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Sustainable Development of Agro-industrial Enterprises Based on ESG Innovation Management

Elena G. Popkova[1], Tatiana N. Litvinova[2]

[1] Armenian State University of Economics, Yerevan, Armenia

[2] Volgograd State Agricultural University, Volgograd, Russia

Author Note

Elena G. Popkova

Armenian State University of Economics, 128, Nalbandyan, Yerevan, 0025, Armenia

E-mail: elenapopkova@yahoo.com; ORCID: 0000-0003-2136-2767

Tatiana N. Litvinova

Volgograd State Agricultural University, 26 Universitetsky Ave., Volgograd, 400002, Russia

e-mail: litvinova1358@yandex.ru; ORCID: 0000-0003-3101-2621

Correspondence concerning this article should be addressed to Elena G. Popkova

Abstract: The research aims to substantiate the benefits and develop recommendations for the sustainable development of entrepreneurship in the agro-industrial complex (AIC) based on ESG management of innovation. Using the example of the sample of countries with incomes above the world average in 2022, the author applied the methods of correlation analysis to determine the closeness of the relationship and the dependence of innovation management indicators in the activities of agricultural enterprises on the factors of ESG management. ESG management of innovation can achieve greater sustainability of agro-industrial enterprises than ESG management of innovation separately. The theoretical significance of the author's conclusions is connected with the fact that the proposed ESG approach to innovation management in the activities of agro-industrial enterprises ensured the fullest compliance of their development with sustainability standards in the Decade of Action. The developed ESG approach involves a new order of implementation of the directions of innovation management in the activities of agro-industrial enterprises: systemic implementation of environmental (E), social (S), and governance (G) directions. The benefits of innovation management in the activities of agro-industrial enterprises in the ESG approach are derived not only by agro-industrial complex enterprises that implement innovations but by all stakeholders. Sustainability in the ESG approach is interpreted as a balance of stakeholder interests, which most closely corresponds to the system of 17 SDGs in the Decade of Action. The practical significance of the author's recommendations is that the recommended control growth of ESG management factors of innovation in the activities of Russian enterprises of the agro-industrial complex will maximize their sustainability in the Decade of Action and increase the effectiveness of their innovation management.

Keywords: agro-industrial complex (AIC), sustainable development of entrepreneurship, ESG management, innovation management, sustainable development goals (SDGs), Decade of Action

JEL code: O32, Q01, Q13, Q16

In an innovative economy, changes and new technologies determine the sustainable development of enterprises. The sustainable development of entrepreneurship in the agro-industrial complex (AIC) is of particular importance because it affects the provision of food security. For example, automation based on innovative technologies makes it possible to increase the productivity of agricultural enterprises and the degree of utilization of their production capacity. Thanks to this, innovation reduces entrepreneurial risks and increases the investment attractiveness of enterprises in the agricultural sector, increasing their resilience to climate change and economic crises.

The problem is that the Decade of Action changes the meaning of sustainable entrepreneurship. The focus is shifting from the interests of entrepreneurs to the interests of all stakeholders. The existing approach to innovation management in the activities of agro-industrial enterprises does not fully meet these interests. For example, reducing the cost of food products achieved through innovation does not guarantee lower prices for consumers.

The sustainable development of agro-industrial enterprises in the Decade of Action should be interpreted through the prism of support for the implementation of sustainable development goals (SDGs): not only SDG 2, to which the connection is most apparent but also all other 17 SDGs, primarily SDG 8 (decent employment for agricultural personnel and growth of the agricultural economy) and SDGs 13 and 15 (climate responsibility and environmental protection by agro-industrial enterprises).

Similar to other sectors of the economy, where the sustainable development of entrepreneurship is achieved through the support of ESG principles, this research hypothesizes that ESG management of innovation will increase the sustainability of entrepreneurship in the AIC. This defined the purpose of this research, associated with the substantiation of the benefits and the development of recommendations for the sustainable development of entrepreneurship in the AIC with the support of ESG management of innovation.

