

Zarina Poberezhna,
Oleksandr Trukhan,
Serhii Smerichevskyi,
Arkadii Bileush,
Maksym Kolesnyk,
Ihor Martsinenko

SOCIAL RESPONSIBILITY MANAGEMENT IN THE ECOLOGICAL MARKETING SYSTEM TO ENSURING BUSINESS SUSTAINABILITY OF ENTERPRISES

The object of research is the processes of formation and development of social responsibility in the system of environmental marketing to ensure the business sustainability of enterprises. It was established that the phased implementation of social and environmental initiatives allows to assess resources, determine priorities and timely adjust strategies. Special attention is paid to the use of modern management principles, such as digital platforms, monitoring systems and interaction with stakeholders, which contributes to increasing the adaptability of enterprises to changes in the market environment. The economic, social, environmental, innovative, strategic, marketing and regulatory impact of CSR on business sustainability is studied. A methodological approach to social responsibility management is presented, which includes diagnostics of the state, definition of goals, assessment of resource potential, formation of management measures, their implementation and control. It was established that the integration of social and environmental responsibility contributes to the formation of a positive image of the enterprise, strengthening the trust of consumers and partners and the development of innovative products. It was determined that the comprehensive application of these approaches ensures the long-term sustainability of enterprises and their competitiveness. It is determined that systemic management of social responsibility is a key tool for sustainable business development. The paper deepens the theoretical foundations and develops practical recommendations for the integration of social, environmental and innovative models and management solutions to increase the business sustainability of enterprises. The presented conclusions can be used to plan sustainable development strategies and assess the effectiveness of CSR initiatives. The study emphasizes the importance of combining social responsibility and environmental marketing to ensure comprehensive and balanced development of enterprises.

Keywords: sustainable development, social responsibility, business processes, environmental marketing, business sustainability, development strategies.

Received: 25.07.2025

Received in revised form: 14.09.2025

Accepted: 07.10.2025

Published: 30.10.2025

© The Author(s) 2025

This is an open access article

under the Creative Commons CC BY license

<https://creativecommons.org/licenses/by/4.0/>

How to cite

Poberezhna, Z., Trukhan, O., Smerichevskyi, S., Bileush, A., Kolesnyk, M., Martsinenko, I. (2025). Social responsibility management in the ecological marketing system to ensuring business sustainability of enterprises. *Technology Audit and Production Reserves*, 5 (4 (85)), 13–19. <https://doi.org/10.15587/2706-5448.2025.341019>

1. Introduction

In the current conditions of globalization and increasing environmental challenges, there is a growing need to form scientific principles of ecological marketing as a key tool for sustainable development of enterprises. Research aimed at integrating the principles of social responsibility in the ecological marketing system allows for the formation of rational management strategies for enterprises. Scientific approaches to the development of ecological marketing ensure the formation of effective mechanisms for harmonizing the economic interests of enterprises and public expectations. The effectiveness of an enterprise is characterized as ensuring a given level of reliability with minimal resource consumption [1]. Of particular importance is the search for new management methods that would help minimize the negative impact on the environment and at the same time increase the competitiveness of the enterprise. In the context of the transformation of world markets, it is the conceptual principles of ecological marketing that create the basis for the development of innovative strategies and business models. By incorporating innovative technologies into their strategic management approach, enterprises can adapt faster

to market changes and make more accurate and well-founded decisions [2].

It should be noted that in the context of global neo-technological transformations, the problem of ensuring the business sustainability of enterprises is becoming particularly relevant. Under the influence of changes in the external environment, increased competition and growing consumer demands, enterprises are forced to look for new approaches to sustainable development. One of the most important areas is the formation of a socially responsible business that combines economic interests with the needs of society and environmental requirements. The use of the principles of ecological marketing allows enterprises not only to minimize the negative impact on the environment, but also to create added value for consumers and partners. Business sustainability in such a system is the result of the effective integration of social and environmental responsibility into strategic management. It ensures long-term competitiveness, forms a positive image and strengthens trust in the enterprise.

Modern market conditions demonstrate that consumers increasingly prefer goods and services produced in compliance with the principles of the "green" economy.

This stimulates enterprises to innovate and implement new business models focused on environmental safety and social value. Thus, ensuring business sustainability on the basis of social responsibility and environmental marketing becomes a key condition for the development of enterprises in the 21st century. The prospects of such an approach lie in the possibility of harmonizing the interests of business, society and the natural environment.

The scientific issues of various aspects of social responsibility management in the system of environmental marketing to ensure the business sustainability of enterprises have been and remain the focus of attention of leading foreign and Ukrainian scientists. Researchers emphasize the importance of integrating social and environmental components into the business development strategy. At the same time, scientific approaches to the identified issues demonstrate significant ambiguity, which leads to a variety of interpretations of its essence and implementation tools. This indicates the complexity of the phenomenon under study and the need for further development of scientific concepts and practical models. Thus, the issue of finding effective management solutions in this area remains open and requires in-depth analysis.

