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Economic Aspects of Sustainable Development: Eco-Branding in Manufacturing Enterprises from Kazakhstan

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Abstract: Economic science provides a rich methodological toolkit for sustainable development combined with the principles of the circular economy and green marketing. The practical adaptation of a set of assessment tools helped the realisation of the goal of this study in the form of the systematisation of interaction factors between economic growth and environmental branding of industrial companies in the Republic of Kazakhstan. Descriptive models were used to assess the economic and technological state of enterprises and to analyse the effectiveness of capital investments for the implementation of green technology projects and social environmental investments. In the course of research of the population's requests to manufacturers of industrial products, it was found out that the requirements to the environmental characteristics of finished products have increased, and the price of ecological products is of concern. Producers and end consumers can be brought closer together through eco-branding, creation of special platforms for green integration participants. To unlock the reserves of economic growth, it is proposed that green investment flows with the participation of industrial capital should be intensified in order to increase investments in the eco-cultural transformation of eco-consumers of the new generation.

Keywords: sustainable economy; eco-branding; sustainable company development; industrial economics; ESG; sustainable consumption; consumer behaviour

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1. Introduction

The rational use of natural resources and a positive environmental image can enable national economies and industrial companies to reach a high level of sustainable development. In the past decade, environmental issues have been on the international agenda, for example, touching on the management of hazardous waste and increasing gross value added in a circular economy. Between 2018 and 2021, European Union countries managed to increase gross value added in the environmental goods and services sector by 13.9% [1]. A total of 33 countries with a share in global GDP of 50% have included their zero emission targets in policy documents and declarations, including Argentina, Australia, Brazil, Chile, India, Italy, Saudi Arabia, the Netherlands, the United States, Turkey, and others [2].

Industrial economics show that industrial enterprises are now seeking to increase their investment attractiveness through participation in green economy programmes [3]. According to the Carbon Disclosure Project, in 2023, 23,000 companies representing more than 60% of global market capitalisation have disclosed some information on their climate impact. At the same time, 330 major supply chain players have obtained specific data on their carbon footprint and strategies with the aim of achieving carbon neutrality. More than

400 companies (mostly from Europe, Asia, and North and South America) received an "A" grade for leadership in environmental transparency and performance on climate change, deforestation, and water security issues [4].

For Kazakhstan's economy, the adoption of the Carbon Neutral Strategy was a long-awaited step towards the formation of a closed-cycle economy. The strategic course of state policy considers the consistent transformation of the economy until 2060 [2]. With the introduction of the mechanism of transboundary carbon regulation, the inflow of green investments gradually forms sustainable consumption. The transition to carbon neutrality is accompanied by the solution of environmental problems in the field of protection of natural resources and the promotion of energy saving. Industrial companies and households in Kazakhstan were able to reduce hazardous waste emissions (all hazard levels) per capita from 55.77 million tonnes per capita in 2010 to 2.2 million tonnes in 2021 [5]. In Kazakhstan, a trend towards the formation of a positive environmental image for companies at the cores of industrial and technological clusters has begun to be observed. Starting from 1 September 2024, all issuers listed on the Kazakhstan Stock Exchange JSC are required to provide data on their activities in the area of managing their impact on the environment, economy, and society, as well as in the area of corporate governance. The heads of enterprises strive to solve the environmental and social problems of the regions and try to interact with the population as consumers of their products. At the same time, a comprehensive mechanism of environmental branding has been activated. Ecological branding is the promotion of the ecological properties of high-quality goods (services) aimed at meeting the sustainable demand of socially responsible consumption in order to mitigate negative impacts on the environment.

Examining sustainable growth through green initiatives highlights three critical approaches to a sustainable economy.

Firstly, approaches to the management of technological processes in the field of mining and the processing of minerals are gradually changing, and the use of natural resources in the agro-industrial complex has become more rational. Global companies in the energy, oil, and metallurgical sectors are developing alternative energy sources and supporting the transition to a closed-cycle economy [6]. Researchers have noted that innovations and environmentally friendly approaches implemented in industrial companies help the development of the institution of stakeholders and involve educational institutions in the joint work of greening of production processes [7]. Environmental priorities have become the basis for minimising the greenhouse gas emissions of agro-industrial companies and organic food production, and natural agricultural production concepts have been put into practice [8]. In turn, strategic green innovation impacts corporate financial and environmental performance [9]. At the same time, issues of organisational change, in the context of sustainable development in production systems, are still debatable [10]. Nearly a decade has passed since the United Nations adopted the Sustainable Development Goals, but solutions to the technical and economic aspects of energy infrastructure are still needed and changes in the state policy of subsidising environmental protection measures remain relevant [11,12].

Secondly, the diversification and risk coordination of the supply chains of industrial companies with trading partners has begun. It should be noted that it is at the intersection of production processes and sales of finished products that the phenomenon of environmental branding manifests itself, which meets the sustainable needs of the new generation of eco-consumers. The preferences of modern green consumers have a positive impact on the profits of manufacturing companies. We can agree with the arguments of researchers that the share of green consumers and their preferences contribute to the inflow of capital for the majority of industrial companies [13]. The openness of trade and international co-operation provides an incentive for cleaner producers to further adopt resource efficient technologies, regulate technology takeovers, digitalise cleaner management and automate

warehousing processes [14–18]. In parallel to the green transformation of technological processes, service programmes to support eco-consumer loyalty and financial success through increased targeting have received new impetus [19]. Attributes such as dynamic pricing, brand names, types of materials used, and eco-labelling, as well as specific green marketing techniques, are increasingly influencing companies' revenue growth [20–22].

Thirdly, there is a gradual "green" transformation of investment policy at the level of the global economy, as well as in the economies of individual regions and enterprises. Priorities comprise planning long-term investments, increasing the share of special public spending on environmental protection, and developing the mechanisms of market incentives on the basis of carbon pricing [23–26]. Practice shows that industrial companies that are committed to environmental initiatives gain additional competitive advantages in developing markets for environmentally friendly products. In microeconomics, green investments have a direct impact on demand and labour productivity growth, which depend on the level of environmental friendliness [27]. At the national economy level, some countries are emerging comprehensive and balanced indicators to assess the environmental performance of regional governments. In particular, research in China has analysed green GDP, environmental compensation, and public satisfaction [28]. However, industrial companies in most developing countries still face an acute dilemma: should they continue to grow with existing traditional technologies, or should they invest capital in environmental innovation, achieve sustainability in raw material supply chains, and modernise production by adopting resource-saving technologies? Taken together, these directions create the foundation for the eco-branding of manufactured products.

In this regard, the purpose of this study is to examine the factors of interaction between sustainable growth and environmental branding of industrial companies in the Republic of Kazakhstan, and to develop recommendations for the active promotion of green economy principles. The following tasks contribute to the achievement of the objectives:

1. The assessment of the current economic and technological state of enterprises in the manufacturing industry of the Republic of Kazakhstan;
2. The identification of reserves for economic growth through environmental transformation in the area of resource conservation management, including eco-branding;
3. The development of proposals for the sustainable development of industrial enterprises on the basis of investment policy and environmental branding.

This study will contribute to the green transformation of Kazakhstani industrial companies and their partners on the basis of the ecological branding of manufactured products. As a result of this, the build-up of the ecological culture of producers and consumers is instigated and the export of ecological products in domestic and foreign markets will increase.

2. Review of the Literature

Eco-branding as a scientific direction in the system of brand management has begun to play a direct role in the transformation of the aggregate management system of industrial companies and their partners. The works of scientists have helped to realise in practice the mechanisms of promoting environmentally friendly goods and green technologies.

The diversity of environmental branding and its relationship to sustainable economic growth is typical of many industries. For example, organisations from the hospitality and tourism sector attract customers with their corporate image, environmental care, and environmental awareness [29]. People become interested in joint environmental activities. Attributes of commitment to eco-labels, green colour accompanies consumers of the service sector [30]. One can agree with this argument, as services and retailing are among the sectors that directly influence consumer behaviour. Special attitude is given to the promotion of ecological brands in the fashion and beauty industry. Manufacturers of clothing and accessories pay attention to en-

vironmental and social sustainability. Finished products have begun to possess new emotional, social, and functional characteristics [31]. The category of environmental branding adherents also includes representatives of the banking sector providing green loans and subsidies [32,33].

Along with the positive effects of green marketing, you can see the manifestation of the flip side—"greenwashing". Researchers have investigated corporate governance problems for companies that use eco-branding as a source of additional benefits. For example, there is the issue of green securities, additional revenue from the sale of products with the name "eco". In this direction, there are contradictions in the methods of promoting environmental ideas. It is important to settle disagreements by means of a transformation of regulations at the legislative level, which will lead to an improvement of approaches to the certification of products and services. In these cases, there is a distortion of the purpose of bona fide green marketing. Scientists have called for the development of mechanisms to control public information on sustainable development [34]. To mitigate the risk of greenwashing, an independent area of eco-branding promotion has been defined, which involves examining the integrity of industrial companies, their relations with government agencies, bureaucratic leverage, and the financial technologies used [35,36].

At the same time, the green branding of industrial companies also requires special scientific approaches to research and promotion. Green technological processes, special marketing policy, and access to green finance determine the potential for the sustainable growth of enterprises. Here is a classification of the essential, in our opinion, approaches to environmental branding (Table 1).

Table 1. Approaches to the implementation of eco-branding mechanisms.

