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Environmental management in construction: trends, management levels, indicators

Preservation of the natural environment largely depends on increasing the environmental responsibility of construction organizations. Statistical data show that recent years are characterized by an increase in the volume of work in the type of economic activity "Construction", which requires organizational, legal, economic, technological, and technical measures implemented at the state, sectoral levels and in the management system of construction organizations aimed at rational environmental management. These measures relate not only to the stage of construction of facilities, but also to the period of operation of real estate, which is due to the significant resource intensity of real estate both during construction and operation throughout the life cycle. The study of the problem leads to the conclusion that the mechanism of environmental management should be formed taking into account the specifics of construction activities, ensuring safety at the stage of designing facilities, organization of the construction site, development of the construction area, implementation of process innovations in construction. In resource saving management, in addition to the investment value of an object, it is necessary to manage the costs of operating the object, which account for 75 % of the cost of ownership of the object. The principles of environmental efficiency should be reflected in the evaluation indicators of investment projects. Environmentally responsible investment can become one of the trends in the implementation of national projects, since the goals of national projects correspond to the concept of sustainable development and the balance of economic, social and environmental factors. Barriers to ESG investment in the domestic economy were identified, in particular, underestimation of the impact of these factors on the long-term financial performance of the organizations themselves. To organize an environmental management system in construction organizations, it is necessary to form a system of indicators (sustainability indicators), the presence of which will allow modelling the environmental profile of the organization. The environmental profile allows to establish a balance between external requests and the real capabilities of the organization itself. This requires not only a balanced system of environmental indicators of the organization, but also reference values of indicators that ensure the organization's competitiveness in the contract market.

Keywords: construction industry, environmental problems, environmental safety, state and industry regulation, environmental management of an organization, areas of improvement, indicators of system stability

The current state of the natural environment largely depends on increasing the environmental responsibility of construction organizations. Statistical data show that recent years are characterized by an increase in the volume of work by the type of economic activity "Construction": in 2021 volume growth compared to the previous year amounted to 107.0 %, in 2022 — 107.5 %, and in 2023 — 107.9 %¹. This increases the impact on the environment, and the consumption of non-renewable natural resources increases. There is a need to increase the costs of environmental protection measures. In particular, the index of physical volume of environmental protection expenditures, starting from 2019 is increasing: in 2019 and 2020 the growth to the previous year amounted to 103.4 %, in 2021 — 104.8 %. Despite this, the problems are not completely solved, but only increasing¹.

The process of tightening environmental requirements is irreversible and the environmental management subsystem of the construction industry should be developed, forecasting, long-term planning, formation of environmental control system is necessary. It is necessary to develop a system of indicators of the ecological block in a comprehensive analysis of the economic activities of construction organizations. To preserve the natural environment, a system of organizational, legal, economic, technological, and

technical measures is needed, implemented at the state, sectoral levels and in the management system of construction organizations aimed at rational environmental management and environmental safety. These measures relate not only to the stage of construction of facilities, but also to the period of operation of real estate, which is due to the significant resource intensity of real estate both during construction and operation throughout the life cycle.

The environmental safety management system provides for full engineering and environmental surveys, which should provide a comprehensive study of the engineering and environmental conditions of urban development activities and forecast possible changes. The results of engineering and environmental surveys are the basis for assessing the environmental impact of construction projects, developing environmental protection measures for capital construction projects and linear facilities, as well as land reclamation and conservation projects².

The concept of "investment value" includes the cost of design and survey work, construction and installation work, an engineering and technical support system, connections to outdoor networks, landscaping and gardening of the adjacent territory, and the cost of purchasing a land plot. The necessity of resource conservation management throughout the life cycle of an object is considered, when, in

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1 Federal State Statistics Service. URL: <https://www.gks.ru> (rus.).
2 A set of rules. Engineering and environmental surveys for construction. SP 502.1325800.2021. Date of introduction: 01.17.2022. (rus.).

▶ addition to the investment cost, operation (including current repairs), reconstruction, major repairs, and demolition of the object are taken into account³. Research shows that the cost of operating a real estate object accounts for 75 % of the cost of owning an object, while only 25 % falls on the design, construction and disposal of the object⁴.