In the scientific work [3], modern approaches to the development of marketing and the integration of its principles into the enterprise management system were highlighted. The authors emphasize the need to take into account social and environmental factors in business strategies, which directly affects its long-term sustainability. However, the relationship between the proposed factors in the context of the social responsibility of the enterprise was not considered. In the works [4, 5], the features of the influence of corporate social responsibility on the formation of brand perception in the context of environmental marketing were studied. It was proven that the positive perception of the enterprise's CSR activities significantly strengthens the competitive positions of companies and their market stability. It is worth noting that the authors did not consider the issues of ensuring business sustainability on the basis of social responsibility. In the work [6], the relationship between business social responsibility and the environmental performance of enterprises was analyzed. It was found that the systematic implementation of CSR practices stimulates enterprises to reduce the negative impact on the environment and at the same time contributes to the improvement of financial indicators. In [7], it was proposed to consider CSR as an institutional basis for the sustainability of small and medium-sized businesses, and approaches to the organization of management were developed that allow harmonizing social, economic and environmental development goals. However, the issues of minimizing the negative impact on the environment and creating value for consumers and partners remained unconsidered. The authors of the study [8] investigate the modeling of the relationship between corporate social responsibility, green innovations and dynamic capabilities of the enterprise. Since the systematic implementation of environmental innovations supported by CSR initiatives is the key to strengthening business sustainability. In [9], strategic corporate social responsibility is investigated as a factor in the formation of long-term business performance. It is worth noting that there is a need to integrate CSR into the corporate strategy to ensure innovative development and competitiveness of the enterprise. In [10], three key approaches to strategic corporate social responsibility in the context of environmental sustainability are revealed. The author argues that CSR should be considered as a strategic resource capable of providing the enterprise with long-term sustainability and competitive advantages in the context of globalization. The conducted research of scientific works indicates a key role in the study of social responsibility management in the system of ecological marketing, because they investigate the specifics of implementing CSR practices in the national business environment. The research allows taking into account local economic, social and environmental features of enterprises to increase business sustainability. Thanks to this, a scientifically sound knowledge base is formed,

which contributes to the development of practical strategies for sustainable development of Ukrainian companies. In the work [11, 12], models of CSR practices of Ukrainian enterprises are considered, typologies of enterprises are distinguished by the level of responsibility, and ways of increasing the efficiency of their activities are proposed. However, the issues of determining the index of sustainable development in value chains, which allows comparing the level of sustainable development management between domestic and foreign enterprises, have not been studied. In [13, 14], the impact of CSR on consumer decisions in Ukraine, in particular on the choice of products with bio-ingredients and sustainable packaging, was investigated. However, the authors did not investigate the combination of sustainable development goals of enterprises with the effectiveness of CSR practices in Ukraine. In [15], CSR practices in Ukrainian enterprises and their contribution to sustainable development, in particular in the agri-food sector, were investigated. The presented ambiguity of approaches requires further in-depth research to create a balanced and substantiated methodology for implementing social responsibility management in the ecological marketing system, which ensures sustainable development and competitiveness of enterprises. This will allow the formation of effective mechanisms for integrating social and environmental aspects in the business processes of enterprises. As a result, enterprises will be able to increase their adaptability to changes in the market environment and ensure long-term business sustainability.

The aim of research is to develop a methodological approach to social responsibility management in the ecological marketing system in order to ensure sustainable development and increase the business sustainability of enterprises. Corporate social responsibility is a priority for ensuring environmental safety and creates conditions for the development of production using modern technologies.

2. Materials and Methods

The object of research is the processes of formation and development of social responsibility in the system of environmental marketing to ensure business sustainability of enterprises.

The methods used in the research were general and special methods, in particular, in order to form the main areas of influence on social responsibility to ensure business sustainability of enterprises, the grouping method was used. The generalization method was used to determine the most promising modern management principles for ensuring business sustainability. In order to develop a methodological approach to managing social responsibility in the system of environmental marketing to ensure business sustainability of enterprises, systematization and comparison methods were used. To test the proposed approach at enterprises, financial data (balance sheet, F1, F2), statistical information and reports of enterprises were used.

Managing social responsibility in the system of environmental marketing requires the use of a wide range of methodological tools. The use of methodological tools allows for a comprehensive assessment of the effectiveness of implementing CSR practices and their impact on business sustainability. In addition, it provides the opportunity to compare Ukrainian and foreign experience in managing social responsibility. It also involves planning, implementing and monitoring measures that ensure a responsible attitude towards society, employees, consumers and the environment [16]. Methodological diversity helps to identify patterns, trends and potential risks in the implementation of environmentally responsible strategies. Thus, the integration of quantitative and qualitative methods is key to the formation of sound recommendations for increasing the business sustainability of enterprises. The importance of modeling integrated business processes for enterprises is manifested in such aspects as: resource optimization, improved coordination, forecasting and risk management, improved customer service, innovation and adaptation to change [17].

