DOI https://doi.org/10.30525/2661-5150/2026-1-10

ECONOMIC FEASIBILITY OF ENVIRONMENTAL INNOVATIONS IN THE FLOWER INDUSTRY

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Abstract. Global environmental challenges have influenced the floriculture industry in the direction of increasing investments in environmental innovations. *The purpose of the article* was to substantiate the economic feasibility of implementing environmental innovations in the floriculture industry by analyzing the market, production and financial benefits of switching to environmental innovations. *The research methodology* is based on a statistical analysis of the main indicators of floriculture development on a global scale and an analysis of the market, production and financial benefits of switching to environmental innovations. *Results.* The article proposes a new approach to environmental innovations in the floriculture industry as a tool for long-term investments in business development in the context of strengthening legislative requirements for recycling, increasing consumer awareness of environmental challenges and increasing consumption of products, willing to pay more for "sustainable" products. The main market and production trends in floriculture in the world are identified, including the growth of global production volumes, the growth of the selling price of flowers and the prices of means of production. It was determined that producers in the flower industry recognize their own responsibility for implementing sustainable practices to increase the production of environmentally friendly packaging. In turn, consumers will transfer responsibility for sustainable production to the enterprise in the field of packaging production and at the same time are willing to pay more for environmentally friendly products. International experience of companies demonstrates the transition to biopackaging of flower products, the establishment of a closed supply cycle, and the reuse of packaging. rarely leads to an increase in the cost of living with such, revenue volumes shift in the long term. *Conclusions.* Further research should focus on the studied strategies of small businesses for the transition to environmentally friendly packaging and the implementation of the principles of closed production in floriculture. The scientific value of the study arises in substantiating the economic feasibility of implementing environmental innovations in the floriculture industry.

Keywords: environmental innovations, "green" innovations, flower industry, economic feasibility, profitability, small business, ecological packaging, sustainable practices.

JEL Classification: Q55, L66, O33

1. Introduction

Global environmental challenges have affected the flower industry, changing consumer preferences, strengthening regulatory requirements for sustainable production in the industry. The demand for environmentally friendly products and the use of biomaterials in the processes of growing, packaging and logistics of flowers is growing, however, due to a number of economic constraints, enterprises are quite cautious in implementing such innovations. The main reasons for such trends include high initial costs of innovation, lack of financial incentives for innovative activity, insufficient institutional support and low level of awareness of entrepreneurs about the long-term economic benefits of implementing environmental innovations.

Flower industry enterprises consider "green" innovations as expenses, rather than investments in their own competitiveness. The arguments explaining this position include an increase in the cost of production, the need for technology modernization, the risks of losing short-term profits, and limited access to credit for ecological innovation projects. At the same time, the main advantages of introducing eco-materials are considered to be the possibilities of increasing the reputational value of the brand, expanding sales markets, compliance with international standards of sustainable development, and reducing environmental

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risks in the long term. In the context of increasing flower production volumes (in particular, in the EU during 2019-2024), the issue of using eco-innovations is becoming more relevant (European Commission, n.d.).

The purpose of the article is to substantiate the economic feasibility of implementing environmental innovations in the floriculture industry by analyzing the market, production, and financial benefits of transitioning to environmental innovations.

2. The Impact of the Trend Towards Sustainable Development on Floriculture

Recent academic research on sustainable floriculture, particularly on eco-innovation, highlights the challenges of growing the industry globally (Neha Devrani and al., 2024), which covers the issues of reducing demand for products, reducing prices in the context of product segments, and other challenges in the activities of producers. A separate research issue remains the technological renewal of floriculture to promote innovative development in conditions of inefficient production to meet existing demand (Andari Titisari, 2025). The study considers ecological packaging as an initial trend in enterprise marketing, taking into account legislative norms (Yurchenko et al., 2025). The authors (Rashed, n.d.) conduct an analysis of traditional and modern types of product packaging. However, scientific research on the economic feasibility of environmental innovations in the floral industry remains limited.

Floriculture, as one of the sectors of the crop sector, is in the process of transitioning to sustainable development, driven by the increasing EU requirements for sustainability. According to the report "Trends in Floriculture" published by Royal Flora Holland (the largest international floriculture market for flowers and plants, acting as both a producer association and a business structure), the vast majority of cooperative growers are actively working on developing sustainable businesses. Among all cooperatives, 84% of growers have implemented more sustainable practices, indicating a recognition of the need for sustainable development in the flower industry (Royal Flora Holland, 2025). Among growers, 62% recognize themselves as responsible for sustainable development and sustainable production methods, and 75% consider activities to support sustainability in the supply chain to be important. Meanwhile, according to the annual financial report of Royal Flora Holland, operating income from product packaging increased to 60,146 thousand euros in 2024 compared to revenues of 53,964 thousand euros in 2023 (Royal Flora Holland, n.d.).

