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Path to Green Economy: Analyzing Innovation, Investment and Taxation in Kazakhstan

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ABSTRACT

The concept of a green economy has gained significant attention, aiming to achieve sustainable development without environmental harm. This study examines Kazakhstan's transition to a green economy, focusing on indicators such as green innovation, investment in environmental protection, and green taxes. Despite Kazakhstan's commitment to a carbon-neutral economy by 2060, significant challenges were identified. The methodology involved three steps: descriptive analysis of green economy indicators for 2016–2022, correlation analysis to identify significant relationships, and trend forecasting for 2023–2025 using a linear regression model. This approach provided a thorough examination of the green economy's current state and future projections. Over the study period, the number of organizations engaged in environmental innovation and their activity levels have decreased. Investments in environmental protection showed initial growth, but declined in recent years. Conversely, there has been an increase in environmental taxes, reflecting the government's focus on tax instruments to promote sustainable development. Correlation analysis revealed complex interdependencies, indicating that higher investments and taxes are often associated with lower levels of green innovation activity. Projections for 2023-2025 suggest a further decline in green innovation indicators unless significant policy measures are taken. The study underscores the need for a balanced approach that encourages green innovation while maintaining robust investment and tax bases.

KEYWORDS: Green Economy, Environmental Investments, Green Innovations, Environmental Taxes, Forecast, Innovation Activity

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1. INTRODUCTION

In recent years, the concept of a green economy has increasingly captured the attention of academic researchers and policymakers. A green economy is defined by its focus on low carbon emissions, resource efficiency, and social inclusiveness, aiming to achieve sustainable development while minimizing environmental harm. As the world faces escalating ecological challenges and climate change, the transition to a green economy has become a crucial priority for many nations and organizations seeking to mitigate their ecological footprint and enhance sustainability.

Kazakhstan's commitment to transitioning to a green economy was prominently highlighted at the Climate Ambition Summit in 2020, where the country pledged to transform its oil and gas-based energy sector into a carbon-neutral economy by 2060 (Concept for the Transition of the Republic of Kazakhstan). This ambitious commitment underscores Kazakhstan's dedication to aligning with international climate agreements, such as the Paris Agreement, and signifies a critical shift in its national climate policy. The transition to a green economy is embedded within Kazakhstan's strategic frameworks, including the Concept for the Transition to a Green Economy and the National Project "Green Kazakhstan," which outline the roadmap for achieving a sustainable and environmentally friendly economic model.

The research presented in this study aims to critically analyze the current status and forecast critical indicators associated with Kazakhstan's green economy transition. The primary research goals are to assess the effectiveness of green innovations, evaluate the impact of investments in environmental protection, and examine the role of environmental taxes in promoting sustainable practices. By employing a multifaceted approach that includes descriptive analysis, correlation analysis, and trend forecasting, the study provides a comprehensive examination of green economy indicators and their interrelationships, offering valuable insights for policymakers and stakeholders.

The context of this study is defined by the significant financial investments required for transitioning to a green economy. The shift involves transforming economic sectors and developing and implementing green technologies, processes, and innovations. Despite these investments' importance, there is a substantial gap between the required volume of green financing and the actual investments made. Currently, most funding for environmental and climate initiatives comes from budget allocations. However, more than public funds are needed to cover the extensive costs associated with large-scale environmental and social projects. This shortfall necessitates a broader financing approach, including increased participation from private businesses and financial institutions.

Globally, there is a growing trend towards reducing direct government involvement in financing environmentally sustainable activities, thereby encouraging the private sector to take on a more active role. This shift aligns with the strategic goals outlined in Kazakhstan's national documents. The Concept for the Transition to a Green Economy envisions annual investments of approximately $3.3 billion, with a cumulative total of about $119 billion projected by 2050. Additionally, the National Project "Green Kazakhstan" plans to allocate a substantial 1.4 trillion tenge from 2021 to 2025, which includes 298.2 billion tenge from the state budget, 82.4 billion tenge from local budgets, and 1032.5 billion tenge from extra-budgetary funds (National Project "Green Kazakhstan"). This financing structure reflects the government's strategic intention to leverage funds from diverse sources, including financial institutions and private enterprises, to support green projects and initiatives.

Green innovations are central to the transition towards a sustainable economy. These innovations encompass technological advancements and process improvements that deliver tangible environmental benefits. Organizations that actively engage in green innovations often gain significant competitive

advantages, such as reduced operational costs, enhanced market positions, and improved compliance with environmental regulations. For example, adopting renewable energy technologies, efficient waste management practices, and sustainable resource use can lead to substantial cost savings and operational efficiencies.