Literature Review

Presented in the literature, the existing approach to innovation management in the activities of enterprises of agro-industrial complex assumes the implementation of the main directions of this management separately:

- Environmental (E) direction related to the implementation of climate innovations aimed at increasing the resilience of agro-industrial enterprises to climate change (Ifeanyi-Obi et al., 2022; Meshesha et al., 2022);
- Social (S) direction, consisting of the management of human resources involved in the innovation process and promotion of innovative products among the target audience in the agricultural markets (Agarwal et al., 2022; Mikhailov et al., 2021);
- Governance (G) direction boils down to attracting investment in innovation for the agro-industrial complex (Islam et al., 2022; Mangaza et al., 2021).

The benefits of innovation management in the activities of agro-industrial enterprises are derived only by enterprises that implement innovations. These benefits are associated with increased profits and profitability and strengthened market positions and competitiveness

(Litvinova et al., 2017; Popkova et al., 2018). Simultaneously, sustainability is interpreted as the stability of the enterprise's market position and its activities, regardless of the consequences for other stakeholders (Borisova et al., 2015; Troyanskaya et al., 2017).

Despite the high degree of elaboration of the existing approach to innovation management in the activities of agro-industrial enterprises described above, the available literature does not form a clear understanding of whether this approach makes it possible to ensure the sustainable development of entrepreneurship in the AIC in the Decade of Action. The identified gap in the literature raises the following research question: "How to manage innovation in the activities of agro-industrial enterprises to ensure their sustainable development in the Decade of Action?"

Based on the ESG management concept (Maji and Lohia, 2023; Ng et al., 2023), this research puts forward the following hypothesis (H): ESG management of innovation makes it possible to achieve greater sustainability of agro-industrial enterprises than ESG management of innovation separately. To test the hypothesis, the contribution of ESG innovation management separately is compared with ESG innovation management in the sustainable development of agricultural enterprises.

Materials and Methods

For the research, the author formed a sample of countries with incomes above the global average. The methods of correlation analysis are used to determine the closeness of the relationship and the dependence of indicators of innovation management in the activities of agricultural enterprises – agricultural research and development and commitment to innovative technologies – on environmental (early-warning measures, climate-smart agriculture, and sustainable agriculture), social (empowering women farmers and food safety) and governance (access to finance and financial products for farmers and supply chain infrastructure) management. The research relies on data for 2022 based on official international statistics from The Economist Impact (2023) (Table 1).

Table 1

The empirical basis of 2022 used in the research

Country	Early-warning measures / climate-smart agriculture	Sustainable agriculture	Empowering women farmers	Food safety	Access to finance and financial products for farmers	Supply chain infrastructure	Agricultural R&D	Commitment to innovative technologies
	E_1	E_2	S_1	S_2	G_1	G_2	I_1	I_2
Argentina	50.0	50.0	100.0	94.4	100.0	49.1	65.2	100.0
Azerbaijan	0.0	0.0	0.0	93.1	100.0	46.4	32.0	0.0
Belarus	0.0	50.0	0.0	86.8	100.0	40.7	52.5	33.3
Botswana	50.0	0.0	0.0	74.5	50.0	57.9	50.2	0.0

Brazil	0.0	100.0	100.0	99.7	100.0	35.8	55.4	100.0
Bulgaria	100.0	100.0	100.0	94.3	100.0	50.3	68.5	100.0
China	50.0	100.0	0.0	92.4	100.0	69.3	57.2	33.3
Colombia	0.0	50.0	100.0	93.7	100.0	38.6	58.4	100.0
Costa Rica	0.0	100.0	100.0	94.7	100.0	37.3	57.9	100.0
Dominican Republic	0.0	50.0	50.0	81.7	50.0	52.7	29.8	0.0
Ecuador	0.0	100.0	50.0	92.6	100.0	49.0	65.4	100.0
Guatemala	0.0	100.0	50.0	86.4	50.0	36.5	33.4	33.3
Jordan	50.0	100.0	0.0	72.2	100.0	47.4	17.2	0.0
Kazakhstan	100.0	100.0	0.0	92.8	100.0	50.8	77.0	100.0
Malaysia	0.0	50.0	0.0	93.6	100.0	51.9	48.7	66.7
Mexico	0.0	100.0	100.0	94.5	50.0	50.4	46.5	66.7
Paraguay	0.0	0.0	50.0	94.6	50.0	37.2	26.8	66.7
Peru	0.0	100.0	50.0	91.7	50.0	41.7	40.8	33.3
Russia	100.0	50.0	0.0	98.7	100.0	45.1	40.9	33.3
Serbia	0.0	0.0	0.0	92.8	100.0	51.1	23.1	0.0
South Africa	0.0	100.0	0.0	93.7	50.0	67.3	63.8	100.0
Thailand	50.0	50.0	0.0	71.4	100.0	55.9	33.0	0.0
Turkey	0.0	100.0	50.0	93.5	100.0	56.9	51.5	66.7