Construction is a vivid example of anthropogenic activity, which often has a serious negative impact not only on individual components of the environment and their safety, but also on the stability of the ecosystem as a whole. Today, the state of the environment largely depends on the environmental regulation of the activities of construction contractors and resource-providing industries. Greening of construction involves the adoption of a system of organizational, legal, economic, technological, technical and other measures aimed at improving the efficiency of environmental management, reducing negative impacts on the natural environment, ensuring a favorable environment and environmental safety when providing natural facilities for construction and throughout the life cycle of a building or structure.

Sustainable development management, unlike the existing model, should be proactive and based on long-term programmes that should not be reduced to simple regulation. The legislative and legal framework, which will be developed and developed at the global, national and regional levels, should also have a preventive character.

The research identifies two interrelated levels of environmental management [1]. At the level of economic entities, environmental management is considered as a management subsystem focused on the development of environmental policy, minimizing the negative consequences of production, monitoring the use of resources, analyzing and evaluating environmental results, and continuously improving the system. At the global level, environmental objectives are formed by the State in the form of standards, which establishes regulations for activities and control.

The following mechanisms for stimulating resource conservation in housing management are being considered at the state and regional levels [2]:

- formation of a resource-saving regional policy, taking into account the specifics of the region;
- development and constant updating of standards for the management of apartment buildings;
- involving businesses in investing in projects aimed at implementing progressive resource-saving technologies;
- development of the public-private partnership system in the modernization of the housing stock.

As one of the directions, the implementation of "control over control" is considered, i.e. the development of methods for checking the environmental supervision authorities themselves and situations of environmental crime [3].

The study of the problem leads to the conclusion that the mechanism of environmental management should be formed taking into account the specifics of construction activities, the peculiarities of resource supply and other factors [1, 4–6]. In particular, the environmental management system should focus on:

- implementation of environmental measures in the design of facilities;
- environmental safety of the building materials used;

- environmental aspects of the construction site organization;
- environmental aspects of the development of the building area;
- environmental safety of waste disposal;
- environmental safety of construction production technologies;
- environmental safety of process and product innovations in construction.

At the design stage, both direct and feedback of environmental factors should be taken into account². The zones of impact of the projected object are highlighted, when negative environmental impacts may occur during construction and operation of the facility, and permissible impact levels are determined. Zones with environmental restrictions, engineering and environmental conditions as a set of factors affecting urban development activities are highlighted.

Engineering and environmental surveys should be sufficient to provide a comprehensive assessment of the environmental conditions of the construction site or development area, evaluate direct and feedback, and create a basis for informed recommendations². Recommendations can be focused either on preventing negative effects or on banning construction. The document contains a detailed list of the composition of engineering and environmental surveys, but does not exclude that additional surveys may be carried out at the initiative of the developer. The limitation period for existing research results is established.

"Green" construction is regulated and stimulated by the state³. The requirements of the standard are aimed at reducing the consumption of energy resources, the use of non-traditional, renewable and secondary energy resources, rational water use, reducing harmful effects on the environment during the construction and operation of a building, including the adjacent territory, while ensuring a comfortable human habitat and adequate economic profitability of architectural, structural and engineering solutions. The concept of "investment value" includes the cost of design and survey work, construction and installation work, an engineering and technical support system, connections to outdoor networks, landscaping and greening of the adjacent territory, and the cost of purchasing a land plot.

During the construction and reconstruction of buildings and structures, it is necessary to monitor the condition of environmental components. This is reflected in the composition of the environmental reporting of construction organizations. It is necessary to comply with the norms of allotment and targeted use of land, soil protection and land reclamation. Since 2021, all construction sites have been divided into certain categories, which determines the list, content and timing of providing statistical reports of an environmental orientation. Construction projects with a duration of work up to 6 months are classified in the 4th category, and with a construction period of more than 6 months in the 3rd category⁵. In particular, the 4-OS form provides for the submission of information on the organization's costs for environmental protection⁶. It is also envisaged that there is a programme of industrial environmental control, which should contain information on: official staff units and/or departments responsible for controlling the ecology of production; about the availability of their own and/or hired laboratories that have the appropriate accreditation according to the legislation of Russia; methods and degree of regularity of control, sampling points and measurement methods.

