Такое управление предполагает обязательный учет факторов внешней среды прямого и косвенного действия и факторов внутренней среды. А также включает такие необходимые элементы, как: субъекты и объекты управления, принципы, подходы (модели), методы управления, функции, организационная структура управления, компетентность, культура, средства и интегральная эффективность. Как результат такого долгосрочного управления, выступают стратегии сбалансированного функционирования на принципах устойчивого развития.*

*Ключевые слова: экономико-экологическое управление, предприятия железнодорожного транспорта, устойчивое развитие, окружающая среда.*

**Formulation of the problem.** The modern system of environmental management in railway transport is affected by globalization and technological progress, which is enhanced by economic activity peculiarities; an important condition for ensuring its stability and sustainable development at the present stage is the innovative nature of the reproduction process and efficient management of its development. On the other hand, the environment is under the influence of railway transport, feeling the impact of harmful emissions, not neutralized waste, soil and water basin pollution. This necessitates the creation a single environmental management system on the railway enterprises. This system

would be able to combine the interests of both the society and the railway transport in ensuring economic and environmental security of the society and, primarily, the urbanized areas that are mostly influenced by the functioning of railway transport.

Railway transport in Ukraine is exercising a significant negative impact on the natural environment (NE) due to pollution of atmospheric air, water, land and forest resources, flora and fauna, noise pollution, etc. Railway transport management should be carried out taking into account and in accordance with established regulatory framework, environmental safety requirements and the requirements of environmental protection.

Development management of the system for environmental management of railway enterprises in terms of the need to ensure economic and environmental security must be focused primarily on the development and implementation of new approaches to improve economic, sociological and ecological efficiency of usage of natural resources. This will ensure the expanded reproduction of transportation services, the sustainable development (SD) of environmental management system in railway transport and efficient use of natural resources with preservation and improvement of the environment condition for economic and environmental security of the country.

The issue of effective management in the railway transport sector, given the significant impact of this type of transport on the environment requires complex systems research to ensure economic and environmental interests of the society.

There is an urgent need to ensure environmentally justified planning of railway transport of Ukraine. Implementation of measures to reduce the negative impact of rail transport on the environment, with the establishment of efficient environmental practices in other types of transport, could significantly improve the environmental situation in Ukraine.

**Analysis of recent research and publications.** The scientific papers of many domestic and foreign scientists and economists are dedicated to theoretical and applied aspects of environmental protection and reducing environmental impact. It is worth noting the works of the following authors: O.A. Rybina [1], Yu. S. Barash [2], O.H. Deineka, O.O. Mishchenko [3], O.I. Borodin [4], V.A. Bazhenov, T.V. Tymochko, Yu.M. Satalkin, P.P. Lizunov, H.O. Biliavskiy, I.D. Loieva, O.I. Bondar [5], H.M. Kirpa [6].

The consideration of the railway transport as an object that provides the vital functions of the society and influences the environment necessitates the improvements of ecological management development at the railway enterprises. Nowadays it is important to realize the inextricable link between nature, society and transport, which is reciprocal. The threat of environmental catastrophe that resulted from the negative consequences of ill-considered use in practical social activity and consumer of natural resources related to the environment necessitated an immediate search for ways of changing public consciousness based on a fundamentally new ideological orientations and values.

**The purpose of the article.** Conducting a comprehensive analysis of the economic and environmental management of sustainable development of railway enterprises of Ukraine in terms of its strategic direction and impact assessment on the environment.

**Presentation of the base material** The Law of Ukraine «On Railway Transport» [7] declares that the railways and the railway enterprises provide public safety of life and health of citizens who use its services, and environmental protection. The Transport Strategy of Ukraine till 2020 [8] declares that now transport as a whole meets the needs of the national economy and people in transportation, but the level of safety, energy efficiency and technogenic load on the environment does not meet the modern requirements [9]. The main expected results of the implementation of this strategy provide for reducing by 30% the amount of harmful emissions into the atmosphere. The purpose of the Law of Ukraine «On the Fundamentals (Strategy) of the State Environmental Policy of Ukraine

till 2020» [10] is the stabilization and improvement of the environment. Clearly there is a need to transfer the maximum possible amounts of cargo and passenger transportation to the railway transport for reduction of air pollution and noise and other impacts of transport on society [6].