Social responsibility management in the ecological marketing system also involves regular monitoring and assessment of the effectiveness of the implemented measures. It includes interaction with various stakeholders, involving them in the decision-making process. Thus, it ensures the long-term business sustainability of enterprises and contributes to the harmonious development of society and the environment. Strategically oriented social responsibility increases employee engagement, loyalty and productivity, which has a positive impact on the internal climate of the enterprise [18, 19].

Modern market conditions require enterprises to actively implement socially and environmentally responsible practices to ensure long-term business sustainability. The need to develop effective management mechanisms is due to the growing demands of stakeholders and regulators for transparency, responsibility and sustainable development [20]. The implementation of modern management mechanisms allows integrating CSR and environmental marketing into business processes and strategic planning of the enterprise.

The most promising modern management principles for ensuring business sustainability based on social responsibility in the system of ecological marketing are:

1. *Strategic CSR policy*: The development of a strategic social responsibility policy involves determining the priorities and goals of the enterprise in the field of social and ecological responsibility. It includes the establishment of key performance indicators and a system for monitoring their achievement. This approach allows integrating the principles of sustainable development into the long-term business strategies of the enterprise.

2. *Systematic planning and monitoring of CSR programs*: This principle provides for regular assessment of the results of the enterprise's social and ecological initiatives. It involves the collection and analysis of data reflecting the effectiveness of the implementation of CSR projects. Based on the results obtained, management can adjust programs to increase business sustainability.

3. *Integration of CSR into marketing processes*: Socially responsible and ecological initiatives are integrated into the promotion of products and services, which increases their attractiveness for conscious consumers. For example, the use of "green" packaging and environmentally friendly products forms a positive image of the enterprise. This helps to attract new customers and increase the loyalty of existing ones.

4. *Stakeholder engagement management*: This principle involves the active involvement of employees, partners, and the community in the implementation of social and environmental projects. It ensures transparency and openness of decision-making processes, which increases trust in the company. Such interaction contributes to the formation of partnerships and strengthening the social capital of the enterprise.

5. *Innovative digital platforms for assessing the impact of CSR*: The use of digital platforms allows to quickly collect and analyze data on the effectiveness of social and environmental programs. This provides forecasting of results and timely correction of strategies. Thanks to this approach, the enterprise increases its adaptability and long-term sustainability in the market.

The use of digital technologies provides new opportunities for optimizing the activities of enterprises, increasing their efficiency, and improving competitive positions [21]. Thanks to the use of modern technologies such as big data (BD), artificial intelligence (AI), machine learning (ML), and cloud computing, enterprises can quickly and accurately process huge amounts of information effectively. This allows them to adapt to market fluctuations, find untapped opportunities for business expansion, and optimize their internal operations [22]. The introduction of artificial intelligence means a fundamental change in the new approach to energy efficiency and sustainable development issues [23].

3. Results and Discussion

3.1. Defining the structure of a methodological approach to social responsibility management in the environmental marketing system

A summary of the values of social responsibility management in the environmental marketing system for ensuring the business sustainability of enterprises is presented in Table 1.

Thus, social responsibility management in the ecological marketing system allows simultaneously to increase economic efficiency, improve the reputation of the enterprise and minimize the negative impact on the environment. Integration of social, ecological and innovative approaches contributes to the development of new products, technologies and strategies for sustainable development. In addition, compliance with regulatory requirements and participation in socio-economic initiatives strengthens the trust of stakeholders and the community. Thus, systemic social responsibility management ensures the long-term sustainability of enterprises and their adaptation to changes in the market environment.

The phased development of the social responsibility management process in the ecological marketing system is key to ensuring the long-term business sustainability of enterprises. This approach allows for the consistent integration of social and ecological initiatives into the strategic planning and operational activities of the enterprise. Each stage of the process provides an assessment of resources, determination of priorities and control of the effectiveness of the implementation of CSR projects [24]. Phased implementation allows to avoid risks and increase the adaptability of the enterprise to changes in the market environment.

Table 1

The values of social responsibility management in the environmental marketing system for ensuring the business sustainability of enterprises

Direction of influence	Importance for the business sustainability of the enterprise	Implementation examples
Economic	Increasing financial efficiency and competitiveness	Implementation of energy-efficient technologies, reduction of resource costs, optimization of production processes
Social	Improving the reputation of the enterprise and the trust of stakeholders	Personnel development programs, corporate volunteering, support of local communities
Environmental	Minimizing the negative impact on the environment and complying with regulatory requirements	Use of biodegradable materials, waste recycling, "green" marketing campaigns
Innovative	Promoting the development of new products and technologies that meet the principles of sustainable development	Creation of environmentally friendly products, use of "green" packaging, innovative production methods
Strategic	Ensuring long-term business sustainability and adaptation to market changes	Integration of CSR into strategic planning, risk analysis, formation of sustainable development strategies
Marketing	Forming a positive image and attracting conscious consumers	Communication campaigns on social and environmental achievements, promotion of "green" products
Regulatory	Complying with legislative and international standards in the field of ecology and social responsibility	Product certification, implementation of ISO 14001 and SA8000 standards, compliance with environmental regulations

As a result, a systematic and balanced approach is formed, which contributes to sustainable development and strengthening the company's reputation.