Investments in environmental protection are another critical driver of green economy objectives. These investments cover a broad spectrum of activities, including pollution control, waste management, and developing renewable energy projects. By channeling resources into these areas, countries can achieve significant environmental and economic benefits, including improved public health, enhanced environmental quality, and the creation of green jobs.

Environmental taxes also play a pivotal role in advancing sustainable practices. These taxes aim to internalize the external costs associated with environmental damage, thereby incentivizing businesses and individuals to adopt more environmentally friendly behaviors. By pricing environmental harm, governments can encourage the reduction of pollution and the adoption of cleaner technologies. However, the effectiveness of ecological taxes depends on their design and implementation and their alignment with broader policy goals.

Understanding the complex interrelationships between various green economy indicators - such as innovation, investment, and taxation - is essential for effective policymaking. The literature indicates that these indicators are interconnected in complex ways, with each influencing the others. For example, higher levels of investment in green technologies may lead to increased innovation, while effective environmental taxes can drive both innovation and investment in sustainable practices. This study aims to explore these interdependencies in-depth, providing insights into how different elements of the green economy interact and contribute to overall sustainability goals.

The results of this study will offer valuable information for a range of stakeholders, including businesses, government agencies, and other entities involved in promoting a sustainable green economy. The study aims to inform and guide policy development, investment strategies, and innovation efforts by analyzing the current status and forecasting future trends. Ultimately, the findings will support the creation of a robust and effective green economy framework, helping Kazakhstan and other countries achieve their sustainability objectives while addressing the pressing environmental challenges of our time.

2. LITERATURE REVIEW

The concept of a green economy has garnered substantial attention in recent years in both academic and policy-making circles. A green economy aims for sustainable development without degrading the environment. Low carbon emissions, resource efficiency, and social inclusivity characterize it. This literature review explores critical themes and findings from recent studies on green economy indicators, their interrelationships, and the implications for policy and practice.

Green innovations are crucial for the transition to a sustainable economy. According to Schiederig et al. (2012), green innovations include technological advancements and process improvements that lead to environmental benefits. Horbach et al. (2012) highlighted that firms with a strong focus on green innovations tend to perform better regarding sustainability and long-term economic success (Miao et al., 2017). They encompass product innovations, such as eco-friendly products and process innovations, which improve resource efficiency and reduce emissions (Song & Yu, 2018). Studies have shown that organizations engaged in green innovations often experience competitive advantages, including cost savings, improved market positioning, and regulatory compliance.

The study by Varavin and Kozlova (2018) provides a detailed analysis of the development of the green economy in various regions of Kazakhstan, highlighting significant regional

differences and the need for targeted policy measures. Their comprehensive methodology, which includes descriptive analysis, correlation analysis, and trend forecasting, provides valuable information but is limited due to the use of data until 2022 and the need for qualitative analysis. Dabyltayeva and Rakhymzhan (2019) consider key economic policy measures such as "green" taxes, subsidies, and investments necessary to develop a green economy. Although Dabyltayeva and Rakhymzhan emphasize the need to align economic policy with environmental goals and cite international examples, their document needs more detailed implementation mechanisms, industry analysis, and quantitative data. Taken together, these studies highlight the importance of regional and policy-oriented approaches, emphasizing the need to balance economic incentives and reliable support for innovation to promote a sustainable green economy.

Investments in environmental protection are a critical driver for achieving green economy objectives. These investments include expenditures on pollution control, waste management, and renewable energy projects. Bassi and Yudken (2011) argue that substantial public and private investments are necessary to support the infrastructure and technologies required for a green economy. These investments help mitigate environmental impacts and create new economic opportunities and jobs in green sectors. However, the effectiveness of these investments depends on the regulatory framework and the alignment of financial incentives with sustainability goals (UNEP, 2011).

Environmental taxes are designed to internalize the external costs of environmental degradation, thereby encouraging more sustainable practices. According to Ekins (1999), Jones (2011), Falcão (2012), and Liu et al. (2023), well-designed environmental taxes can drive significant reductions in pollution and resource consumption while generating revenue that can be used to fund further environmental initiatives. Green investment, fiscal policies, and ecological taxes positively influence clean energy consumption. Environmental taxes increase the demand for clean energy, preserving the environment and promoting sustainable practices. Studies by the OECD (2010) indicate that countries with higher levels of environmental taxation tend to have better environmental outcomes without compromising economic growth. For example, in Sweden, introducing a NOx emissions tax led to a significant reduction in emissions and stimulated innovation (Coste et al., 2018).