The International Association of Horticultural Producers (AIPH) Annual Review 2025 demonstrates the growing role of floriculture in ensuring sustainable development in the face of environmental challenges. Innovative producers in the industry are considered initiators of setting standards in this sector (The International Association of Horticultural Producers (AIPH), 2025).

3. Results

3.1. Features of the Development of the Floriculture Industry on a Global Scale

The global production rate in the flower industry is estimated at 10% annually. The highest growth rate of imports of the industry's products was recorded in Singapore (14.18% in 2024) with exports of 1%. 45-50 countries around the world are engaged in floriculture on a large scale. In terms of production value, the leaders in the industry are Thailand, the Netherlands, the USA, the UK and China. At the same time, Australia, Italy, the Netherlands and the USA demonstrate significant negative rates of production reduction. The floriculture industry was affected by the economic recession, the increase in energy prices on a global scale, which led to a reduction in demand for products in the main countries of sale (the USA, Japan and European countries). (Andari Titisari, 2025). At the same time, a significant increase in selling prices was observed in all product segments of the industry as a result of increased production costs. According to Eurostat, in leading European countries producing floriculture products, prices increased during 2020-2023 (Table 1).

According to Eurostat, in 2024 the EU exported €98.9 million of floriculture products to its main partner countries, with the Netherlands having the highest share of European exports at 83%. Poland, Belgium, Germany and Denmark had significantly smaller shares of exports (Eurostat, 2025).

At the same time, during 2022-2024, price indices for agricultural production facilities (seeds and planting material, electricity, fertilizers, plant protection products) increased significantly (Table 2). These production conditions affect the costs of floriculture enterprises, causing constraining effects in the processes of transition to ecological innovations. due to rising prices for means of production.

3.2. Environmental Innovations in the Floriculture Industry

Common packaging materials for flowers are LDPE – low density polyethylene, PO – polyolefin, oil paper, oil paper, PP – polypropylene, cellophane, newspapers, banana leaves and other materials (Nirmala and al., 2023). Traditional packaging materials, which are actively used in the floral industry (polyethylene films, plastic wrap, tapes, containers)

Table 1
Dynamics of sales prices of products in the floriculture industry in different EU countries in 2020-2024, euros per 100 units of product (Eurostat, 2025b)

Product type	2020	2021	2022	2023	2024	Absolute deviation, (2023-2020), euros
Roses						
Spain	36.50	36.10	36.45	39.39	29.20	2.89
Netherlands	44.62	48.87	55.66	48.67	53.67	4.05
Belgium	34.38	41.36	42.50	40.09	-	5.71
Carnation						
Spain	10.49	12.51	12.60	14.26	11.51	3.77
Netherlands	23.40	26.77	28.00	28.00	32.00	4.60
Belgium	25.81	29.07	28.35	28.31	-	2.50
Tulips						
Spain	21.64	34.57	43.28	46.41	-	24.77
Netherlands	13.53	18.98	17.70	16.99	21.47	3.46
Belgium	18.42	25.29	25.67	23.28	-	4.86
Chrysanthemums						
Spain	26.41	38.25	41.52	39.72	-	13.31
Netherlands	29.60	29.60	29.60	29.60	46.08	0.00
Belgium	37.90	50.99	43.12	37.10	-	-0.80
Gladiolus						
Spain	30.80	39.86	41.83	42.55	-	11.75
Netherlands	19.90	19.71	19.00	21.50	25.00	1.60
Belgium	29.64	30.88	33.23	33.36	-	3.72

Table 2
Price indices for agricultural inputs in the EU during 2020-2024 (%, 2020 prices) (Eurostat, 2025a)

Means of production	2020	2021	2022	2023	2024	Absolute deviation, +/-
Seeds and planting material	100.00	103.74	114.75	124.13	128.00	28.00
Electricity	100.00	118.00	182.25	158.13	143.72	43.72
Fertilizers	100.00	129.31	244.20	184.40	152.00	52.00
Plant protection products	100.00	101.65	112.15	120.43	118.35	18.35

remain the cheapest and most common material due to their low production cost and ease of distribution (Data Bridge Market Research, 2021). The global cut flower packaging market size was estimated at $ 13.2 billion in 2024 and is projected to reach $ 19.99 billion by 2032, with a CAGR of 5.33% during the forecast period (Data Bridge Market Research, 2021). The market growth is largely driven by the increasing demand for fresh cut flowers in the retail, gift and floral décor segments globally. The increasing adoption of eco-friendly and biodegradable packaging materials is driving innovation and encouraging sustainable development and practices in the floral supply chain. The market is showing steady growth due to technological advancements in packaging materials such as corrugated boxes, biodegradable films, and protective wraps that increase the shelf life of flowers and reduce damage during transportation. The growing consumer preference for aesthetically appealing and environmentally friendly packaging is driving manufacturers to use innovative designs and environmentally friendly materials (Data Bridge Market Research, 2021).