Source: Compiled by the author based on The Economist Impact (2023)

The hypothesis (H) is considered proven if the multiple correlation coefficients exceed the arithmetic mean of the pairwise correlation coefficients. Based on the regression analysis results, the author makes alternative forecasts for the sustainable development of entrepreneurship in the AIC in the Decade of Action depending on the application of the existing or ESG approach to innovation management.

Results

Factor Analysis of Innovation Management in Agro-industrial Enterprises from the Perspective of Sustainable Development

To clarify the cause-and-effect relations of sustainable development of agro-industrial enterprises, the author analyzed the practice of their innovation management based on the statistics from Table 1. This allowed the author to construct the following two multiple linear regression models. Model (1) is as follows:

$$I_1=-69.51+0.10E_1+0.10E_2+0.11S_1+0.74S_2+0.09G_1+0.60G_2 \quad (1)$$

The results obtained in Model (1) show that the change in agricultural R&D among the sample countries is by 72.49% due to the systemic influence of factors of innovation management of agro-industrial enterprises; the arithmetic mean impact of these factors is estimated at 32.18%. Fisher's F-test is passed, which indicates the reliability of the obtained results of the regression analysis at a significance level of 0.05. Model (2) is as follows:

$$I_1=-234.50+0.08E_1+0.27E_2+0.38S_1+2.44S_2+0.15G_1+0.41G_2 \quad (2)$$

The results obtained in Model (2) also testify to the fact that the change in the commitment to innovative technologies among the sample countries is by 81.97% explained by the systemic influence of innovation management factors of agricultural enterprises; the average arithmetic influence of these factors is estimated at 29.62%. Fisher's F-test is passed, which indicates the reliability of the obtained results of the regression analysis at a significance level of 0.01.

Perspective on the Sustainable Development of Agro-industrial Enterprises in the Decade of Action Depending on the Innovation Management Approach

To determine the perspective of sustainable development of entrepreneurship in the AIC in the Decade of Action depending on the approach to innovation management, the author substantiated alternative values of factor variables in the regression Models (1) and (2) (Figure 1).