Reducing the underutilization of human resources and the overexploitation of natural resources has become an economic policy goal for sustainable development. Research shows that environmental taxes positively impact employment, promoting the emergence of new sectors and types of jobs. However, women benefit less from these new jobs than men. This underscores the need for policies to reduce discrimination against women in the labor market as part of a green economy (Domguia ye al., 2022). Yan et al. (2023) indicated that green investments promote renewable energy use, and fiscal policies like tax incentives and subsidies expand renewable energy sources.

Understanding the relationships between different green economy indicators is vital for effective policy-making. The literature suggests complex interdependencies exist between green innovations, investments, and environmental taxes. For instance, Rennings (2000) discusses the concept of “innovation effects,” where environmental regulations and taxes can stimulate green innovations. Conversely, inadequate investment and poorly designed taxes can stifle innovation and lead to suboptimal ecological outcomes. Empirical studies, such as those by Jaffe et al. (2002), highlight the importance of integrated policy approaches that consider these interrelationships to maximize the effectiveness of green economy strategies.

At the same time, Sibt-i-Ali et al. (2024) consider the impact of technological innovations, the transition to energy, and financial globalization on the environmental footprint in selected developing countries in order to assess how these factors affect

environmental sustainability. In addition, these elements are essential in shaping environmental outcomes and promoting green development. However, the study needs a detailed analysis of country-specific conditions and policy implications that could provide more practical information for developing targeted environmental strategies. Wei Teng et al. (2024) explored the impact of nuclear power, greener energy, and economic progress on throughput, showing that advances in these areas increase energy efficiency and sustainability in leading nuclear power countries. While the study highlights the positive impact on throughput, it is limited to focusing on nuclear power, which potentially needs to consider the broader energy context and related environmental and social effects. Considering different energy systems and a more comprehensive range of environmental and social factors, a more integrated approach could provide a more holistic understanding of energy changes.

Forecasting future trends in green economy indicators is essential for long-term planning and decision-making. Techniques such as linear regression and scenario analysis are commonly used to project future developments based on historical data. According to Armstrong (2001), accurate forecasting requires robust statistical methods and an understanding of underlying economic and environmental dynamics. Recent studies, such as those by the International Energy Agency (2020), emphasize the importance of continuously monitoring and updating forecasts to account for emerging trends and unexpected developments.

In conclusion, the literature provides valuable insights into the dynamics of green economy indicators and their implications for policy and practice. The analysis should consider the relationships between indicators such as green innovations, investments in environmental protection, and various ecological taxes. Understanding these relationships is crucial for making informed decisions and formulating effective strategies. Forecasting these indicators is vital to developing recommendations promoting a sustainable green economy.

3. METHODOLOGY

The research methodology combines descriptive analysis, correlation analysis, and trend forecasting to provide a comprehensive assessment of the indicators of the "green" economy. Descriptive analysis provides a fundamental understanding of the current state and historical trends. In contrast, correlation analysis identifies significant relationships between indicators, paying particular attention to those with the most significant impact. Trend forecasting using linear regression allows you to predict future developments, making informed political and strategic decisions based on a detailed study of past and present data.

This analysis was conducted in three stages to comprehensively understand the key green economy indicators and their trends. The study used data from 2016 to 2022, including information on the number of companies with green innovations, activity levels, and other vital indicators.

The first stage involved describing the country's current situation of green economy indicators. This entailed collecting data from 2016 to 2022 on various metrics such as the number of organizations with green innovations, the level of green innovation activity, the share of green innovations in the total number of innovations, product innovations, and business process innovations. This initial descriptive analysis provided a baseline understanding of these indicators' current status and historical trends.

A correlation analysis was performed in the second stage to identify the relationships between different green economy indicators. The indicators were encoded using specific codes (Table 1).