3 GOST R 54964–2023. Conformity assessment. Environmental requirements for real estate objects. Approved. By order of the Federal Agency for Technology Regulation and Metrology No. 1488-st dated 11.29.2023. (rus.).

4 Calculation of the cost of construction taking into account the life cycle of the building. URL: <https://tula.profnastil.com/news/raschet-stoimosti-stroitelstva-s-uchetom-zhiznennogo-tsikla-zdaniya> (rus.).

5 Reporting on the ecology of construction sites from 2021. URL: <https://all4eco.ru/отчетность-по-экологии-объектов-строительства-с-2021-года> (rus.).

6 Form 4-OS "Information on current environmental protection costs" (Appendix 5 to the order of Rosstat dated 07/31/2023 No. 369). URL: <https://normativ.kontur.ru/document?moduleId=44&documentId=46678> (rus.).

The transition to "green" construction requires additional and sometimes significant costs. In particular, the use of wooden structures in construction instead of reinforced concrete leads to an increase in price by 5–7 %, but pays off due to energy efficiency during the operation of the facility [7].

The principles of environmental efficiency should be reflected in the indicators of investment projects [8]. Environmentally responsible investment can become one of the trends in the implementation of national projects, since the goals of national projects correspond to the concept of sustainable development and the balance of economic, social and environmental factors. Barriers to ESG investment in the domestic economy are identified, in particular: misunderstanding of the aggravation of the ESG problem and the impact of taking into account these factors on the long-term financial performance of the organizations themselves [8].

Achieving ESG goals, including in the field of ecology, requires additional costs and leads to a decrease in the profitability of production, but ensures the growth of the company's business reputation, which in the future will lead to an increase in business profitability, strengthening competitive positions [9].

GOST R 54964–2023 discloses the concept of basic categories reflecting the essence of environmental requirements for real estate, and also provides evaluation criteria within each basic category. In particular, the state of environmental management is assessed in the following sections³:

- organization of an environmental management and monitoring system;
- optimization of design solutions;
- monitoring the fulfillment of resource saving requirements;
- reliability during commissioning of the facility;
- control and monitoring of the main indicators of the facility;
- optimization of the shape of the building, taking into account the direction of air flows, which involves taking into account climatic features.

Basic levels of electricity and heat consumption are developed, taking into account the area of the facility and the number of floors. A mandatory methodology for calculating the energy characteristics of buildings has been developed, taking into account regional and political conditions.

In some studies, the institutionalization of socio-environmental responsibility of the construction business is considered as a necessary condition for the development of the investment and construction sector, in particular: the development of forms of interaction between participants in investment and construction processes; the development of tools for environmental and economic management and regulation [10].

To organize an environmental management system in construction organizations, it is necessary to form a system of indicators (sustainability indicators) that must meet the following requirements:

- possibility of using it at the macro level on a national scale;
- combine environmental, social and economic aspects of the company's activities;
- provide an unambiguous interpretation for decision makers;
- have a quantitative expression;
- rely on the existing system of national statistics and the reporting of enterprises themselves;
- ensure the possibility of applying a system of comparative measurements at the industry level;
- possibility of evaluation in time dynamics.

The availability of an indicator system will make it possible to implement one of the most effective tools for developing

a sustainable development strategy taking into account environmental factors: building an environmental profile of an organization. The construction of an environmental profile is based on a rational combination of qualitative and quantitative analysis methods, which creates opportunities to identify strategic reserves. The environmental profile allows you to establish a balance between external requests and the real capabilities of the organization itself. This requires not only a balanced system of environmental indicators of the organization, but also reference values of indicators that ensure the organization's competitiveness and compliance with environmental standards. The following values can be taken as reference values:

- level of changes planned by the organization itself due to the implementation of environmental measures;
- level of performance provided by advanced construction production technologies;
- level of requirements for organizations in the competitive selection process;
- environmental performance of enterprises with a high rating in the contracting market.

It is necessary to increase the information transparency of the activities of construction organizations for investors, consumers and business partners. The competitiveness index as an aggregated indicator should contain, along with other components, indicators of environmental responsibility, reflecting the availability of environmentally friendly building materials, their production technology, construction production technology, resource conservation at the stage of operation of the property.