Scientific and Methodological Approaches/Impact Measures	The Object of Eco-Branding	Subjects of Eco-Branding	Literature
Creation of innovation ecosystems of high-tech industry	Regional strategies for breakthrough environmental innovation	Regional sales representatives, digital platform developers	[37]
	Green energy infrastructure		[38]
	Green Finance		[39]
Transformation of the trade system for recycled materials	Secondary raw material markets	Primary producers, Environmental and sustainable organisations, Recycling companies	[40]
Formation of green culture and values in the production environment of the enterprise and among the population	Green processes, green products, economic and social performance	Green HRM	[41–43]
	Digital competence ecosystem		[44]
	Environmental innovation, green R&D		[45]
	Practitioners of eco-friendly destination brands (eco-travel)		[46]
Formation of a green information field	Internal corporate environment, media	Business Managers, Information Intermediaries	[47]
	Green image		[48,49]
	Green trademarks		[50,51]
	Information and marketing communication		[52]

Source: compiled by the authors.

Research shows that the promotion of eco-branding is based on sustainable development and green economies in countries that are striving for sustainable growth. Advanced economies and developing countries have joined forces for common green goals, offering options for the future state of the economy as a whole (Table 2).

Table 2. Sustainable Production and Sustainable Consumption in Green Science.

Prerequisites for Sustainable Development	Integration Elements	Assignment of Transformations	Literature
Accelerated technological transition	Innovation environment in clusters, including small and medium-sized enterprises	Improvement of the human resource management system based on corporate social responsibility. Identification of potential new markets for eco-products	[53]
	Green infrastructure in the spatial planning system		[54,55]
	Digital marketing ecosystem		[56]
Transformation of the trade system for recycled materials	Secondary raw material markets	Primary producers, environmental and sustainable organisations, Recycling companies	[57–59]
Revitalising green financial flows	Digital finance ecosystem for SMEs	Developing and promoting inclusive finance	[60]
Need for ESG transformations	Participants of platform greening in production	Efficient material flow management, lean production	[61,62]
Demand for sustainable market communication	Participants in the internal and external environment of industrial companies	Developing sustainable media and green innovations	[63]

Source: compiled by the authors.

We can see how diverse the system of relations between the participants of the sustainable ecosystem is. In addition to the size of companies and their industry specifics, there are the factors of digitalisation, the state of regulatory and legal regulation of sustainable processes, and people's readiness for green transformation of their spheres of life. This opens up research perspectives and imposes responsibility for making the right decisions in the field of ecological consumption.

3. Methods

The relationship between sustainable economic growth and investment in the development of eco-branding technologies gives rise to the hypothesis that investment in green transformation is an important condition for maintaining the competitiveness of enterprises of the industrial complex of the Republic of Kazakhstan in the context of modern challenges. The use of official information of international organisations and research centres engaged in solving the problems of the "green" transformation of production and economic systems helps to study the problems of the current economic and technological state of enterprises, to identify the reserves of economic growth through the ecological transformation of resource conservation, activation of investment policy and ecological branding. For this purpose, this study applied classical methods of synthesis and analysis, such as comparative methods, methods of strategic planning, and forecasting.

The information basis is provided by Eurostat open sources (the Statistical Office of the European Union), Kazstat (the Bureau of the National Statistics Agency for Strategic Planning and Reforms of the Republic of Kazakhstan), Adilet (legal information resource

of the Republic of Kazakhstan), and the Carbon Disclosure Project (official resource for the international non-profit charity organisation CDP Global).

Since 2017, Kazakhstani industrial companies have been starting to create special platforms for interaction with stakeholders, represented by the teachers and students of educational institutions located in the regions where these companies are located [64]. Thanks to open reporting, for the first time it was possible to assess and visualise the results of the population survey—stakeholders of industrial enterprises of the Pavlodar region, Republic of Kazakhstan (Appendix A, Tables A1–A3). The purpose of the survey was to diagnose the key problems of sustainable development in combination with the mechanisms of environmental branding of the industrial complex. A total of 302 people participated in the survey. The survey was distributed via email, comprising a link to the questionnaire on Google Forms and an accompanying information letter with a description of the survey objectives. The questionnaire did not contain questions involving the disclosure of state secrets, official information with only restricted distribution allowed, or the confidential personal information of the respondents [65].

The notional structural and logical scheme of this study is presented in Figure 1.

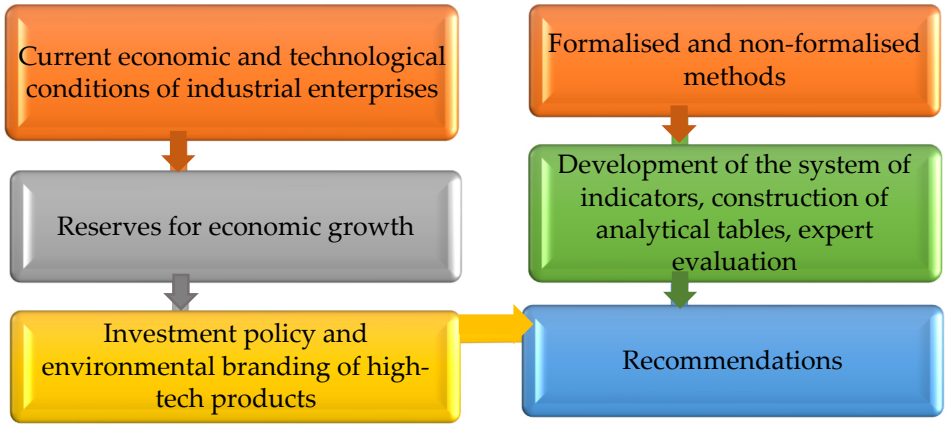

Figure 1. Structural and logical framework of this study. Source: compiled by the authors.

To assess readiness for eco-branding based on the economic and technological state of enterprises, descriptive models were used, which formed the basis for the construction of the system of balances in production capacity utilisation and for the calculation of analytical indicators. The study and forecast of production capacity utilisation is a universal model for revealing the technological potential of operating companies. The choice of such a model is justified by the industrial specialisation of the Pavlodar region and the high share of industrial products in the gross regional product.

The method of causal analysis between different variables was used for the model of determining the effectiveness of capital investment in green projects to improve a company's environmental image. Modern applied research in the field of investment project efficiency is an important source of practical and theoretical recommendations. Researchers have studied the relationship between an increase in raw material processing capacity and an increase in total capital costs, comparing them with annual operating costs [66]. When launching new production facilities, the return on investment (ROI), the internal rate of return adjusted for inflation, is calculated [67]. Researchers diversify assets using cluster analysis, which involves grouping sample objects according to a set of defined attributes, and study the geological, environmental, social, and economic aspects of investment portfolios [68]. In this study, the focus is on changes in the volume of revenue from the sales of manufactured products, the costs and expenses incurred, the earnings before interest, including taxes, depreciation, and amortisation (EBITDA), and the capital

investment in green projects (Capital Expenditure, CAPEX), as well as the return on capital investments, yielding the number of monetary units of total profit per one monetary unit of capital investments in green projects. Quantitative assessment of these indicators is based on the calculation of relative indicators in the context of annual reporting and their comparison over the period of implementation of green investment projects.

The main criteria for selecting models were their universality, simplicity of calculations, and prospective use by Kazakhstani enterprises. The reliability of initial information plays an important role, which is ensured by open financial documents and reports on sustainable development.

A proven correlation analysis between various economic indicators is also used to develop recommendations for sustainable growth management and eco-branding. The set of indicators may include the dynamics of environmental innovations, production capacity reserves, the level of equipment depreciation, labour productivity, and the volumes of capital investments in green projects (resource-saving technologies, green marketing technologies, social environmental investments, etc.).

For each variable, their mean values and mean deviations are calculated. Through the calculation algorithm, the products of deviations are found and then summarised. For each variable, the sums of the squares of deviations are calculated. Pearson's linear correlation coefficients are calculated for the most significant variables, as shown in Formula (1):

$$r = \frac{\sum(x - \overline{x}) \cdot (y - \overline{y})}{\sqrt{\sum(x - \overline{x})^2 \cdot \sum(y - \overline{y})^2}} \quad (1)$$

r is Pearson's correlation coefficient;

x and y are the values of variables x and y.

After that, the relationship between the variables was checked by observing the correlation condition. If the value of "r" is close to "-1", it indicates a strong negative correlation between the selected variables. In cases where the value of "r" is close to zero "0", then there is no linear relationship between the variables. If "r" is close to "1", then a strong linear correlation is found between the variables.

Based on the results of the analysis, recommendations have been developed to improve mechanisms for managing sustainable economic growth and investments in the environmental transformation of industrial enterprises in Kazakhstan, including the environmental branding of products. This methodological approach, along with non-formalised approaches, can be adapted to the activities of enterprises of various industries. The conclusions of the analysis are the basis for proposals to promote environmental branding for economic development proposals for the industrial enterprises of the Republic of Kazakhstan, which have reliable business partners in different countries and should fully meet the sustainability criteria.

4. Results

4.1. Economic and Technological Conditions of Enterprises in the Manufacturing Industry of the Republic of Kazakhstan in the Light of Environmental Transformations

In order to establish the relationship between sustainable economic growth and environmental branding of companies, it is important to identify a set of influencing factors. These are divided into external factors (exogenous), which have little dependence on industrial companies, and internal factors (endogenous), which directly depend on the companies' activities [69–72] (Figure 2).