TABLE 1. Encoded Indicators and Their Significance

Code	Indicator	Significance
A1	Number of organizations with green innovations	Significant
A2	Level of green innovation activity	Significant
A3	Share of green innovations	Significant
A4	Product innovations	Significant
A5	Business process innovations	Significant
A6	Number of issued licenses in the field of environmental protection	Not significant
A7	Production of products in value terms (mln tenge)	Not significant
A8	Production of environmentally friendly products (mln tenge)	Not significant
A9	Investments in environmental protection (mln tenge)	Significant
A10	Share of environmental taxes (%)	Significant
A11	Energy taxes (mln tenge)	Significant
A12	Transport taxes (mln tenge)	Significant
A13	Pollution taxes (mln tenge)	Significant
A14	Resource use taxes (mln tenge)	Significant
A15	Total environmental taxes (mln tenge)	Significant
Note: complied by authors		

Note: compiled by authors

Indicators A6, A7, and A8, which represent the number of issued licenses in the field of environmental protection, production of products in value terms (mln tenge), and production of environmentally friendly products (mln tenge) respectively, were excluded from the correlation matrix due to their non-significant correlations with other indicators. This helps to focus the analysis on the most relevant and impactful relationships between the key indicators of the green economy. This encoding facilitated a more straightforward interpretation of the correlation matrix. The correlation analysis helped to uncover significant positive and negative relationships between the indicators, allowing for insights into how changes in one metric might influence others.

The final stage of the analysis involved forecasting trends for key green economy indicators from 2023 to 2025. To achieve this, we applied a linear regression model to the historical data to estimate future values. The trend calculation was based on the linear regression formula (1):

$$y=mx+by = mx + by=mx+b \quad (1)$$

where "y" is the forecasted value, mmm is the slope of the trend line, "x" is the year, and "b" is the intercept. This formula was used to project the future values of each indicator based on their historical trends. The results provided forecasts for the number of organizations with green innovations, the level of green innovation activity, the share of green innovations, product innovations, business process innovations, investments in environmental protection, and various categories of environmental taxes.

These three stages—descriptive analysis, correlation analysis with encoded indicators, and trend forecasting—combined to offer a detailed and structured examination of the green economy's current state and future projections. This methodology ensures that the analysis is both thorough and academically rigorous, providing valuable insights for policymakers, businesses, and stakeholders involved in fostering a sustainable green economy. The indicators were encoded and a total of 15 indicators were encoded, out of which three indicators with non-significant correlations were excluded from the correlation matrix. The Table 1 summarizes the indicators along with their corresponding codes and significance based on the correlation analysis.

4. FINDINGS AND DISCUSSION

Currently, the country is experiencing the following level of development in the green economy. The number of organizations with green innovations has decreased from 312 in 2016 to 97 in 2022. The level of green innovation activity has also declined from 1% in 2016 to 0.3% in 2022. Similarly, the share of green innovations in the total number of innovations has dropped from 10.8% to 3.0% over the same period.

Investments aimed at environmental protection have shown a significant upward trend from 2016 to 2019, increasing from 43,936,904 in 2016 to 198,721,626 in 2019. However, from 2020 onwards, there has been a slight decline, with investments dropping to 159,660,892 by 2022. This indicates a robust initial growth in environmental investments, followed by a stabilization and slight decrease in recent years.

The analysis of the critical indicators of the green economy from 2016 to 2022 reveals several significant trends and insights. Firstly, the number of organizations with green innovations and the level of green innovation activity have both significantly declined, suggesting a decrease in adopting environmentally sustainable practices among businesses. Despite this, the share of green innovations in the total number of innovations has shown some resilience, albeit much lower than in 2016.

Secondly, the trends in environmental taxes indicate an overall increase in the total amount and the share of these taxes. This reflects a growing governmental focus on environmental taxation as a tool to promote sustainability. Energy taxes, transport taxes, pollution taxes, and resource use taxes have all increased, with some fluctuations, particularly during the year 2020, likely due to the impact of the global pandemic.

Lastly, there has been a significant rise in the number of issued licenses in environmental protection and the production of products in value terms. This suggests a growing regulatory framework and economic activities aimed at protecting the environment. However, the production of environmentally friendly products has shown variability, highlighting the ongoing challenges in consistently increasing the output of such products.

Figure 1 shows information about trends in environmental taxes below.