In 2024, the Asia Pacific region led the cut flower packaging market with a revenue share of 42%, driven by rapid urbanization and increasing fresh flower exports from China, India, and Japan (Data Bridge Market Research, 2021). According to preliminary forecasts, North America will witness the highest growth rates in the global cut flower packaging market, driven by high consumption volumes in floriculture, developed logistics infrastructure, and growing consumer awareness of environmentally friendly and protective packaging options (Data Bridge Market Research, 2021). In 2024, the paper and paperboard segment held the largest market share in terms of revenue due to its biodegradability, cost-effectiveness, and widespread use in retail and flower export. Paper packaging solutions often provide superior strength, moisture retention, and ease of use, making them a preferred choice for florists and exporters (Data Bridge Market Research, 2021).

The high cost of advanced packaging solutions and limited awareness in emerging markets about sustainable packaging remain major constraints to their adoption. Advanced packaging solutions for cut

flowers, such as biodegradable films, moisture-retaining wraps and specialized corrugated boxes, often have higher costs, limiting their availability for small floriculture businesses. In markets sensitive to commodity price fluctuations, the cost of sustainable packaging remains a major barrier to their adoption. Smaller players continue to use traditional, less efficient packaging, resulting in higher post-harvest losses (Data Bridge Market Research, 2021).

3.3. Economic Feasibility of Ecological Innovations in Floriculture

The average price of standard plastic packaging for cut flowers in 2024 was about 15-25 UAH per unit. In contrast, similar packaging made of biodegradable materials (biofilms based on corn or potato starch, cellulose or PLA plastic) costs 1.8-2.5 times more expensive – 35-50 UAH per unit. The main difference in costs is related not only to the cost of raw materials, but also to the need for new technological lines for packaging, adaptation of equipment and the need to comply with EU standards – Directive 94/62/EC of the European Parliament and of the Council of 20 December 1994 on packaging and packaging waste (European Parliament and Council, n.d.). The document defines the obligations of manufacturers to reduce the use of traditional plastics by 50% by 2030. The updated requirements of EU Directive 94/62/EC of 20 December 1994, which entered into force on 11 February 2025, are aimed not only at reducing the amount of packaging, but also at high-quality recycling of packaging in European countries (*Update PPWR Legislation*, n.d.).

At the same time, cost analysis shows that the transition to biopackaging has a long-term payback effect due to reduced crop losses when using environmentally friendly packaging, which allows flowers to be stored longer, increased customer loyalty in markets with a high level of awareness of environmental challenges, opportunities to position the brand as sustainable, reduced environmental taxes, and additional income from packaging.

According to calculations based on data from industry suppliers, the cost of a bouquet of the middle price segment using bio-packaging increases by 7-12%, while for wholesale orders (florist chains, wedding agencies) the figure decreases to 3-5%. When scaling up ecological solutions, the difference in costs gradually decreases. The implementation of the principles of circular production (reuse of packaging) will reduce the total costs of packaging production in the flower industry by up to 10% to partially compensate for the higher price of bio-materials for production.

The experience of leading international companies shows the financial benefits of implementing environmental innovations in floristry. The British brand Arena Flowers became one of the first carbon-neutral florists in the world to be certified under the Climate Neutral Certified 2022 program. Since 2017, the company has abandoned plastic, replaced packaging with bio-cardboard and recycled paper, and introduced a closed-loop supply of flowers from farms that use renewable energy sources in production (Arena Flowers, n.d.; Arena Flowers Sustainability Report, n.d.). A similar business model is implemented by Bloom & Wild in the United Kingdom, which since 2021 has fully switched to FSC-certified packaging, developed a system for reusing delivery boxes and invests in carbon footprint research. According to the Sustainability Report, in 2022 the company completely abandoned plastic flower nets, saving more than 12.5 kg of plastic from landfills. Thanks to various sustainable practices, more than 95% of flower products are delivered to customers: smart forecasting, special eco-sales, composting green waste and working with zero-waste warehouses. The introduction of bio-packaging increased the cost of products by 7%, but the company's overall profit increased by 25% due to the expansion of the customer base and media effects (Flower Delivery. Send Flowers Plants & Gifts, n.d.). International practice of eco-innovations demonstrates that eco-strategies as a form of investment in the development of an enterprise increases its value, allowing to increase profitability in the long term.