In our previous studies, the main points of sustainable development of railways was determined, specifically: the rail transport has to carry out its transportation operation so that its environmental impact could be reduced to a level at which the formation of all types of damage have reparable nature; the structure of railways income should provide for full cost of preventing damage to the environment and measures for its recovery; by state (public) property and natural monopoly position the railways have to carry all types transportation in the required amount. This implementation of transport must serve only the interests of the society and meet the modern needs of passengers and consignors; according to disposal the railway carrier should leave the funds for the state and these funds allow maintaining extended reproduction [11].

Among the economic instruments of organizational and economic mechanism currently used in railway transport, we can select the system of environmental charges, resource payments, including fees for use of water and land, operating costs for environmental protection, the cost of major repairs of environmental facilities, etc. It should be noted that the main purpose of payment for environmental pollution is economic stimulation of the implementation of measures for the atmosphere protection and water conservation measures, measures to reduce the waste of production processes.

We should note that the railway intensified its efforts to reduce environmental impact and compliance with environmental legislation in recent years. The stimulating factor in this case is the particular requirements of international transport systems aimed at reducing consumption of resources and implementation of environmentally friendly forms of transport to meet international environmental standards.

I agree with a number of authors who believe that the sustainable development of the railway sector provides coordinated functioning of its economic, environmental and social components [2, 3], and the choice of environmental strategy of railway enterprises should be carried out taking into account the economic indicators of environmental activities [4].

The system of environmental management at railway enterprises is a system the main purpose of which is to improve economic and environmental performance of railway enterprises and environmental safety in urban areas, which consists of objects of railway transport and the environment, the elements and structures which have certain properties, developing interact and mutually influence on each other. Therefore, development management system for environmental management at railway undertaking should be based on single methodological approach, formed in the area of the railway transport management.

The main objective of development management system of natural resources at the enterprises of railway enterprises is to ensure the most favorable conditions for human life, the preservation of ecological balance in urban areas, while the rational use of material, natural, human, financial and other resources and improving the economic and environmental efficiency at the railway enterprises.

Theoretical, methodological and practical achievements on the economic and environmental sustainability growth management at the railway enterprises described in the author's own monograph [12], allowed offering such economic and environmental management of railways of Ukraine as a long term strategic management. It is presented in Fig. 1. Actually such management mandates consideration of these factors influence at the railway enterprises, such: environmental factors of direct and indirect actions and

internal environment factors. It is also perceived availability of the necessary elements of the strategic implementation of economic and environmental management, such as: subjects and objects of management, principles, approaches (models), management methods, functions, organizational structure management, competence, culture, tools and integrated efficiency. There are the strategies of balanced functioning based on sustainable development as a result of the long-term management.

An integral part of the development and improvement of organizational and economic mechanism of environmental protection rail transport activity is an analysis and assessment of the situation at present at railway enterprises. It is important to mention that the analytical researches on the impact of railway transport on the environment should be based on a combination of economic analysis, environment analysis and analysis of environmental protection activities. It is a synthesis of these components of the environmental, economic and systemic and structural analysis that will allow solving at the railway enterprises the following problems: provision of the environmental protection with necessary financial and economic levers; harmonization of key environmental and economic indicators of environmental protection activity; providing legal, economic and technical basis for the assessment of anthropogenic impact on the environment; accounting costs for environmental protection activity and determining its results; impact on the scope and nature of pollution of the environmental objects and railway enterprises by changing the structure of economic complex; analysis and prospects of basic production funds of environmental protection purposes; detection of the impact of economic factors and greening criteria of business activity of railway enterprises on the final results of the core activities; comparative analysis of the environmental protection activity of railway enterprises, including in the cross-sector aspect.