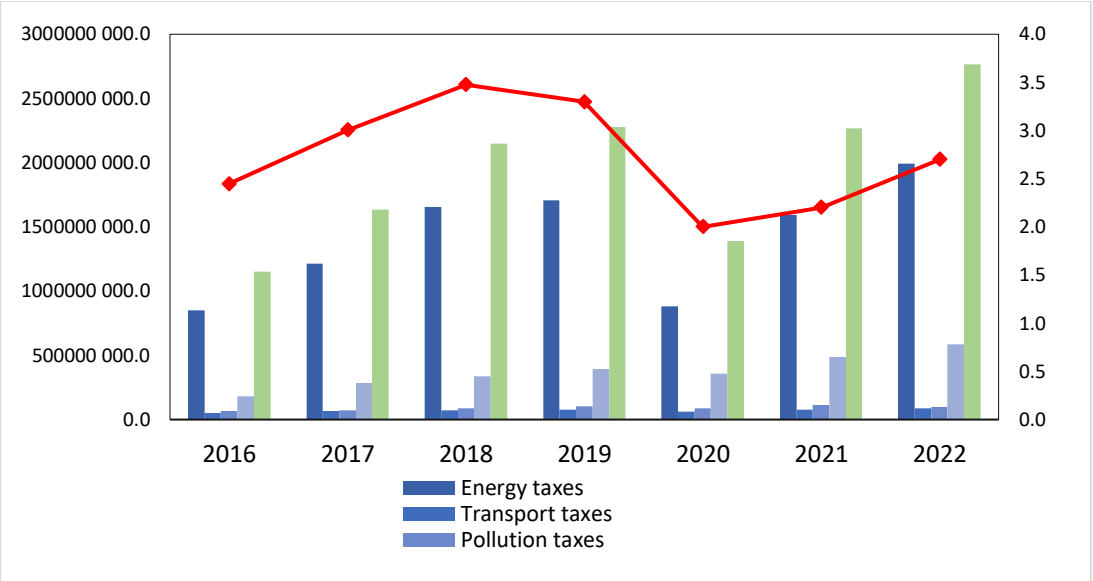

FIGURE 1. Trends in Environmental taxes for 2016-2022

Note: compiled by authors

While there are positive developments in environmental taxation and regulatory measures, the decline in green innovation indicates a need for renewed efforts and policies to encourage sustainable practices among businesses. Ensuring consistent growth in producing environmentally friendly products remains a critical challenge that must be addressed to achieve a more robust green economy. Below is an analysis showing changes in key indicators from 2016 to 2022.

The graph illustrates the trends in various types of environmental taxes from 2016 to 2022. Energy taxes have shown a significant increase, peaking in 2019 and then slightly declining before rising again in 2022. Transport taxes and pollution taxes have also increased over time, with a noticeable dip in 2020. Resource use taxes have steadily increased, reflecting a growing focus on taxing the use of natural resources. The total environmental taxes and the share of environmental taxes have generally increased, with a notable drop in 2020 followed by a recovery.

Below, in Figure 2 describes information about the statistical data on licenses and production in environmental protection.

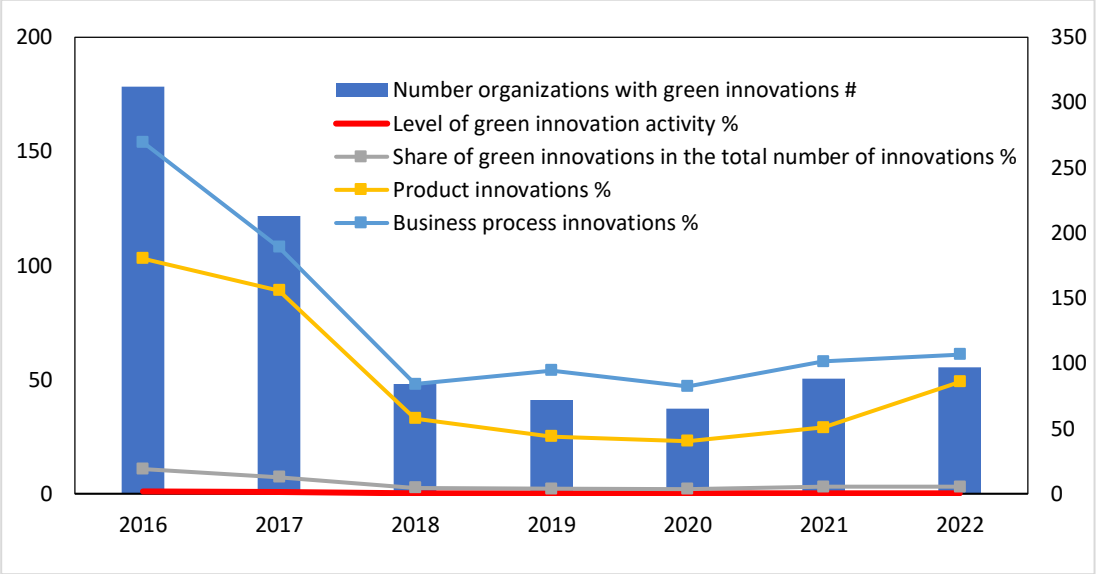

FIGURE 2. Trends in Environmental Taxes for 2016-2022

Note: compiled by authors

The graph shows the trends of key indicators related to environmental innovations from 2016 to 2022. The number of organizations with green innovations (blue bars) has significantly decreased from 312 in 2016 to 97 in 2022. The level of green innovation activity (orange line) has remained low, fluctuating between 0.2% and 1%. The share of green innovations in the total number of innovations (grey line) has dropped from 10.8% in 2016 to 3% in 2022. Product innovations (yellow line) and business process innovations have also declined, indicating a general reduction in green innovation activities over the years.