When analysing the current economic and technological state of manufacturing enterprises, it is important to consider the peculiarities of the functioning of the national

economy and its raw material orientation. In the two years after the COVID-19 pandemic, the country managed to achieve growth of almost a quarter of the gross domestic product. The production of industrial products has gained momentum with an increase of almost 30% in 2022. At the same time, the production of environmentally friendly products increased by about one and a half times (by 44.9%), but its low share in the total production volume is a concern (Figure 3).

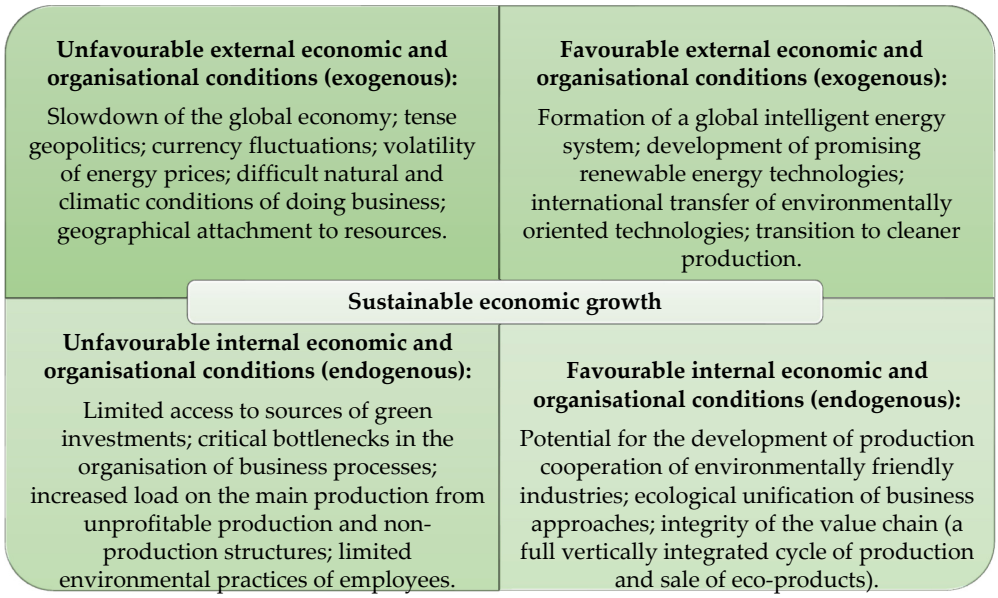

Figure 2. Factors of the relationship between sustainable economic growth and environmental branding of industrial companies. Source: compiled by the authors.

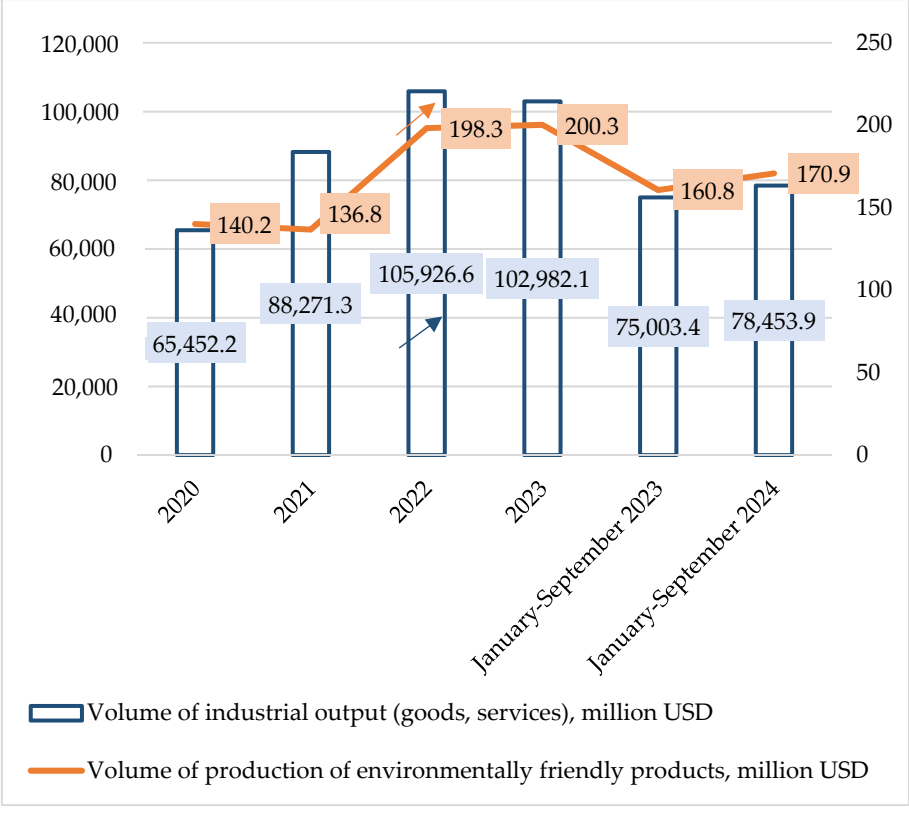

Figure 3. Dynamics of changes in industrial production volumes. Source: compiled by the authors [73].

Industries play an important role for the socio-economic development of the country. There was a progressive trend in manufacturing employment before the pandemic and after its active phase in 2020. In the same year, the volume of export shipments decreased, then the situation improved. Kazakhstan's industrial companies export most of their finished products to Eurasian and European countries. For instance, in 2021, about 40% of exports went to the EU countries, 34.6% to Asian countries, and 20% to countries in the Commonwealth of Independent States. To date, the geography of sales markets has not changed significantly. In 2023, due to a decrease in effective demand and the diversification of transport routes, the volume of total shipments decreased by 4.1%. Despite the complexity of the foreign economic environment, enterprises continue to work towards the sustainability of business processes, including digitalisation. The increase in the implementation of digital technologies, including a system for tracking environmental parameters in production, was 65.4% in 2022 and 27.1% in 2023. Observations show that environmental compliance and carbon footprint reduction have become goals aiming to support the sustainable growth of large and medium-sized industrial companies that are active in terms of innovation both within and outside their regions (Table 3).

Table 3. Dynamics of economic indicators of the manufacturing industry of the Republic of Kazakhstan (pandemic and post-pandemic period).

Indicators	2018	2019	2020	2021	2022	2023	Growth Rate, in %	
							2022 to 2021	2023 to 2022
Number of individuals employed in the manufacturing industry, thousand people	580.5	583.6	581.8	585.6	613.7	605.6	4.8	−1.3
Volume of manufacturing industry exports, USD million	15,712.1	15,798.1	15,498.1	19,851.8	26,819.6	25,721.6	35.1	−4.1
Export volume of goods of medium technological complexity, USD million	2432.7	2865.8	2944.8	4088.9	4829.8	4467.5	18.1	−7.5
Export volume of goods of high technological complexity, USD million	3263.4	3449.8	3746.6	4552.0	7924.1	9698.4	74.1	22.4
Number of operating enterprises in the manufacturing industry, units	14,700.0	15,803.0	16,862.0	18,163.0	19,998.0	20,858.0	10.1	4.3
Share of large and medium-sized enterprises in the manufacturing industry using digital technologies, in % (the indicator is being calculated in Kazakhstan for the first time since 2019)	–	4.8	6.1	7.8	12.9	16.4	65.4	27.1
Share of innovation-active enterprises in the manufacturing industry, in % (the indicator is being calculated in Kazakhstan for the first time since 2018)	15.8	14.4	15.4	12.9	14.8	14.7	14.7	−0.7

Source: authors' calculations [73].

By analysing the technological state of industrial companies, we can confidently state that the achieved technological redesigns and the level of environmental innovation activity are the growth points of the economy of enterprises for the coming years. In order to make economic growth measures effective, it is necessary to compare the possibilities of the full use of the existing production base and take steps to ensure green business processes and eco-branding. In assessing progress in the first instance, it is important to note the positive inflow of investments in projects in areas such as air protection, combating climate change, wastewater treatment (especially important for this period of severe floods), energy-saving technologies, and energy efficiency (Figure 4).

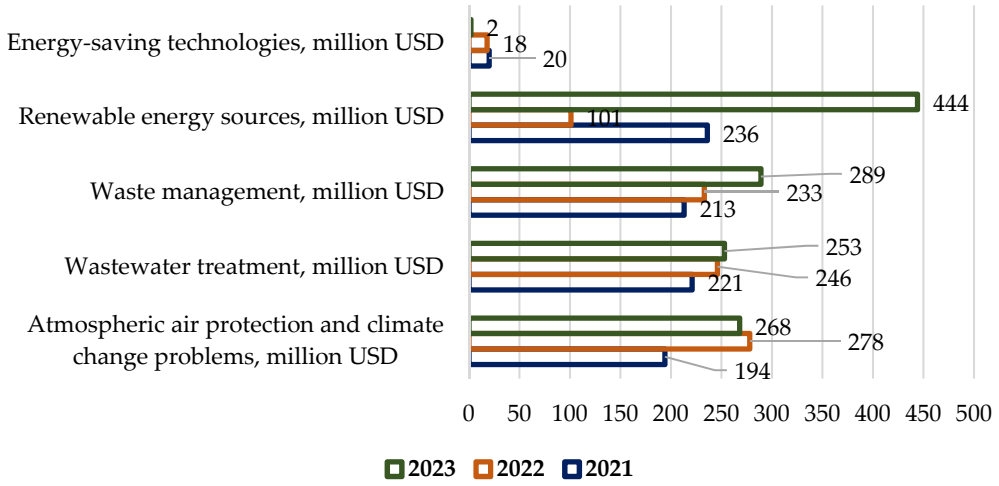

Figure 4. Areas of green investment in Kazakhstan, USD million. Source: compiled by the authors [74].