So, important is not only the separate analytical study parameters of the environment pollution and environmental costs, but also their direct comparison for assessing reality as indicators derived from reports and empirical determination of the effectiveness of environmental protection measures. So, we need to determine whether it is possible to pay the relatively small amounts of money for large volumes of emissions and discharges of pollutants into the environment. At this stage, given the level of information provision and development of methodological base for the analysis of both environmental protection activity and impact of railway enterprises on the environment, the indicators abstraction and use of water resources are used as well as air emissions of polluting substances; the number of emission sources; the proportion capture and purification of hazardous substances; the costs for environmental protection, environmental fees and rental payments; the cost environmental protection and other equipment.

Under the conditions of the present problem of rational use of natural resources and provision of environmental safety of the population is a prerequisite for sustainable economic and social development of Ukraine, because railway transport activity is associated with the consumption of large amounts of water, water and air pollution, pollution of surrounding areas under the transportation of goods and formation of wastes, noise and vibration. In addition, the railways are carried the transportation of dangerous goods, in cases of emergencies can lead to environmental disaster.

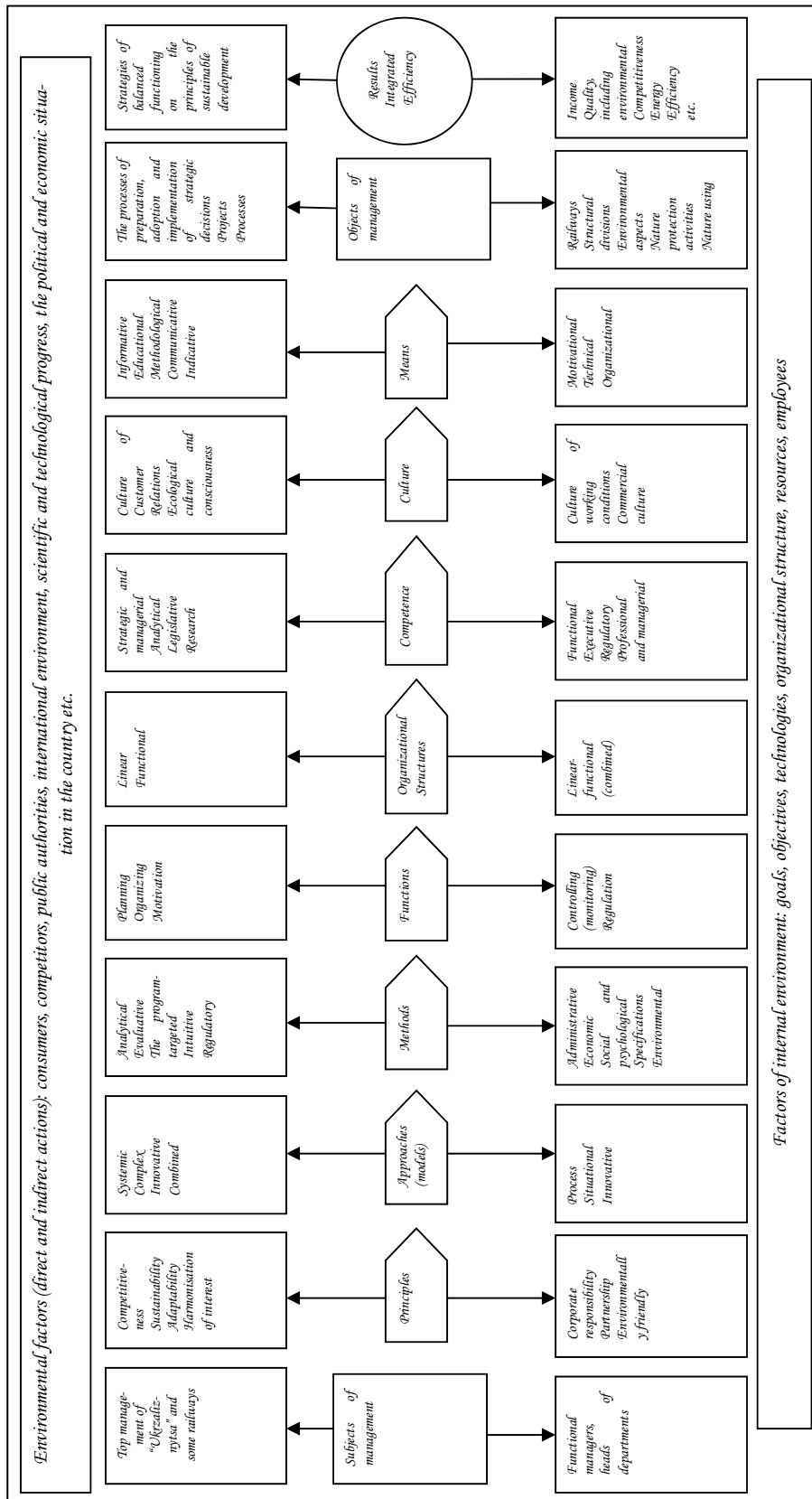


Fig. 1. Strategic economic and ecological management of railways of Ukraine Source: author's development

We also note that the development and implementation of highly engineered solutions occupy an important place for improvement of the environmental situation in railway transport, but we must also solve complex economic problems for their use. We also noted that it is not enough attention paid to the economic mechanism of environmental protection in railway transport in the Sector Program of the Environment Protection. Because today there is not industry agreed methods of cost estimates, including losses from pollution of the environment, methods of economic assessment of environmental protection measures, etc. [1].

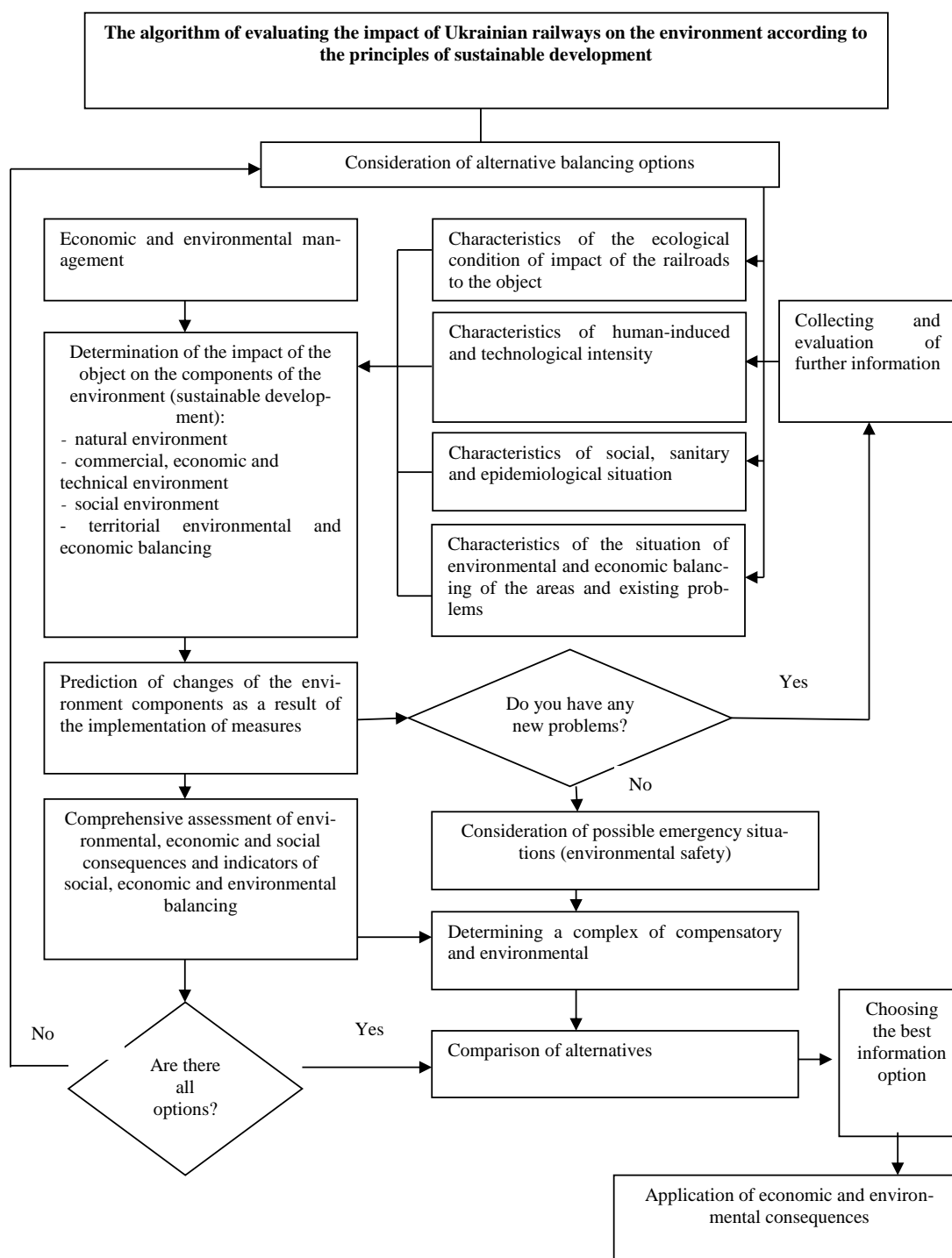
It is also advisable to introduce modern management measures, decisions and practices of foreign companies and adapt them to the work of Ukrainian railways to resolve problems associated with a decrease in noise, vibration and their impact on the environment and human health caused by the activities of railway transport [13]. Implementation of measures to reduce the negative impact of rail transport on the environment, with the establishment of effective environmental practices in other types of transport, could significantly improve the environmental situation in Ukraine.