The following can be considered as separate subsystems of indicators capable of reflecting the environmental conditions of management [11]: the degree of greening of all links of economic activity; the degree of progressiveness of resource conservation and ecological purity of technologies; the cost of natural resources; the level of environmental payments; the degree of environmental safety of the population.

Environmental factors are practically not taken into account when making management decisions both in the organization itself and by investors making decisions on financing projects. For internal management purposes, the state of the environmental management subsystem can be represented by a relatively wide range of indicators that provide guidance for making strategic and operational decisions in the field of construction products, construction technologies, and the real estate market. This requires the development of an environmental management system in the management of a construction organization with a focus on measures implemented at the state, regional and sectoral levels within the framework of the concept of sustainable development.

REFERENCES

1. Kosyakova I.V., Kapmar I.V. *Environmental innovations at industrial enterprises as a factor in achieving balanced development of society. Fundamental research.* 2017; 9(2):455–459. (rus.).
2. Sevka V.G., Polukhina M.N. *Methodological approaches to assessing the security of the housing stock management system with material and technical resources. Creative economy.* 2023; 17(1):385–404. DOI: 10.18334/ce.17.1.117061. EDN IKAKIK. (rus.).
3. Rudenko M.N., Subbotina Yu.D. *The state of environmental safety at the present stage of development. Economic security.* 2023; 6(1):347–366. DOI: 10.18334/ecsec.6.1.117556. EDN UPWGQM. (rus.).
4. Akhmetova K.M., Kuzminykh N.A. *Efficiency assessment of environmental innovation management. Economics and Management: a scientific and practical journal.* 2021; 4(160):43–51. DOI: 10.34773/EU.2021.4.7. EDN XIJHAY. (rus.).
5. Yakovleva E.A., Titova E.V., Stepanova Yu.N. *Methodological approaches to assessing the role of innovations in the "green"*

- ▶ development of the economy. *Actual Problems of Scientific Research of the 21st Century: Theory and Practice*. 2023; 11(3(62)):107-121. (rus.).
6. Arsky A.A. Environmental aspects of construction and operation of logistics transformation centers. *Herald of MASI*. 2022; 2:11-14. DOI: 10.52470/2224669X_2022_2_12. EDN UPFBAE. (rus.).
7. Petrova E.A., Korshunov A.F. Prospects for the construction of environmentally friendly buildings. *Modern construction and architecture*. 2022; 1(25):14-19. DOI: 10.18454/mca.2022.25.2 (rus.).
8. Shemyakina T.Y. Application of ESG factor standards in innovative construction projects. *Bulletin of the University*. 2021; 1:132-139. DOI: 10.26425/1816-4277-2021-3-132-139 (rus.).

9. Ovechkin D.V. Reporting investments: the impact of the ESG rating on the rating market and the expected result in the global market. *Scientific journal of the ITMO Research Institute*. 2021; 1:44-52. DOI: 10.17586/2310-1172-2021-14-1-43-53 (rus.).
10. Buzyrev V.V., Nuzhina I.P., Zolotareva M.V. The influence of socio-logical and environmental factors on urban planning in developing urbanized territories. *Problems of the modern economy*. 2017; 3(63): 210-214. (rus.).
11. Sheremet A.D. Comprehensive analysis of indicators of sustainable development. *Economic analysis: theory and practice*. 2014; 45(396):106-118.

Экологический менеджмент в строительстве: тенденции, уровни управления, показатели