Starting from 2023, we chose the industrial complex of Kazakhstan and enterprises of the Pavlodar region as the objects of study in terms of sustainable economic growth and eco-branding [75]. According to statistics, at the beginning of 2024, more than 7% of all Kazakhstani industrial production was concentrated in the Pavlodar region. Today, industrial facilities employ more than a quarter of the working population of the oblast and generate about 43% of the gross regional product. When assessing reserves of economic growth, it is advisable to rely on the data of the analysis of the balance of production capacity utilisation (Appendix B, Table A3). There were favourable conditions for identifying the potential and increase of environmentally friendly production volumes by the enterprises of the Pavlodar region. Enterprises can count on the reserve capacity of their production facilities.

- Agro-industrial cluster—The companies Rubikom LLP (Pavlodar, Kazakhstan), Laska LLP (Pavlodar, Kazakhstan), Dyusembaev IE, and Kachir Sausages IE saw an increase in the production of sausages of 43.4%; Ruff LLP and Galitskoye LLP saw an increase in the production of canned meat and meat-sauce products of 77.5%; and Galitskoye LLP, Maslo-Del LLP, and AGREX Company LLP saw an increase in production of unrefined vegetable oil of 96.1%. Advanced competitive positions in the Pavlodar region involve producers of dairy products (yoghurt, milk, and cream), which utilise their own resource-saving technologies and registered trademarks—Molcom LLP, Foodmaster LLP, Galitskoye LLP, Rodnik & K LLP, and Kachirsky Molzavod LLP. In Kazakhstan, the leaders of milk processing production are Agrofirma Rodina and Imeni Karl Marx LLP.
- Food products cluster—Producers of mineral and carbonated water Zhana Rosa LLP (trademark “Pavlodarskaya”) additionally developed up to 88.7% production capacity.

- Petrochemical cluster—Pavlodar Oil Chemistry Refinery LLP saw an increase in production of oil fuel of 32.0% and in oil road bitumen of 42.3%; the company Neftekhim LTD LLP (Pavlodar) saw an increase in the production of sacks and packaging bags of 29.6%; Polymer LLP (Pavlodar) saw an increase in the production of rubber and plastic products of 74.3%; and Lacquer Factory "Lacra" has the potential to increase the production of paints and varnishes and related products by 98%.
- Metallurgical cluster—The Eurasian Resources Group (ERG), Aluminium of Kazakhstan JSC, and Kazakhstan Aluminium Smelter JSC achieved optimal capacity utilisation; Kasting LLP and KSP Steel LLP saw an increased output of rolled steel and steel pipes of 65.2%.

Environmental norms and standards aid in the compliance of the primary production assets and applied technologies with the requirements of lean production. According to statistics, the degree of depreciation in the fixed assets of enterprises in 2023 was 46.5%, the renewal rate was 11.4%, and the liquidation rate was 1.3% [76]. Fixed assets of industrial enterprises need modernisation, and new equipment should meet the requirements of high environmental friendliness and energy efficiency. In this case, capital investments can be classified as "green" investment projects. This will directly affect the formation of a positive environmental image for companies.

4.2. Unlocking Reserves of Economic Growth Through Environmental Transformation, Including Eco-Branding

In order to unlock economic growth reserves, it is necessary to intensify activities for the development of environmental initiatives; for this purpose, it is advisable to move in parallel in two directions:

1. Activation of the green investment flow through investments in resource-saving and environmental protection projects involving industrial capital, public, and private investments;
2. Investments in the eco-cultural transformation of the new generation of eco-consumers, involvement of young people in the development of new ideas for the formation of ecological brands of national products, expanding the boundaries of eco-cultural communication in the global economy, and greening industrial projects on special platforms along the lines of "Industrial Clusters plus Generation Z", in particular, the Eurasian Resources Group (ERG) Platform [77].

4.2.1. Activation of Green Investment Flows—The Case of the Eurasian Resources Group (ERG)

As an example of how to activate green investment flow, let us look at the case of the ERG and its subsidiary Aluminium of Kazakhstan JSC, which is located in Pavlodar and is part of the division "Metallurgical Cluster. Aluminium". It is important to point out that the ERG comprises 18 integrated companies, and the share of the ERG's full contribution to the GDP of the Republic of Kazakhstan is about 2.5% [77]. Since 2021, the ERG's Analytical Centre for Decarbonisation has been active in the group. The ERG is currently implementing decarbonisation projects with a total investment of KZT 143,295.5 million (or USD 300 million). The results of the analysis of the ERG and Aluminium of Kazakhstan JSC showed an increase in investments in projects including environmental, social, and governmental (ESG) projects from USD 1135 million in 2022 to USD 1440 million in 2023 (Appendix C, Table A4, Figures A1 and A2). The products of the ERG and Aluminium of Kazakhstan JSC are export-oriented; so, in 2023, Aluminium of Kazakhstan sold products worth a total of 245,828.5 KZT million (or USD 538.7 million), of which 34.9% were exported to Europe, 30.5% to Eurasia, and 34.6% to Kazakhstan. The downward trend in sales

volumes is due to a decline in global prices for the group's main products. As a result, the ERG companies suffered losses in the efficiency of their capital expenditures (Figure 5).

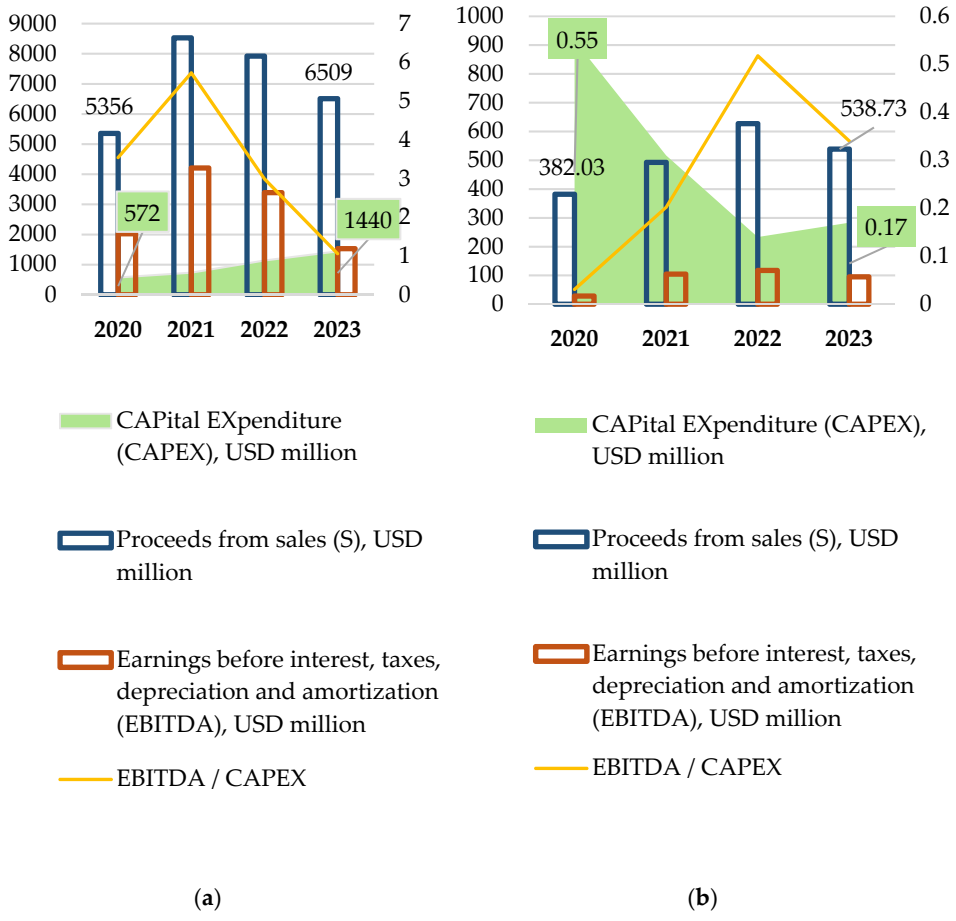

Figure 5. Dynamics of financial and economic indicators of the enterprise: (**a**) sales, EBITDA, and CAPEX dynamics of the Eurasian Resources Group (ERG); (**b**) sales, EBITDA, and CAPEX of Aluminium of Kazakhstan JSC. Source: compiled by the authors [77].

Despite the influence of external factors, in 2022–2023, projects aiming to implement resource-saving technologies continued, and the ERG companies increased social investments, including maintaining an environmental culture in their teams and among residents of the region. The ERG has managed to cover the costs of the investments made. This has created a safety cushion for the project implementation period; no deadlines were missed and no adjustments to the investment cost estimates were required. Given the dependence of the profitability of capital investments on the results of core activities, managers of structural units responsible for the implementation of green projects were included in the working group promoting the green finance policy. This group oversees corporate finance, sustainable development, risk management, production, energy supply, and environmental protection. It ensures transparency in the processes of attracting investments through green finance instruments in accordance with the International Capital Market Association (ICMA) and green loan principles (GLP), green bonds principles (GBP), the Loan Market Association (LMA), the Asia Pacific Loan Market Association (APLMA), and the Loan Syndications and Trading Association (LSTA).