Ukrainian entrepreneurs have access to several international and state programs to support eco-innovations. The EU program EU4Environment is aimed at developing a "green" economy, eco-labeling and the production of "green" products through the use of an approach to developing eco-innovations to reduce the use of input raw materials, minimize waste (EU4Environment, 2025). Within the framework of the program, small and medium-sized enterprises can receive consultations to assess the potential of environmental innovations and develop promising strategies for improving environmental performance (EU4Environment, 2025). The European Bank for Reconstruction and Development (EBRD) Green Economy Financing Facility (GEFF) program provides loans to finance enterprises' investments in energy efficiency through loan mechanisms by financial institutions operating in Ukraine (European Bank for Reconstruction and Development, n.d.). Financial support in the form of grants is offered to medium-sized businesses in Ukraine through the cooperation mechanism of the international humanitarian organization Mercy Corps in cooperation with local organizations within the framework of the Agricultural Support Program of Ukraine (Diya.Business, 2025). The average grant size of 150 thousand dollars is provided to agrarian businesses that have suffered due to the war, in particular farmers, to replace equipment or machinery (Diya.Business, 2025). Existing support

programs allow enterprises to purchase new equipment for the production of eco-packaging.

3.4. Consumer Preferences in the Floriculture Industry as a Factor in the Implementation of Eco-Innovations

Informed consumers with middle and high incomes are willing to pay for environmentally friendly packaging, as they evaluate the product not only by price characteristics, but also by the environmental value (value) created. According to the results of a survey of 11 thousand respondents from 11 countries around the world (McKinsey, 2025), price and quality remain the most important characteristics for consumers when choosing products, while environmental challenges occupy the last place in the rating of factors for assessing the purchase of a product. At the same time, respondents noted the importance of recycling products to ensure sustainable development. At the same time, different countries have different views on the "most sustainable" packaging materials, depending on the waste collection system. Despite the low importance of environmental friendliness when choosing a product, most respondents are willing to pay more for "sustainable" packaging, especially younger consumers and buyers with higher incomes. More than 60% of European consumers are willing to pay 5-20% more for products made from environmentally friendly materials or with minimal environmental impact. In the premium floristry segment, the figure reaches 25% (McKinsey, 2025). At the same time, across countries, consumers generally consider packaging manufacturers responsible for promoting sustainable development in the production of products, rather than themselves, retailers or regulators (McKinsey, 2025). Therefore, biopackaging manufacturers and brand owners in the floral industry need to review their own strategies to respond to changing consumer demand and social behavioral factors.

Environmental challenges are influencing the consumer behavior of Generation Z, of whom, according to a survey, almost two-thirds, or 65% and 63% of millennials, are willing to pay more for environmentally sustainable products or services (Deloitte Global, 2025).

In Ukraine, a similar trend towards consumers' willingness to spend more on environmentally friendly products is observed (Yurchenko et al., 2025). According to the data, 38% of flower buyers in large cities (Kyiv, Lviv, Odessa) are ready to choose brands that use biopackaging. even with an increase in the final price by 10-15%. Therefore, the ecological differentiation of floriculture products creates added value, forming a new market segment – eco-conscious buyers, economically beneficial for domestic business. For floriculture, this means the formation of a new market segment and ethically oriented marketing, which combines quality, price characteristics and conscious consumption.

4. Conclusions and Prospects for Further Research

Ecological innovations in the flower industry should be considered as long-term investments in business development in the context of increasing legislative requirements for recycling, growing consumer awareness of environmental challenges and an increase in the number of consumers willing to pay more for "sustainable" products. Manufacturers in the flower industry recognize their own responsibility for implementing sustainable practices while increasing the production of environmentally friendly packaging. In turn, consumers shift the responsibility for sustainable production to packaging companies and at the same time are willing to pay more for environmentally sustainable products. International experience of companies demonstrates the transition to biopackaging of flower products, the establishment of a closed supply cycle, and the reuse of packaging. Despite the increase in cost during such a transition, revenue volumes increase in the long term. State financial support does not play an important role in ensuring the ecological transition of manufacturers. Further research should focus on studying small business strategies for transitioning to eco-friendly packaging and implementing closed-loop production principles in floriculture.

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Received on: 10th of March, 2026
Accepted on: 25th of April, 2026
Published on: 15th of May, 2026