The structure of the proposed methodological approach to social responsibility management in the ecological marketing system to ensure the business sustainability of enterprises is presented in Fig. 1.

Therefore, the process of social responsibility management in the ecological marketing system should be considered as a phased activity that ensures the consistent integration of CSR programs in the business processes of the enterprise. Each stage is aimed at assessing the current state, defining goals, optimizing resources and forming effective management measures.

The introduction and control of the implementation of social and ecological initiatives allows to increase the business sustainability of the enterprise and its adaptability to changes in the market environment. The systematic application of these stages ensures long-term strengthening of the reputation of the enterprise and its sustainable development.

3.2. Model for determining the level of social responsibility of enterprises

To solve the problem of determining the reliability and assessing the parameters in the event of deterioration of the indicators of the financial and technical conditions of the enterprise, it is necessary to conduct analytical calculations and statistical modeling [25, 26].

The market for transport and logistics services with n enterprises $I \in \{1, 2, \dots, n\}$ is considered. The interaction is described by a two-stage game with investments in social and environmental initiatives (CSR) and subsequent Cournot competition [27].

Consider the following model parameters:

A, B – demand parameters;

σ – impact of CSR on financial and economic sustainability;

c_i – marginal costs of the i -th enterprise;

δ – efficiency of cost reduction from investments;

k_i – curvature of the investment cost function of the i -th enterprise;

a_i – emission intensity of the i -th enterprise;

β – social effect of investments;

τ – rate of payments for environmental responsibility;

q_i – production volumes of the i -th enterprise;

g_i – investment volumes of the i -th enterprise;

P – average price for products (services);

Q – total volume of products (services);

π_i – profit of the i -th enterprise;

e_i – volumes of negative environmental impact of the i -th enterprise.

Stage 1. Modeling CSR investments. Each company chooses the amount of CSR investments $g_i \geq 0$. Investment costs are described by a function of the form

$$K_i(g_i) = \frac{k_i}{2} g_i^2, k_i > 0. \quad (1)$$

At the same time, investments reduce individual marginal costs

$$c_i^{\text{eff}} = c_i - \delta \cdot g_i, \delta > 0, \quad (2)$$

and also increase market capacity due to the reputation effect

$$A^{\text{eff}} = A + \sigma \cdot \sum_{j=1}^n g_j, \quad (3)$$

where A – a constant demand parameter, $\delta > 0$ – the efficiency of cost reduction, $\sigma > 0$ – the coefficient of influence of social and environmental investments on demand.

Stage 2. Modeling of competition according to Cournot. Enterprises determine the volume of production $q_i \geq 0$. In this case, the inverse demand function has the form

$$P = \max\{0, A^{\text{eff}} - B \cdot Q\}, Q = \sum_{i=1}^n q_i, B > 0, \quad (4)$$

where $B > 0$ – the elasticity of demand parameter, $q_i \geq 0$ – the volume of output of the i -th enterprise.

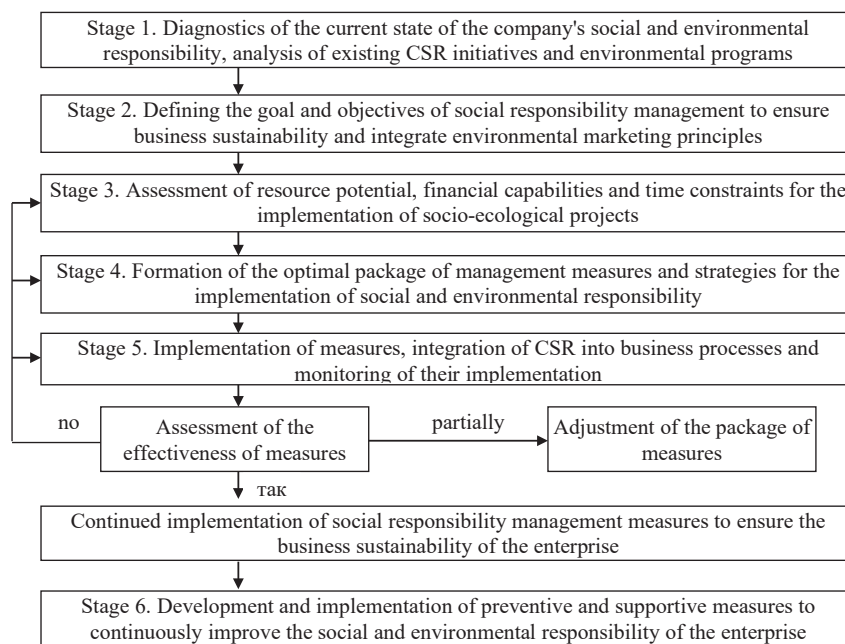


Fig. 1. Structure of a methodological approach to social responsibility management in the ecological marketing system to ensure business sustainability of enterprises

The profit of the enterprise, taking into account investments, environmental effects and tax incentives/sanctions, is determined as follows

$$\pi_i(q, g) = (P - c_i^{\text{eff}})q_i - \frac{k_i}{2}g_i^2 - \tau e_i(q_i, g_i), \quad (5)$$

where $e_i(q_i, g_i)$ – the amount of negative environmental impact, which is modeled by the equation

$$e_i(q_i, g_i) = \max\{0, \alpha_i q_i - \beta g_i\}, \quad (6)$$

where α_i – the intensity of negative environmental impact per unit of output, β – the coefficient of environmental compensation of investments, and $\tau \geq 0$ – the rate of environmental tax or payment for negative environmental impact.