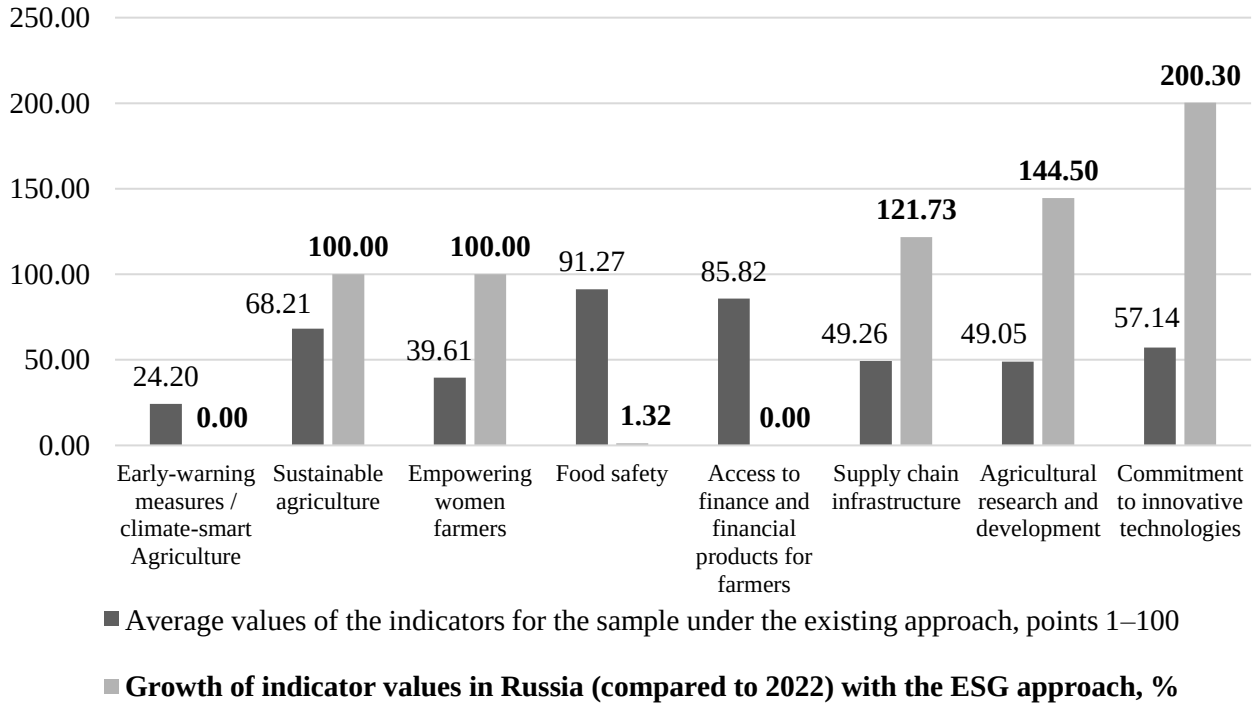

Figure 1

Perspective on the sustainable development of entrepreneurship in the agro-industrial complex in the Decade of Action depending on the approach to innovation management

Source: Calculated and compiled by the author

Figure 1 shows that if the current trend of growth of the sustainable development index in the sample countries over eight years (from 2016 to 2022) is maintained by an average of 1.22% (i.e., with the current approach to innovation management in the activities of agricultural enterprises), access to finance and financial products for farmers will be only 49.05 points by 2030; supply chain infrastructure will be 57.14 points out of 100.

Implementing the ESG approach to innovation management in the activities of agro-industrial enterprises involves increasing the values of all factor variables to 100 points so that

by 2030 R&D in agriculture and commitment to innovative technologies will reach 100 points. For this purpose, in Russia, it is recommended to increase sustainable agriculture and empowering women farmers by 100%, food safety by 1.32%, and supply chain infrastructure by 121.73%.

ESG Approach to Innovation Management in Agro-industrial Enterprises for Sustainable Development

To improve the management of innovation in the activities of agro-industrial enterprises for their sustainable development in the Decade of Action, a new ESG approach was developed (Figure 2).

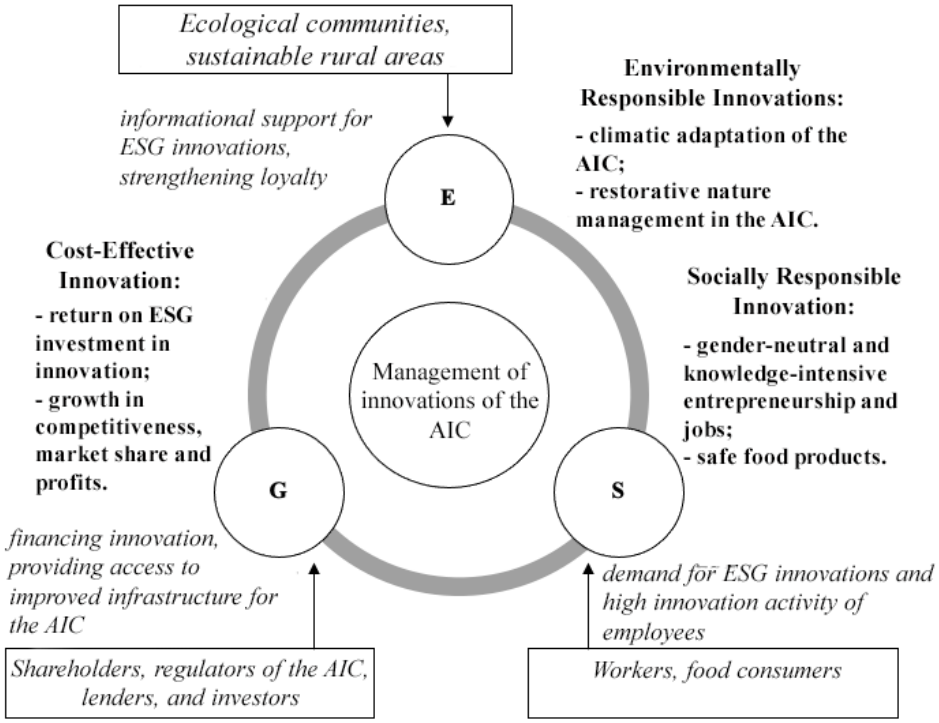

Figure 2

ESG approach to innovation management in the activities of agro-industrial enterprises for their sustainable development