The implementation of green projects is a factor for strengthening the positive environmental image of enterprises. By promoting ESG principles, the ERG enterprises provide a positive example for other Kazakhstani producers. Ecological concerns in product quality, openness in reporting on finance and sustainable development, and care for employees and

the general population became the "green intangible" assets in the ERG Group companies, increasing their competitive positions (Appendix C, Figure A3).

4.2.2. Investing in the Eco-Cultural Transformation of the New Generation of Eco-Consumers—Opinions of Stakeholders of Industrial Companies

As an important area of eco-branding development measures contributing to the sustainable growth prospects of the industrial complex, it is possible to define investments in terms of the eco-cultural transformation of the new generation of eco-consumers as part of social investments. According to the ecological code of the Republic of Kazakhstan, environmental culture is understood as "a system of knowledge, skills and value orientations, expressing and defining the nature of relations between man and nature, the measure and method of human involvement in activities for the conservation and development of the natural environment" [78].

Eco-cultural transformation activities require investment injections. According to statistics, Kazakhstan spent KZT 4,921,332 million (or USD 11.6 million) on research and development in the field of environmental protection in 2021, KZT 3,479,430 million (or USD 7.6 million) in 2022, and KZT 5,063,347 million (or USD 11.1 million) in 2023. Large companies, which are at the core of regional industrial and technological clusters, finance ecological projects as part of social investment projects. For example, the ERG Way Production System promotes the formation of a more efficient production culture and enables efficiency throughout the entire product life cycle, including through the application of lean production principles. Thanks to the Idea Factory Concept, 61,811 active proposals have been accepted for implementation in 2023, which will result in production cost reductions of USD 37.8 million [77].

In order to diagnose the key problems of ensuring sustainable development in combination with the mechanisms of environmental branding of the industrial complex, researchers from Toraighyrov University conducted a survey that allows us to determine the points of interaction between industrial companies of the Pavlodar region and their stakeholders, represented by the population [65]. Of the 302 people who took part in the survey, most of the respondents (72.3%) were young people under 30 years of age, who were studying, in internships, or already working at the enterprises in the region (Figure 6).

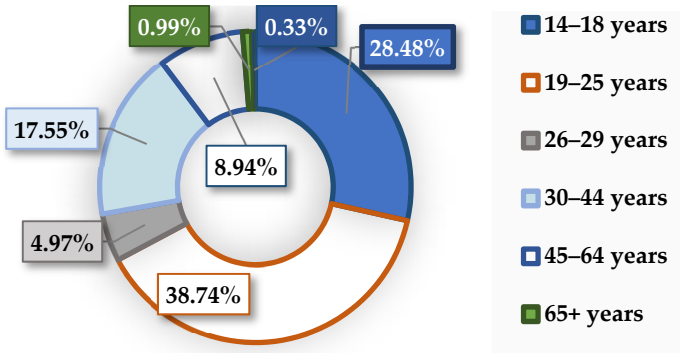

Figure 6. Age structure of respondents. Distribution of responses of the population—stakeholders of industrial enterprises of the Pavlodar region, Republic of Kazakhstan, in % of the number of respondents. Source: compiled by the authors.

According to the responses received, the region's residents associate the characteristics of a "new generation eco-consumer" with a desire to preserve the ecosystem combined with responsible consumption (Figure 7). According to the majority of respondents, ecological products are associated with a high price (66.2% of answers). Many people believe that more information about the advantages of organic products is needed (47.0% of answers).

The population expects counter measures from the government in the form of financial injections and tax preferences for eco-producers (36.4% of answers) (Figure 8).

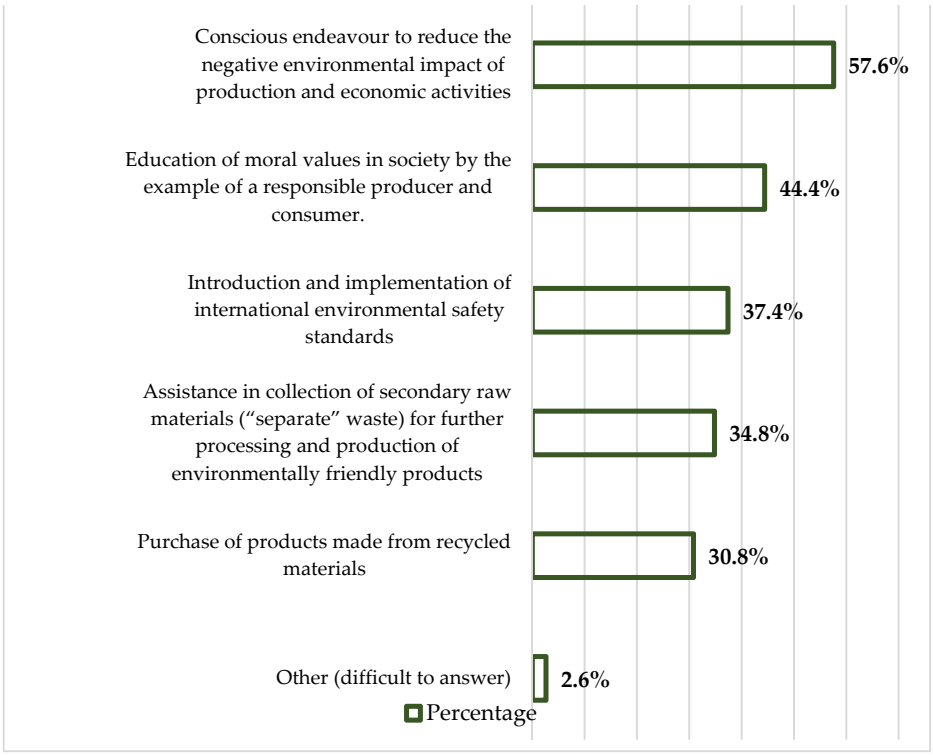

Figure 7. Behavioural attributes of the "New generation eco-consumer" (multiple choice). Distribution of responses of the population—stakeholders of industrial enterprises of the Pavlodar region, Republic of Kazakhstan, in % of the number of respondents. Source: compiled by the authors.

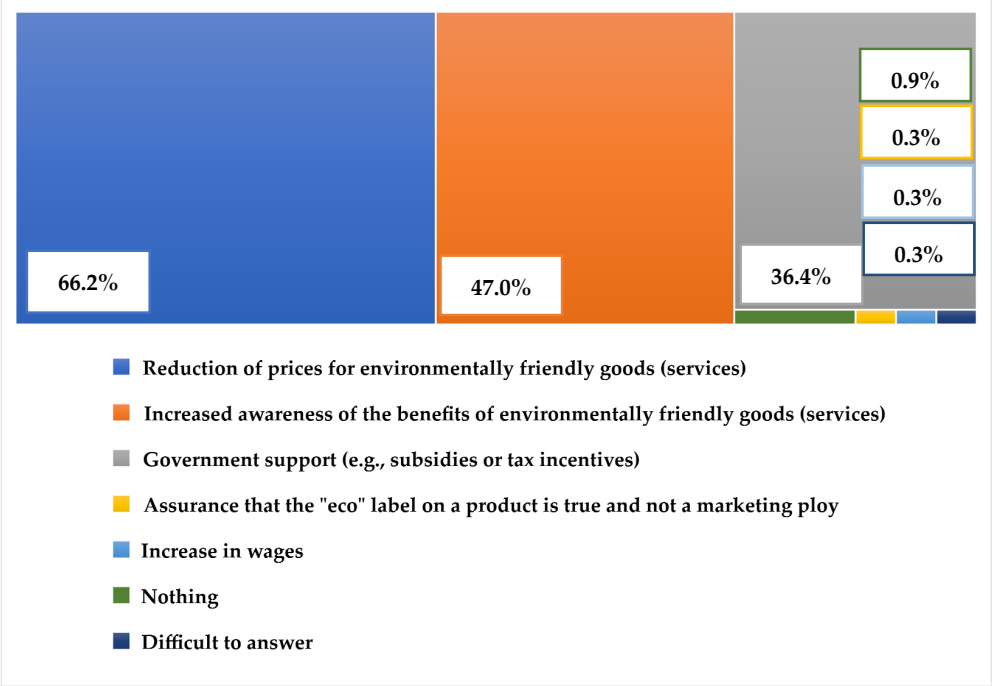

Figure 8. What would persuade you to spend more money on environmentally friendly goods (services) if you do not yet do so? (Multiple choice). Distribution of responses of the population—stakeholders of industrial enterprises of the Pavlodar region, Republic of Kazakhstan, in % of the number of respondents. Source: compiled by the authors.

Thanks to the survey, it was possible to rank attributes for the development of eco-branding in the region in terms of their importance. According to the majority of respondents, enterprises should ensure compliance with increased requirements for the environmental characteristics of finished products (53.3% of responses). The eco-labelling of the product production chain from raw materials to product consumption and utilisation is also important (47.3% of responses).