Stage 3. Solving the game. For fixed g , the classical Cournot competition conditions with heterogeneous costs have the following optimal values of production volumes

$$\dot{q}_i(g) = \frac{A^{\text{eff}} - (n+1)c_i^{\text{eff}}(g) + \sum_{j \neq i} c_j^{\text{eff}}(g)}{(n+1)B}, \quad \dot{q}_i \geq 0. \quad (7)$$

The equilibrium price is found as

$$P^* = A^{\text{eff}} - B \sum_{i=1}^n \dot{q}_i.$$

For linear demand with $B > 0$ and quadratic investment costs, the optimal solution (1) exists under standard assumptions (non-negative volumes, finiteness of A^{eff}).

If g_i is not fixed, let's consider two methods:

1. *Search for non-cooperative equilibrium (according to Nash)*: each enterprise maximizes $\pi_i(q^*(g), g)$ for g_i . The equilibrium is found by the method of successive iterations.

2. *Search for cooperative equilibrium (coalition)*: the choice of g maximizes

$$\sum_i \pi_i(q^*(g), g).$$

For convex functions, the solution is found by the gradient descent method over the total profit.

The modeling parameters c_i , k_i , a_i are determined by the reporting characteristics of enterprises. The pair (δ, σ) reflects, respectively, the efficiency of cost reduction and elastic demand shift due to CSR; (β, τ) is the social effect of investments and the level of internal monetization of externalities (tax/fee).

The simulation was conducted for three Ukrainian enterprises: SE "KUHNE & NAGEL" (Ukraine), SE "SHENKER" (Ukraine), LLC "ZAMMLER UKRAINE" in a common market with representative (scenario) parameters.

All indicators were analyzed in a normalized form. Two scenarios were considered:

1. Nash equilibrium for investments (Table 2).

2. Cooperative choice of investments (maximum total profit) with subsequent Cournot game (Table 3).

Figs. 2–5 presents the results of the simulation at the equilibrium levels for three transport enterprises. It should be noted that the comparison of the two scenarios demonstrates significant differences:

– *Non-cooperative equilibrium (Nash)*: Enterprises invest to a limited extent, since they only take into account their own effect. This leads to a lower intensity of CSR initiatives, higher levels of environmental impacts and lower overall efficiency of the industry.

– *Cooperative scenario (Coop)*: The total volume of investment increases. This reduces effective costs, stimulates demand by increasing customer trust and ensures a reduction in negative environmental impact. The overall profit of the industry increases, although in the short term some companies receive a smaller individual gain.

In this case, the most profitable enterprise, SE "KUHNE & NAGEL", which, thanks to cooperation, increases investments in CSR much more actively than competitors, creating an additional positive environmental effect. Less profitable enterprises (SE "SHENKER" and LLC "ZAMMLER UKRAINE") benefit from a reduction in the relative burden of costs and the maintenance of acceptable profitability.

Table 2

Modeling results based on 2024 data for Nash equilibrium

Enterprise	Revenue 2024, UAH	Net profit 2024, UAH	Net profit margin	c_i (norm.)	g_i Nash	q_i Nash	e_i Nash	π_i Nash (norm.)
SE "KUHNE & NAGEL"	1477743000	113379000	0.0767	0.9233	0.4405	0.13	0.1691	0.0776
SE "SHENKER"	488763000	29120000	0.0596	0.9404	0.3705	0.0812	0.1564	0.041
LLC "ZAMMLER UKRAINE"	489861100	25562000	0.0522	0.9478	0.3233	0.0561	0.1553	0.0224

Table 3

Modeling results based on 2024 data for cooperative equilibrium

Enterprise	g_i Coop	q_i Coop	e_i Coop	π_i Coop (norm.)
SE "KUHNE & NAGEL"	0.2845	0.1706	0.1598	0.0907
SE "SHENKER"	0.2219	0.1186	0.1562	0.0516
LLC "ZAMMLER UKRAINE"	0.1858	0.0886	0.1493	0.0326