Taking into account the collective monograph «Fundamentals of integrated environmental management and infrastructure development» [5] as a basis work, we can see that there was improved the algorithm of evaluating the impact on the environment of the object on the basis of balance of competent (sustainable development) for Ukrainian railways as the railway enterprises according to the principles of sustainable development.

This impact assessment on environment by the railways of Ukraine according to the principles of sustainable development involves a sequence of steps to consider alternatives to balance selection option and the best application of economic and environmental consequences, which are presented in Fig. 2. There are the following characteristics: environmental condition of the railways on certain objects, the state of human and technological strength, social and sanitary-epidemiological situation and the state of ecological and economic balancing of the areas in the process of choosing the best option balance. It is also needed is accounting a complex of compensatory and environmental measures in this algorithm. Economic and environmental management takes its prominent place this algorithm, because it is possible to determine the railway enterprises effect on the environment components, to predict the changes of the environment components and evaluate the environmental, economic and social consequences, and thus indicators of social, economic and ecological balance with it help.

**Conclusions and suggestions.** The importance of solving the problem of improving sustainability of environmental management system at the railway enterprises is determined by the following main areas of economic policy, such as: the need to improve the social and economic assessment of efficiency and sustainability of natural resources, ensuring the improvement of the quality of nature and increasing interest of enterprises in the implementation of environmentally significant activities, formation programs to increase efficiency and sustainability of enterprises and the environmental protection. For this purpose, the algorithm for evaluating the impact on the environment of the object on the principles of competent balancing (sustainable development) was improved for Ukrainian railways as the railway enterprises according to the principles of sustainable development.





**Fig.2. The algorithm for evaluating the impact of Ukrainian railways on the environment according to the principles of sustainable development**

*Source: improved on the basis of [5]*

So, the base for implementation of economic and environmental management at the railway enterprises should be the following strategic areas: scientific and technical prerequisites of the railway enterprises; scientific and technical complex of the railway enterprises which is a set of enterprises engaged in scientific, technical activities and training employees; highly qualified information infrastructure of transport, logistical and research and experimental base of the railway; focus on solving complex scientific, technical and technological problems of providing the railway enterprises by the necessary resources and advanced communication infrastructure.

Based on the theoretical, methodological and practical developments on the economic and environmental sustainability management of the railway enterprises, the strategic economic and environmental management of Ukrainian railways was proposed. Actually, such management foresees the mandatory consideration of the following factors influence on the railway enterprises: the environmental direct and indirect actions and internal environment factors. It also includes the necessary elements as subjects and objects of management, principles, approaches (models), management methods, functions, organizational structure management, competence, culture, tools and integrated efficiency. There are the strategies of balanced functioning based on sustainable development as a result of the long-term management.

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