It is advisable to compare the answers of enterprises to the same question and the answers of people. As the main signs of environmental branding development, managers of industrial enterprises indicated the first priority of implementing international standards of environmental management (60.0% of responses). The problems of passing the procedure for recognising the environmental friendliness of manufactured products, the need to implement carbon footprint tracking methods entails additional financial expenses on the part of industrial companies, as well as the strictness of the certification procedure. Sustainable consumption and consumer behaviour largely depend on the ways and speed of the dissemination of information and knowledge about the production and sale of eco-products, especially new goods and services. Information support and the dissemination of information was chosen by business managers as the second most important attribute for the development of eco-branding in the region (51.0% of responses). Also, enterprises expect state support to promote brands of environmentally friendly products (47.0% of responses). Consultative and supportive assistance can come from the Ministry of Trade and Integration of the Republic of Kazakhstan, the National Institute of Intellectual Property and other authorised bodies in the sphere of trade and protection of producers' and consumers' rights. If the proposed measures are implemented comprehensively in the near future, the industrial sector will make significant progress towards a green economy (Figure 9).

4.3. Development of Proposals for Sustainable Development of Industrial Enterprises on the Basis of Investment Policy and Promotion of Environmental Branding

The sustainable development of industrial enterprises is seen in the formation of special approaches that will promote the combination of economic priorities in the form of value-added growth, ensuring the profitability of capital investments and environmental priorities in the form of greening industrial projects and the ecological branding of manufactured products. As an effective tool of interaction between industrial capital, ecological innovation, and human capital, the creation of special platforms like "Industrial clusters plus Generation Z" is proposed. In Kazakhstan, the equivalent of such a platform is the "Student Entrepreneurship Ecosystem", supported by industrial companies from the Eurasian Resources Group [64]. On this platform, training sessions on the digitalisation of business processes and the development of green tools are held with the participation of enterprises and educational institutions. There are regular competitions for the best idea for the introduction of resource-saving technologies, thus popularising knowledge about environmental initiatives both globally and in Kazakhstan. Students, together with mentor teachers, participate in the promotion of innovative business ideas and present their projects at annual competitions. Investors and sponsors, who have real skills in implementing environmental innovations, can sponsor youth projects and provide jobs in their companies, thus allowing them to participate as collaborators with business entities. The successful practice of social environmental investment can be scaled up as a prospect for sustaining sustainable growth. For example, a group of young entrepreneurs proposed the production of an environmentally friendly national product called "Eco Kurt". Kurt is a type of hard cheese made from pressed and dried fermented sour milk. Due to technological process, it is possible to modify the finished product, for example, to give it a creative taste and colour, using natural fruit jams, dried fruits, nuts, and cereal grains from local producers as additives. The sites of the business centre of Toraighyrov University could be offered as a

testing ground. Production facilities and investment capital could be provided by regional entrepreneurs, in particular, Galitskoye LLP and the ERG enterprises. Let us consider the implementation of this case study on the basis of Pearson's correlation coefficient, which will help to substantiate the relationship between investment in the green project and the potential output of the national sour-milk product "Eco Kurt" (Appendix D, Table A5).

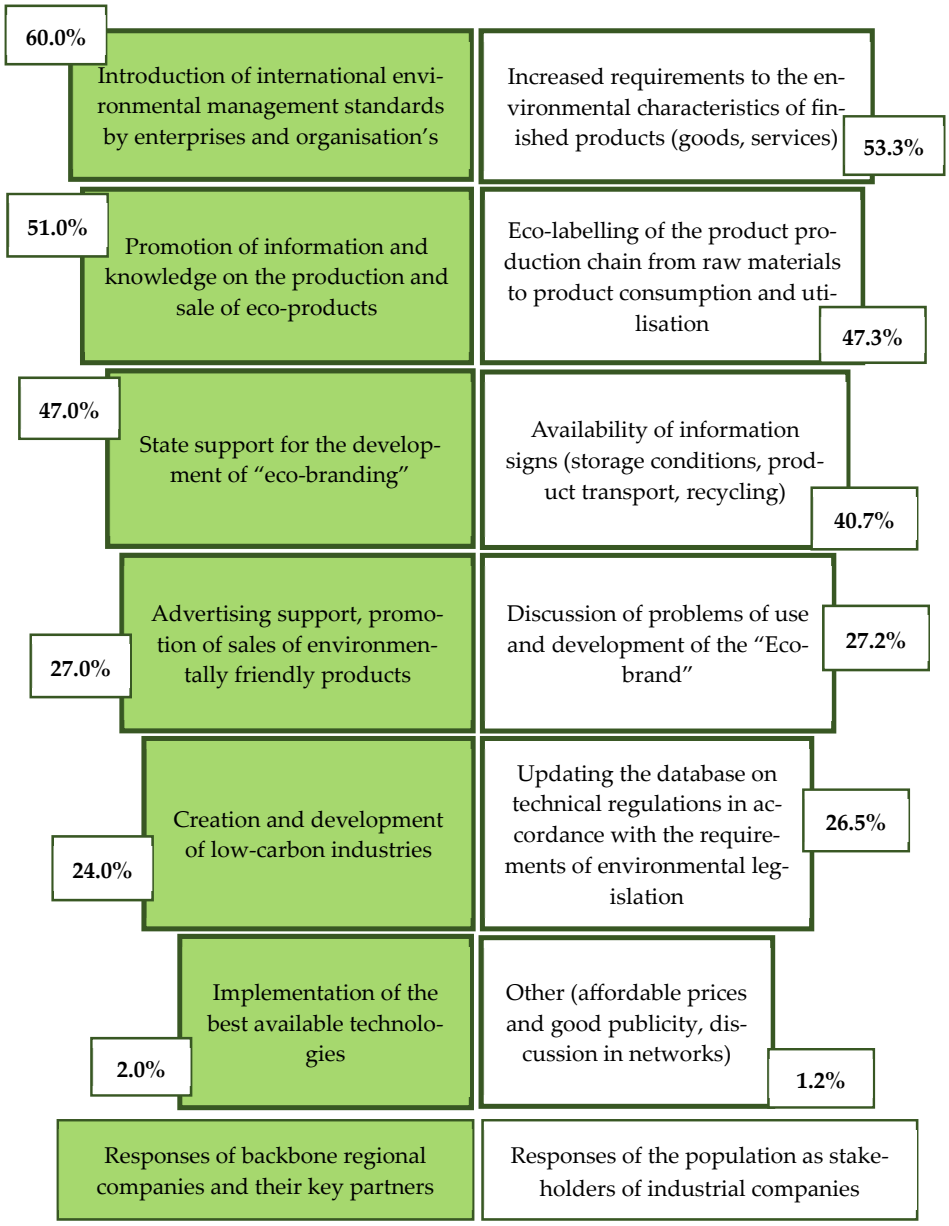

Figure 9. Funnel of attributes for the development of eco-branding in the region. Comparison of responses of backbone companies of the region and their key partners with the responses of the population—stakeholders of industrial enterprises of the Pavlodar region, Republic of Kazakhstan, in % of the number of respondents. Source: Reprinted with permission from refs. [65,75]. Copyright 2024 Toraighyrov University.

According to the forecast model, the value of Pearson's correlation coefficient "r" is close to 1, which indicates a close relationship between the planned production volumes of environmentally friendly sour-milk product "Eco Kurt" and investments in this project from a five-year perspective. In addition, this project could be realised through the technological integration of related youth projects for the production of ecological packaging for "Eco Kurt", an advertising campaign for a national ecological brand based on the principles of green marketing.

Based on the data from this study, we see those investments in green projects, environmental initiatives by industrial companies and the public help promote environmental brands and provide the basis for a sustainable economy.

5. Conclusions and Discussion

The generalisation of approaches to the sustainable economic growth of industrial enterprises and eco-branding helps society to move towards progressive ecological development in order to fully and competently utilise the natural resources and human capital at their disposal. Thanks to the analytical data presented in this study, it is possible to confirm the hypothesis about the high role of effective capital investments in the green transformation of enterprises of the industrial complex of the Republic of Kazakhstan. Having assessed external and internal factors that could fundamentally change the position of any company in the market, we can observe the following picture.

In the coming years, Kazakhstani manufacturers and their partners in Eurasia, Europe, and America will have to implement carbon neutrality projects, the "smart" logistics of goods and raw materials, and the development and implementation of digital management systems for high-tech production. The European Commission launched a global program to reduce emissions and invest in an advanced research and innovation "Green Deal" and proposed a mechanism for cross-border carbon regulation. Kazakhstani companies have set goals for themselves to implement green technologies, involve the public in solving existing environmental problems, which forms their green image as a new type of asset. At the same time, technological lag is a cornerstone on the way to accelerating green transformation. Practitioners believe that ecological branding can become an impetus for sustainable consumption and activate the state system of scientific and technological support for environmental initiatives. To unlock the potential for economic growth, it is important to adapt modern developments in the field of sustainable economics and eco-branding (Tables 4 and 5).

Table 4. Promising research in the field of sustainable economy and eco-branding.

Research Direction	Description	Researchers
State mechanisms to support economic sustainability in entrepreneurship	Improvement of state support instruments in standardisation, technical regulation, certification, export–import operations	[79]
Mechanisms for regulating corporate environmental performance	Disclosure of a company's philosophy on environmental protection, environmental policy, organisational structure of circular economy management	[80,81]
The new production culture of the circular economy	Introducing circular thinking, redesigning production processes for primary raw materials	[82]
Mechanisms for sustainable behaviour when purchasing green products	Supporting and motivating consumers to purchase green products through environmental programmes	[83,84]
Branding mechanisms through design developments in creative spheres	Developing sustainable packaging, promoting the biosphere value of the brand, levelling reputational risks in the market	[85,86]
Mechanisms for an effective green marketing strategy	Adapting digital technologies to study consumer preferences to promote the consumption of eco-products. Exploring environmental cultural sensitivity and cross-cultural understanding in the global economy	[87,88]

Source: compiled by the authors.