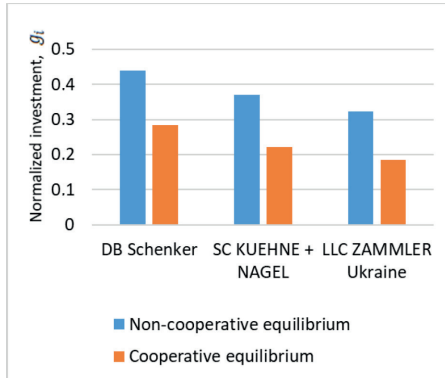


Fig. 2. Comparison of CRS investment modeling

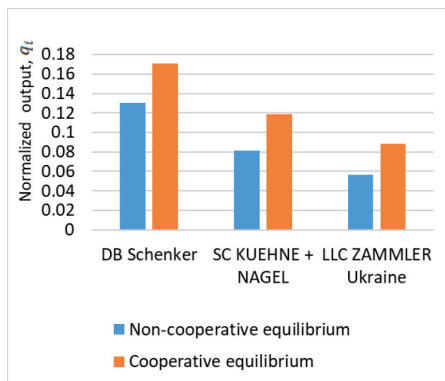


Fig. 3. Comparison of production modeling

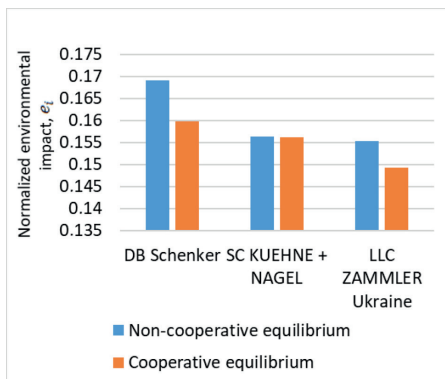


Fig. 4. Comparison of negative environmental impacts modeling

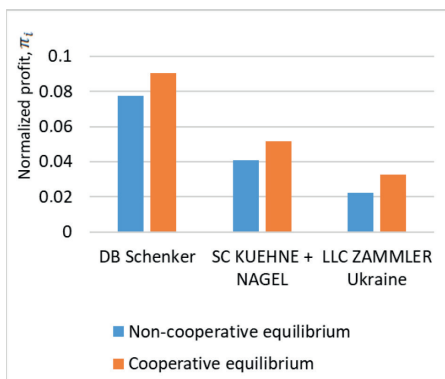


Fig. 5. Comparison of enterprise profit modeling

The practical significance of the results obtained confirms that cooperative strategies in the field of CSR meet the goals of sustainable development and can be applied in the practice of enterprises, in order to:

- increase the long-term profitability of the industry in which the enterprise operates;
- strengthen its market stability and position in the market;
- reduce the negative impact on the environment from its operating activities.

The development and implementation of effective management measures allows to increase the level of development of social and environmental programs. Interaction with stakeholders creates conditions for partnership and attraction of external resources in the implementation of CSR projects. The integrated application of these approaches ensures balanced development of the enterprise, aimed at economic, social and environmental sustainability.

However, in this research there are certain limitations in obtaining statistical information on the level of investment, therefore it is impossible to predict the number and real volume of investments made at enterprises. This model and the results of the study can be used as a key tool for implementing “green” investments in the logistics sector, which is advisable from both an economic and socio-ecological point of view. The prospects for further research are to determine the interaction of all existing business processes of the enterprise in the context of compliance with the principles of social responsibility and their possible modeling to improve the enterprise’s activities in the context of digitalization.

4. Conclusions

1. Social responsibility management in the ecological marketing system allows to ensure the long-term sustainability of enterprises. The research showed that the integration of social and ecological practices into strategic management contributes to increasing the competitiveness and efficiency of the enterprise. A phased approach to the implementation of CSR programs allows to assess resources, determine priorities and timely adjust strategies. The use of modern management principles, such as digital platforms, monitoring systems and integration of CSR into marketing processes, increases the adaptability of the enterprise to changes in the market environment. The proposed methodological approach to social responsibility management in the ecological marketing system to ensure the business sustainability of enterprises is aimed at diagnosing the current state, defining goals, optimizing resources and forming effective management measures. This approach allows to determine and analyze the level of investment in CSR initiatives depending on the existing potential and financial capabilities of the enterprise.

2. The model for determining the level of corporate social responsibility allows to determine the effect of applying CSR initiatives, determine the level of environmental consequences, the volume of expenses, which stimulates demand by increasing customer trust and ensures a reduction in the negative environmental impact on the industry. Increasing investment in CSR ensures the minimization of the negative impact on the environment and support for the principles of sustainable development, forms an additional positive environmental effect. This model reflects mathematical modeling, which is described by game theory with a two-stage game: investments in social and environmental initiatives (CSR) and subsequent Cournot competition, which makes it possible to reduce costs, determine the level of monetization (taxes/fees).

Conflict of interest

The authors declare that they have no conflict of interest regarding this research, including financial, personal, authorship or other nature that could affect the research and its results presented in this article.

Financing

The research was conducted without financial support.

Data availability

Data will be provided upon reasonable request.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the presented work.