Сохранение окружающей природной среды во многом зависит от повышения экологической ответственности строительных организаций. Статистические данные показывают, что последние годы характеризуются ростом объемов работ по виду экономической деятельности «Строительство», что требует организационных, правовых, экономических, технологических и технических мер, реализуемых на государственном, отраслевом уровнях и в системе управления строительными организациями, направленными на рациональное природопользование. Эти меры относятся не только к стадии строительства объектов, но и к периоду эксплуатации объектов недвижимости, что обусловлено значительной ресурсоемкостью объектов недвижимости как в процессе строительства, так и эксплуатации в течение всего жизненного цикла. Исследование проблемы приводит к выводу, что формировать механизм экологического менеджмента следует с учетом специфики строительной деятельности, обеспечивая безопасность на стадии при проектировании объектов, организации строительной площадки, освоении территории застройки, внедрении процессных инноваций в строительстве. В управлении ресурсосбережением кроме инвестиционной стоимости объекта необходимо управлять затратами на эксплуатацию объекта, которые составляют 75 % затрат владения объектом. Принципы экологической эффективности должны находить отражение в показателях оценки инвестиционных проектов. Ответственное с позиций экологии инвестирование может стать одним из трендов реализации национальных проектов, поскольку цели национальных проектов соответствуют концепции устойчивого развития и сбалансированности экономических, социальных и экологических факторов. Выявлены барьеры препятствий ESG-инвестированию в отечественной экономике, в частности недооценка влияния названных факторов на долгосрочные финансовые показатели самих организаций. Для организации системы экологического менеджмента в строительных организациях необходимо формирование системы показателей (индикаторов устойчивости), наличие которой позволит моделировать экологический профиль организации. Экологический профиль позволяет установить баланс внешних запросов и реальных возможностей самой организации. Это требует не только наличия сбалансированной системы экологических показателей организации, но и эталонных значений показателей, обеспечивающих организации повышение конкурентоспособности на рынке подрядных работ.

Ключевые слова: строительство, экологические проблемы, экологическая безопасность, государственное и отраслевое регулирование, экологический менеджмент организации, направления совершенствования, индикаторы устойчивости системы

СПИСОК ИСТОЧНИКОВ

1. Косякова И.В., Капмар И.В. Экологические инновации на промышленных предприятиях как фактор достижения сбалансированного развития общества // *Фундаментальные исследования*. 2017. № 9 (ч. 2). С. 455–459.
2. Севка В.Г., Полухина М.Н. Методические подходы к оценке обеспеченности системы управления жилищным фондом

материально-техническими ресурсами // *Креативная экономика*. 2023. Т. 17. № 1. С. 385–404. DOI: 10.18334/ce.17.1.117061. EDN IKAKIK.

3. Руденко М.Н., Субботина Ю.Д. Состояние экологической безопасности на современном этапе развития // *Экономическая безопасность*. 2023. Т. 6. № 1. С. 347–366. DOI: 10.18334/ecsec.6.1.117556. EDN UPWQGM.

4. Ахметова К.М., Кузьминых Н.А. Оценка эффективности управления экологическими инновациями // *Экономика и управление: научно-практический журнал*. 2021. № 4 (160). С. 43–51. DOI: 10.34773/EU.2021.4.7. EDN XJHAY.

5. Яковлева Е.А., Титова Е.В., Степанова Ю.Н. Методические подходы к оценке роли инноваций в «зеленом» развитии экономики // *Актуальные проблемы научных исследований 21-го века: теория и практика*. 2023. Т. 11. № 3 (62). С. 107–121.

6. Арский А.А. Экологические аспекты строительства и эксплуатации логистических трансформационных центров // *Вестник МАСИ*. 2022. № 2. С. 11–14. DOI: 10.52470/2224669X_2022_2_12. EDN UPFBAE.

7. Петрова Е.А., Коршунов А.Ф. Перспективы строительства экологически чистых зданий // *Современное строительство и архитектура*. 2022. № 1 (25). С. 14–19. DOI: 10.18454/mca.2022.25.2

8. Шемякина Т.Ю. Применение ESG-факторов в инновационно-строительных проектах // *Вестник университета*. 2021. № 1. С. 132–139. DOI: 10.26425/1816-4277-2021-3-132-139

9. Овечкин Д.В. Ответственные инвестиции: влияние ESG-рейтинга на рентабельность фирм и ожидаемую доходность на фондовом рынке // *Научный журнал НИУ ИТМО*. 2021. № 1. С. 44–52. DOI: 10.17586/2310-1172-2021-14-1-43-53

10. Бузырев В.В., Нухина И.П., Золотарева М.В. Влияние социологических и экологических факторов на градостроительную деятельность на развивающихся урбанизированных территориях // *Проблемы современной экономики*. 2017. № 3 (63). С. 210–214.

11. Шерemet А.Д. Комплексный анализ показателей устойчивого развития // *Экономический анализ: теория и практика*. 2014. № 45 (396). С. 106–118.

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