Table 5. Growth prospects in the field of sustainable economy and eco-branding for companies of the Republic of Kazakhstan and their partners.

Direction of Transformational Change	Description	Key Economic Sectors
Improvement of the management system at the level of companies and sectoral government agencies, introduction of ESG principles	Replenish low carbon technology databank, make the case for leveraging the Green Climate Fund	Industrial sector, financial sector, construction, transport, state structures
Renewal of power and heat generation technologies	Attract investment in replacing outdated carbon-intensive equipment and technological infrastructure with innovative low- and no-carbon technologies, introduction of renewable energy sources	Extractive and manufacturing industries
Digital technologies and decarbonisation of industrial processes	Adoption of new zero greenhouse gas emission production technologies combined with smart carbon capture and storage systems	Extractive and manufacturing industries
Construction of infrastructure for industrial and domestic waste treatment and utilisation	Development of joint projects on collection, recycling and utilisation of wastes	Extractive and manufacturing industries, construction
Investing in the transition to a green and carbon-neutral economy	Updating the regulatory, legal and institutional framework, creating conditions for the development of innovative green finance instruments	Government agencies, financial sector, science and education
Branding of environmentally friendly high-tech-logic products	Searching for and scaling up the best eco-branding practices, environmental education of the younger generation	Industries, government agencies, science and education

Source: compiled by the authors.

As potential consequences of the research results, there can be recommendations for sustainable development of the business environment. First of all, it is important to continue the implementation of investment policy of industrial companies in green projects, despite currency fluctuations and unstable demand for products from external consumers. The introduction of resource-saving technologies is highly demanded for the prospects of diversification of the national economy and modernisation of its infrastructure. It is important to overcome disproportions in the implementation of environmental innovations. According to statistics, only 26% of Kazakhstani enterprises, by strengthening environmental control, were able to reduce emissions in the third quarter of 2024, compared to the previous period [89]. Secondly, it is important to optimise sales processes based on the development and promotion of environmentally friendly products, marketing, and sales of products considering their environmental characteristics. Thirdly, it is necessary to initiate audits on the certification of environmental management systems, examination, and registration of trademarks.

Along with ecological branding, it is advisable to develop and implement a sustainable consumption policy. Realisation of these two directions is connected with the development of the institution of stakeholders. In the Pavlodar region there is a positive trend of joint projects related to ESG, but the area of decision-making should spread from big business to small and medium-sized businesses in the production and service sectors. Research in the field of economic growth considering environmental factors serves as a basis for successful implementation of projects aimed at achieving carbon neutrality. Successful environmental branding is an incentive for industrial enterprises and their stakeholders to work closely together.

The sustainable growth points identified in the course of this study can serve as a basis for future research:

- Greening of production technologies, introduction of green marketing mechanisms at enterprises to continuously study the needs of the new generation of eco-consumers;
- Engaging the younger generation in new green projects to produce branded products that are environmentally friendly and reflect the national traditions of each country;
- Development of digital technologies and special platforms to facilitate the interaction of participants in green integration;
- Formation of progressive images of responsible consumption and environmental protection.

It can be concluded that green transformation is a long and costly process that requires a lot of effort from economic actors. The implementation of sustainable projects brings its real achievements aimed at the well-being of future generations.

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Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Non-profit joint-stock company "Toraighyrov University" (protocol code 02/1, date: 27 September 2023).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Publicly available datasets were analysed in this study. The data used are open-source. Neither classified nor trade secret data were used. These data can be found at https://stat.gov.kz/ (accessed on 1 September 2024), https://science.tou.edu.kz/storage/Report_on_the_sociological_survey_Population.pdf (accessed on 31 October 2024).

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Roadmap for conducting and approbation of the results of sociological survey (online questionnaire) of the population—stakeholders of industrial enterprises of the Pavlodar region, Republic of Kazakhstan.

Process Stage	Period
The purpose of the survey—to diagnose the key problems of sustainable development in combination with the mechanisms of eco-branding of the industrial complex	Q4 2023
Organisation of a discussion platform in the Pavlodar Youth Initiatives Development Centre with youth, public, and governmental bodies on the topic "Eco-branding in youth entrepreneurship"	Q1 2024
Estimating the volume of investment in the implementation of eco-branding technology	Q2 2024
Development of principles for the implementation of eco-branding technology	Q3 2024
Preparation of a scientific publication (article) based on the results of the survey	Q4 2024
Scaling/extrapolation of platform green manufacturing to regions of Kazakhstan and networking to promote national eco-branding	2025

Table A2. Characteristics of sociological survey (online questionnaire) of the population—stakeholders of industrial enterprises of the Pavlodar region of the Republic of Kazakhstan.

Parameters	Characteristics
Purpose of sociological research	Diagnostics of key sustainable development problems in combination with mechanisms of ecological branding of industrial complex. Opinion of the population.
Procedure for dissemination and collection of information	Placing an announcement about the questionnaire on the website of Toraighyrov University. Targeted distribution of questionnaires by e-mail (link to the Google form of the questionnaire). Accompanying informational letter describing the survey objectives. The format of the online questionnaire was chosen in order to create comfortable conditions for respondents.
Pre-testing of questionnaires, analysis of sampling bias	In order to analyse the systematic biases caused by the research methods, a three-frame sample was used. The representativeness of the sample corresponds to the characteristics of the general population: 302 people participated in the survey, including one third of the total contingent of students who undergo internships or work at enterprises in the region. The control of fieldwork within the framework of the survey was carried out on the basis of provided Google-statistics.
Analytical blocks of the questionnaire	Block "Social portrait of the respondent" (five questions): place of residence (region, urban or rural resident); age group (range); social status; level of education. "Respondent's Economic Portrait" block (three questions): income compared to the subsistence minimum; satisfaction with financial situation; value of expenditures on food and essential goods (range). "Eco-consumption of the new generation" block (six questions): availability and signs of a 'new generation eco-consumer'; connection between types of products and eco-standards; availability of "green" trading sites in the region; consumer demands and availability of information about eco-goods. "ESG" block (five questions): awareness of ESG principles; environmental problems in the region; responsibility of ecosystem actors; willingness to protect nature. "Sustainable Consumption and Eco-branding" block (nine questions): connection between eco-labelling and trust in producers; consumer preferences for eco-goods; barriers to purchasing and using eco-goods; regional eco-brands and their promotion. "Feedback" block (one question): cooperation with the university in the development and promotion of eco-branding technology for goods and services.
Analysing and presenting the results of the survey	Detailed check of the survey results for completeness of answers. Results of the conducted surveys: completed interviews—302; partially completed interviews—0; refusals and interrupted interviews—0. Respondent does not meet the selection criteria—0. Statistical processing of data. Frequency analysis was conducted for questions where respondents were presented with several answer options to choose from. The results were ranked by frequency and specific weight. Graphical display method based on thematic visualisation of the research.
Target audience for survey results	Economists, managers, sociologists, ecologists, heads of economic entities, central and local executive bodies, non-governmental organisations, public associations, media representatives, financial institutions, and partners working and implementing sustainable development projects in the regions of Kazakhstan and other countries.
Posting a report	Open access on the website of Toraighyrov University [65].

Appendix B

Table A3. Analysis of the balance of production capacity utilisation by types of finished products, compliant with environmental standards for 2023, Growth Reserve for 2024–2030.

Region/Oblast	Capacity at the Beginning of the Year	Capacity at the End of the Year	Average Annual Capacity	Output or Quantity of Raw Materials Processed	Average Annual Capacity Utilisation in the Reported Year, in %	Growth Reserve, in %
Sausages and similar meat products, tonnes						
Republic of Kazakhstan	101,537.0	99,708.0	87,308.0	46,305.0	53.0	47.0
Pavlodar region	10,437.0	10,467.0	10,467.0	5927.0	56.6	43.4
Canned meat, tonnes						
Republic of Kazakhstan	1724.0	1724.0	1471.0	1147.0	78.0	22.0
Pavlodar region	160.0	160.0	160.0	36.0	22.5	77.5
Unrefined vegetable oil, tonnes						
Republic of Kazakhstan	1,592,343.0	1,689,111.0	1,442,391.0	505,646.0	35.1	64.9
Pavlodar region	28,904.0	29,154.0	15,834.0	612.0	3.9	96.1
Butter and dairy spreads (pastes), tonnes						
Republic of Kazakhstan	58,229.0	62,228.0	60,839.0	27,133.0	44.6	55.4
Pavlodar region	3320.0	3740.0	3540.0	2459.0	69.5	30.5
Cheese and cottage cheese, tonnes						
Republic of Kazakhstan	94,572.0	100,815.0	98,592.0	37,237.0	37.8	62.2
Pavlodar region	3836.0	3856.0	3846.0	1816.0	47.2	52.8
Yoghurt, milk, and cream, other fermented or squashed dairy products, tonnes						
Republic of Kazakhstan	353,652.0	353,307.0	330,865.0	194,717.0	58.9	41.1
Pavlodar region	47,245.0	47,791.0	47,791.0	43,624.0	91.3	8.7
Macaroni, noodles, couscous, and similar flour products, tonnes						
Republic of Kazakhstan	427,912.0	409,183.0	389,761.0	154,484.0	39.6	60.4
Pavlodar region	11,831.0	11,831.0	11,831.0	9539.0	80.6	19.4
Mineral and carbonated waters, unsweetened and unflavoured, thousand litres						
Republic of Kazakhstan	1,492,852.6	1,520,356.4	1,733,334.2	657,046.3	37.9	62.1
Pavlodar region	122,350.0	123,335.2	123,245.2	13,924.2	11.3	88.7
Bed linen, thousand pieces						
Republic of Kazakhstan	54,768.8	52,817.2	43,495.6	28,830.6	66.3	33.7
Pavlodar region	25.0	25.0	25.0	11.1	44.4	55.6