References

- Solomentsev, O., Zaliskyi, M., Poberezhna, Z., Zuiev, O.; Ostroumov, I., Marais, K., Zaliskyi, M. (Eds.) (2025). Predictive Analytics of Decision-Making for Aviation Operation Enterprise. *Advances in Civil Aviation Systems Development*. Cham: Springer, 348–363. https://doi.org/10.1007/978-3-031-91992-3_23
- Zaliskyi, M., Solomentsev, O., Poberezhna, Z., Okoro, O. C., Chumachenko, B., Chumachenko, S. (2024). Information technologies of data processing for linear deterioration process during aviation equipment operation. *CEUR Workshop Proceedings*, 3732, 32–44. Available at: <https://ceur-ws.org/Vol-3732/paper03.pdf>
- White, K., Cakanlar, A., Sethi, S., Trudel, R. (2025). The past, present, and future of sustainability marketing: How did we get here and where might we go? *Journal of Business Research*, 187, 115056. <https://doi.org/10.1016/j.jbusres.2024.115056>
- Chen, G., Sabir, A., Rasheed, M. F., Belascu, L., Su, C.-W. (2024). Green marketing horizon: Industry sustainability through marketing and innovation. *Journal of Innovation & Knowledge*, 9 (4), 100606. <https://doi.org/10.1016/j.jik.2024.100606>
- Coelho, R., Jayantilal, S., Ferreira, J. J. (2023). The impact of social responsibility on corporate financial performance: A systematic literature review. *Corporate Social Responsibility and Environmental Management*, 30 (4), 1535–1560. <https://doi.org/10.1002/csr.2446>
- Bhat, A. A., Mir, A. A., Allie, A. H., Ahmad Lone, M., Al-Adwan, A. S., Jamali, D. et al. (2024). Unlocking corporate social responsibility and environmental performance: Mediating role of green strategy, innovation, and leadership. *Innovation and Green Development*, 3 (2), 100112. <https://doi.org/10.1016/j.igd.2023.100112>
- Caha, Z., Skýpalová, R., Mrhálek, T. (2024). CSR as a framework for sustainability in SMEs: The relationship between company size, industrial sector, and triple bottom line activities. *Asia Pacific Management Review*, 29 (4), 451–461. <https://doi.org/10.1016/j.apmr.2024.09.006>
- Xiao, H., Al Mamun, A., Reza, M. N. H., Lin, X., Yang, Q. (2024). Modeling the significance of corporate social responsibility on green capabilities and sustainability performance. *Heliyon*, 10 (19). <https://doi.org/10.1016/j.heliyon.2024.e38991>
- Maury, B. (2022). Strategic CSR and firm performance: The role of prospector and growth strategies. *Journal of Economics and Business*, 118, 106031. <https://doi.org/10.1016/j.jeconbus.2021.106031>
- Orlitzky, M., Siegel, D. S., Waldman, D. A. (2011). Strategic Corporate Social Responsibility and Environmental Sustainability. *Business & Society*, 50 (1), 6–27. <https://doi.org/10.1177/0007650310394323>
- Sukhonos, V., Makarenko, I., Serpeninova, Y., Drebot, O., Okabe, Y. (2019). Patterns of corporate social responsibility of Ukrainian companies: clustering and improvement strategies for responsible activities. *Problems and Perspectives in Management*, 17 (2), 365–375. [https://doi.org/10.21511/ppm.17\(2\).2019.28](https://doi.org/10.21511/ppm.17(2).2019.28)
- Makarenko, I., Steiner, B., Yuhai, K. (2024). Toward a novel Sustainability Transparency Index for improved governance in agri-food value chains: A comparative study of Finnish and Ukrainian companies. *Accounting and Financial Control*, 5 (1), 68–81. [https://doi.org/10.21511/afc.05\(1\).2024.06](https://doi.org/10.21511/afc.05(1).2024.06)
- Lobachevska, G., Daub, C.-H. (2021). The role of Corporate Social Responsibility in the decision-making process of consumers in Ukraine. *Innovative Marketing*, 17 (1), 78–93. [https://doi.org/10.21511/im.17\(1\).2021.07](https://doi.org/10.21511/im.17(1).2021.07)
- Makarenko, I., Plastun, A., Kozmenko, S., Kozmenko, O., Rudychenko, A. (2022). Corporate Transparency, Sustainable Development and SDG 2 and 12 in Agriculture: The Case of Ukraine. *Agris On-Line Papers in Economics and Informatics*, 14 (3), 57–70. <https://doi.org/10.7160/aol.2022.140305>
- Tkal, Y., Yarmak, T., Martynova, L., Yurchyk, I., Andrusenko, N. (2025). Corporate Social Responsibility in Ukraine as a Tool for Sustainable Development. *Grassroots Journal of Natural Resources*, 8 (1), 566–582. <https://doi.org/10.33002/nr2581.6853.080123>
- Wirba, A. V. (2023). Corporate Social Responsibility (CSR): The Role of Government in promoting CSR. *Journal of the Knowledge Economy*, 15 (2), 7428–7454. <https://doi.org/10.1007/s13132-023-01185-0>
- Poberezhna, Z., Zaliskyi, M.; Ostroumov, I., Marais, K., Zaliskyi, M. (Eds.) (2025). Modeling of Integration Business Processes for Aviation Enterprise in the Context of Sustainable Development. *Advances in Civil Aviation Systems Development*. Cham: Springer, 59–73. https://doi.org/10.1007/978-3-031-91992-3_5
- Kamyshnykova, E. V. (2014). Stratehichnyi pidkhd do upravlinnia korporativnoiu sotsialnoiu vidpovidalnistiu pidpriemstva. *Teoretychni i praktychni aspekty ekonomiky ta intelektualnoi vlasnosti*, 1 (1), 81–85. Available at: [http://nbuv.gov.ua/UJRN/Tpaeiv_2014_1\(1\)_15](http://nbuv.gov.ua/UJRN/Tpaeiv_2014_1(1)_15)
- Tiahunova, N., Tiahunova, Z. (2020). The influence of digital transformation of business on social responsibility of trade enterprises. *Problems of systemic approach in the economy*, 4 (78), 177–183. <https://doi.org/10.32782/2520-2200/2020-4-24>
- Pasinovych, I., Myskiv, G. (2023). Ukrainian context of sustainable development and the role of business in its achievement. *Regional Science Policy & Practice*, 15 (1), 161–181. <https://doi.org/10.1111/rsp3.12619>
- Smerichevskyi, S., Truhan, O., Poberezhna, Z., Chumak, O.; Ostroumov, I., Marais, K., Zaliskyi, M. (Eds.) (2025). Strategic Diagnostics for Optimization of Aviation Enterprises Activity in the Condition of Digital Transformations. *Advances in Civil Aviation Systems Development*. Cham: Springer, 92–104. https://doi.org/10.1007/978-3-031-91992-3_7
- Smerichevskyi, S., Poberezhna, Z., Mykhalchenko, O., Petrova, Y., Smilyanets, V. (2024). Ensuring the sustainable development of the aviation enterprise in the context of forming innovative potential using digital technologies. *CEUR Workshop Proceedings*, 3732, 174–185. Available at: <https://ceur-ws.org/Vol-3732/paper14.pdf>
- Slimani, K., Khoulji, S., Larbi Kerkeb, M. (2024). The Evolution of Wireless Sensor Networks through Smart Radios for Energy Efficiency. *E3S Web of Conferences*, 477, 00072. <https://doi.org/10.1051/e3sconf/202447700072>
- Sysoieva, I. M., Roleders, V. V., Pohrishchuk, O. B. (2022). Sotsialna vidpovidalnist biznesu v umovakh stanovlennia tsyrukliarnoi ekonomiky: realii vedennia biznesu v umovakh viiny. *Investysii: praktyka ta dosvid*, 23, 19–25. <https://doi.org/10.32702/2306-6814.2022.23.19>
- Zaliskyi, M., Solomentsev, O., Kozhokhina, O., Herasymenko, T. (2017). Reliability parameters estimation for radioelectronic equipment in case of change-point. *2017 Signal Processing Symposium (SPS)*. Jachranka: IEEE, 1–4. <https://doi.org/10.1109/sps.2017.8053676>
- Solomentsev, O. V., Zaliskyi, M. U., Zuiev, O. V., Asanov, M. M. (2013). Data processing in exploitation system of unmanned aerial vehicles radioelectronic equipment. *2013 IEEE 2nd International Conference Actual Problems of Unmanned Air Vehicles Developments Proceedings (APUAVD)*. Kyiv: IEEE, 77–80. <https://doi.org/10.1109/apuavd.2013.6705288>
- Backhoff-Veraguas, J., Zhang, X. (2022). Dynamic Cournot-Nash equilibrium: the non-potential case. *Mathematics and Financial Economics*, 17 (2), 153–174. <https://doi.org/10.1007/s11579-022-00327-3>