Source: Compiled by the author

The ESG approach shown in Figure 2 assumes that the innovations introduced by agribusiness enterprises should simultaneously be as follows:

(1) Environmentally responsible (ensure climatic adaptation of the AIC and regenerative environmental management in the AIC);

(2) Socially responsible (ensure gender-neutral and knowledge-intensive entrepreneurship and jobs, as well as safe food production);

(3) Cost-effective (ensure return on ESG investment in innovation and growth of competitiveness, market share, and profits).

Due to this, improved communication with all stakeholders is achieved, which contributes to more effective management of innovation in the activities of enterprises in the AIC. Environmental communities and sustainable rural areas provide informational support for ESG innovations and contribute to strengthening stakeholder loyalty to agro-industrial enterprises. Workers and consumers of food products have a consistently high demand for ESG innovation; high innovation activity of workers is achieved. Shareholders, regulators of the AIC, lenders, and investors are more actively financing innovation and providing access to improved infrastructure for agribusiness.

Discussion

The contribution of the research to the literature consists of the development of scientific provisions of the ESG management concept through the justification of the advantages and development of a special approach to ESG management of innovation in the activities of agricultural enterprises for their sustainable development. The new approach is compared with the existing approach in Table 2.

Table 2

Comparison of existing and new approach

Comparison criterion	The approach to innovation management of agro-industrial enterprises	
	Existing approach	New: ESG approach
The order of implementation of the directions of innovation management in the activities of agro-industrial enterprises	Implementing separately: - Environmental (E) direction (Ifeanyi-Obi et al., 2022; Meshesha et al., 2022); - Social (S) direction (Agarwal et al., 2022; Mikhailov et al., 2021); - Governance (G) direction (Islam et al., 2022; Mangaza et al., 2021).	Systemic implementation of the environmental (E), social (S), and governance (G) directions
Advantages of investment management in the activities of agro-industrial enterprises (interpretation of sustainability)	Benefits are derived only by agro-industrial enterprises that implement innovations (Litvinova et al., 2017; Popkova et al., 2018) (sustainability as the stability of the company's market position (Borisova et al., 2015; Troyanskaya et al., 2017))	Benefits are derived by all stakeholders (sustainability as a balance of stakeholder interests)

Source: Compiled by the author

As shown in Table 2, the developed ESG approach involves a new order of implementation of the directions of innovation management in the activities of agro-industrial enterprises. In contrast to Agarwal et al. (2022), Ifeanyi-Obi et al. (2022), Islam et al. (2022), Mangaza et al. (2021), Meshesha et al. (2022), and Mikhailov et al. (2021), which assume the implementation of these directions separately, the author's approach recommends the systemic implementation of the environmental (E), social (S), and governance (G) directions.

In contrast to Litvinova et al. (2017) and Popkova et al. (2018), the advantages of innovation management in the activities of agro-industrial enterprises are derived not only by agro-industrial enterprises that implement innovations but by all stakeholders. In contrast to Borisova et al. (2015) and Troyanskaya et al. (2017), sustainability is interpreted not as the stability of the enterprise's market position but as a balance of stakeholders' interests, which most fully corresponds to the system of 17 SDGs in the Decade of Action.

Conclusion

This research has answered the set RQ by confirming the hypothesis (H) and proving that ESG management of innovation makes it possible to achieve greater sustainability of agricultural enterprises than environmental, social, and governance management of innovation separately. This is evidenced by a much higher correlation of agricultural R&D (72.49% instead of 32.18%) and commitment to innovative technologies (81.97% instead of 29.62%) with factors of innovation management of agro-industrial enterprises under ESG management depending on the environmental, social, and governance management separately.

The theoretical significance of the author's conclusions is connected with the fact that the proposed ESG approach to innovation management in the activities of agro-industrial enterprises ensured the fullest compliance of their development with sustainability priorities in the Decade of Action. The practical significance of the author's recommendations is that the recommended control growth of ESG management factors of innovation in the activities of Russian enterprises of the AIC will maximize their sustainability in the Decade of Action and increase the effectiveness of their innovation management.

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