Table A3. *Cont.*

Region/Oblast	Capacity at the Beginning of the Year	Capacity at the End of the Year	Average Annual Capacity	Output or Quantity of Raw Materials Processed	Average Annual Capacity Utilisation in the Reported Year, in %	Growth Reserve, in %
Packaging bags and pouches, thousand pieces						
Republic of Kazakhstan	265,134.3	255,568.8	228,253.0	162,471.2	71.2	28.8
Pavlodar region	60,144.9	60,145.2	60,145.2	42,335.3	70.4	29.6
Bags and pouches (including conical) made of polyethylene, kg						
Republic of Kazakhstan	42,276,132.0	43,026,217.0	40,329,248.0	18,976,952.0	47.1	52.9
Pavlodar region	2,378,318.0	2,090,000.0	2,090,000.0	1,516,260.0	72.5	27.5
Petroleum fuel (fuel oil), gas oil (diesel fuel), and petroleum distillates, thousand tonnes						
Republic of Kazakhstan	20,599.4	20,877.7	20,067,8	14,540.5	72.5	27.5
Pavlodar region	6058.0	6062.0	6062.0	4124.3	68.0	32.0
Petroleum road bitumen, thousand tonnes						
Republic of Kazakhstan	1386.6	1486.6	1486.6	801.5	53.9	46.1
Pavlodar region	500.0	500.0	500.0	288.4	57.7	42.3
Rubber and plastic products, pipes, tubes, sleeves, and hoses made of rubber (except ebonite), kg						
Republic of Kazakhstan	1,346,700.0	1,399,948.0	1,399,678.0	625,193.0	44.7	55.3
Pavlodar region	290,000.0	290,000.0	290,000.0	74,590.0	25.7	74.3
Plates, sheets, films, foils, and strips of plastics, unreinforced or not combined with other materials, kg						
Republic of Kazakhstan	71,812,174.0	76,947,406.0	64,038,565.0	33,159,853.0	51.8	48.2
Pavlodar region	1,065,812.0	610,000.0	610,000.0	373,366.0	61.2	38.8
Paints, varnishes and other related products, artists' paint and printing ink, tonnes						
Republic of Kazakhstan	17,945.0	18,058.0	4805.0	3496.0	72.8	27.2
Pavlodar region	600.0	600.0	600.0	7	1.2	98.8
Unprocessed aluminium, tonnes						
Republic of Kazakhstan	345,664.0	325,551.0	303,587.0	275,102.0	90.6	9.4
Pavlodar region	304,991.0	279,488.0	261,484.0	260,876.0	99.8	0.2
Rolled steel and steel pipes, tonnes						
Republic of Kazakhstan	13,500.0	13,500.0	12,000.0	4176.0	34.8	65.2
Pavlodar region	12,000.0	12,000.0	12,000.0	4176.0	34.8	65.2

Source: compiled by the authors [73].

Appendix C

Table A4. Calculations on the factor model for assessing the efficiency of capital investments in green projects of the Eurasian Resources Group enterprises.

Indicator	2019	2020	2021	2022	2023
Proceeds from sales (sales), million USD	4872	5356	8530	7924	6509
Costs and expenses (costs), million USD	4145	4701	6397	6159	6136
EBITDA, million USD	1538	2023	4210	3392	1530
Capital expenditures (CAPEX), million USD	869	572	735	1135	1440
R (EBITDA/CAPEX)	1.7699	3.5367	5.7279	2.9885	1.0625
Change in capital investment efficiency (R), in points	−0.7740	1.7669	2.1912	−2.7393	−1.9260

Source: Compiled by the authors [77].

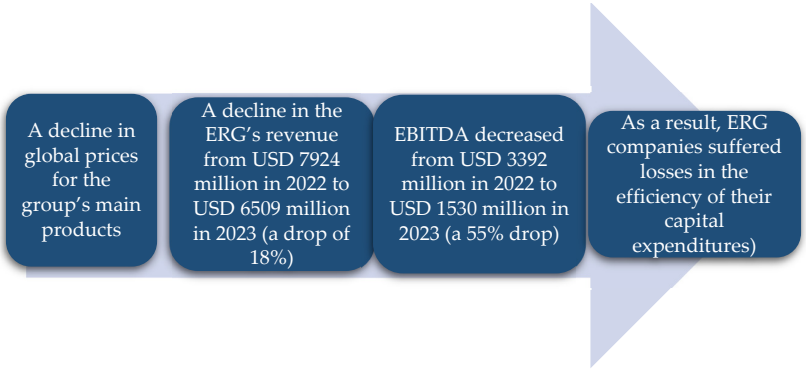

Figure A1. Factors influencing the sustainable growth of the ERG Group companies. Source: Compiled by the authors [77].

Figure A2. Factors influencing the environmental image of the ERG Group companies. Source: Compiled by the authors [77].

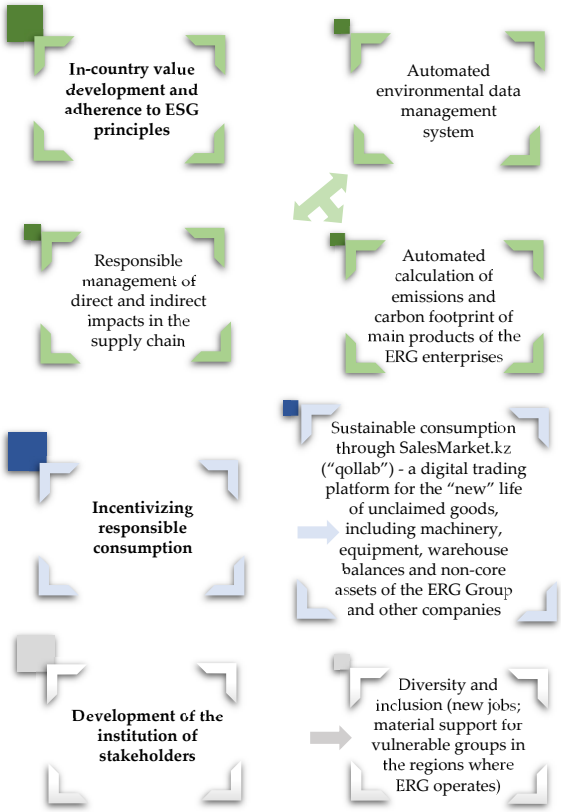

Figure A3. Process regulation of competitiveness thanks to ESG projects of the ERG Group companies. Source: Compiled by the authors [77].

Appendix D

Table A5. Dynamics of capital investments and production volumes of national sour-milk product "Eco Kurt", relationship based on Pearson's correlation coefficient.

Indicators	2025	2026	2027	2028	2029
Volume of planned investments (present value), million KZT (variable "x")	3	5	7	9	11
"Eco Kurt" production volume, tonnes (variable "y")	300	320	350	380	400
Average planned investments, $\overline{x}$	$(\overline{x}) = (3 + 5 + 7 + 9 + 11)/5 = 35/5 = 7$				
Average production volume of "Eco Kurt", $\overline{y}$	$(\overline{y}) = (300 + 320 + 350 + 380 + 400)/5 = 1750/5 = 350$				
Calculation of deviation $(x - \overline{x})$ from the mean $\overline{x}$ for each variable "x"	$3 - 7 = -4$	$5 - 7 = -2$	$7 - 7 = 0$	$9 - 7 = 2$	$11 - 7 = 4$
Calculation of the deviation $(y - \overline{y})$ from the mean $\overline{y}$ for each variable "y"	$300 - 350 = -50$	$320 - 350 = -30$	$350 - 350 = 0$	$380 - 350 = 30$	$400 - 350 = 50$
Multiplication of deviations of variable "x" by deviations of variable "y"	200	60	0	60	200
Sum of products $\sum(x - \overline{x}) \cdot (y - \overline{y})$	$200 + 60 + 0 + 60 + 200 = 520$				
Sum of squares of deviations of "x" $\sum(x - \overline{x})^2$	$(-4)^2 + (-2)^2 + 0^2 + 2^2 + 4^2 = 40$				
Sum of squares of deviations of "y" $(y - \overline{y})^2$	$(-50)^2 + (-30)^2 + 0^2 + 30^2 + 50^2 = 6800$				
$r = \frac{\sum(x-\overline{x})\cdot(y-\overline{y})}{\sqrt{\sum(x-\overline{x})^2 \cdot \sum(y-\overline{y})^2}}$	$r = \frac{520}{\sqrt{40 \cdot 6800}}$ $r = \frac{520}{\sqrt{272{,}000}}$ $r = \frac{520}{521.53619242}$ $r \approx 0.99705$				

Source: authors' calculations.

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