✉ **Zarina Poberezhna**, Doctor of Economic Sciences, Professor, Department of Economics and Business Technologies, State University "Kyiv Aviation Institute", Kyiv, Ukraine, e-mail: zarina_www@ukr.net, ORCID: <https://orcid.org/0000-0001-6245-038X>

Oleksandr Trukhan, PhD, Associate Professor, Department of Fundamental Training, Management and Administration, Zhytomyr Institute of Private Joint-Stock Company "Higher Educational Institution "Interregional Academy of Personnel Management", Zhytomyr, Ukraine, ORCID: <https://orcid.org/0000-0001-7986-0297>

Serhii Smerichevskyi, Doctor of Economic Sciences, Professor, Acting Dean of Faculty of Economics and Business Administration, State University "Kyiv Aviation Institute", Kyiv, Ukraine, ORCID: <https://orcid.org/0000-0003-2102-1524>

Arkadii Bileush, PhD Student, Interregional Academy of Personnel Management, Kyiv, Ukraine, ORCID: <https://orcid.org/0009-0002-6814-8362>

Maksym Kolesnyk, PhD, Associate Professor, Department of Marketing, State University "Kyiv Aviation Institute", Kyiv, Ukraine, ORCID: <https://orcid.org/0000-0003-0814-4220>

Igor Martsinenko, PhD Student, State University of Intellectual Technologies and Communications, Odesa, Ukraine, ORCID: <https://orcid.org/0009-0003-9210-3006>

✉ Corresponding author