Figure 3 shows information about the statistical data on licenses and production in environmental protection.

The graph presents the trends in the number of issued licenses in the field of environmental protection, production of products in value terms, and production of environmentally friendly products from 2016 to 2022. The number of issued licenses has significantly increased, reaching a peak of 297 in 2022.

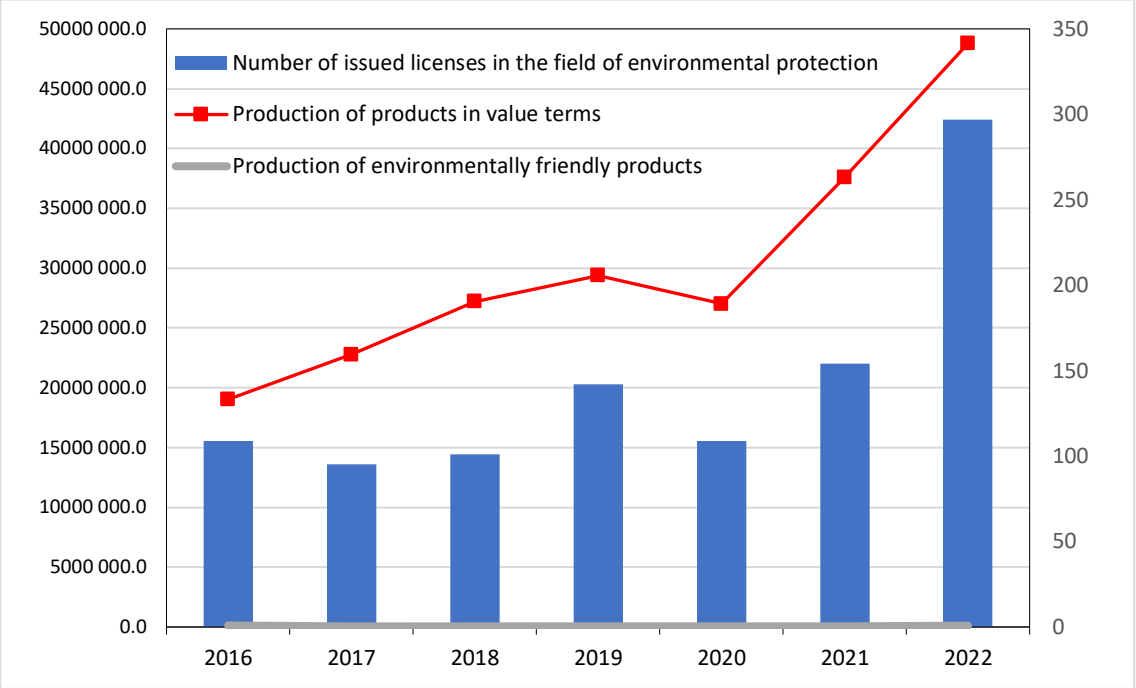

FIGURE 3. Licenses and Production in Environmental Protection for 2016-2022

Note: compiled by authors

The production of products in value terms has also shown a consistent upward trend, indicating growth in economic activities related to environmental protection. However, the production of environmentally friendly products has fluctuated, with a general increase but notable variations year by year. This highlights both the progress and the challenges in scaling up ecologically friendly production.

Analyzing the critical indicators of the green economy from 2016 to 2022 reveals several significant trends and insights. Firstly, the number of organizations with green innovations and the level of green innovation activity have both significantly declined, suggesting a decrease in adopting environmentally sustainable practices among businesses. Despite this, the share of green innovations in the total number of innovations has shown some resilience, albeit much lower than in 2016.

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Lastly, there has been a significant rise in the number of issued licenses in the field of environmental protection and the production of products in value terms. This suggests a growing regulatory framework and economic activities aimed at protecting the environment. However, the production of environmentally friendly products has shown variability, highlighting the ongoing challenges in consistently increasing the output of such products.

In summary, while there are positive developments in environmental taxation and regulatory measures, the decline in green innovation indicates a need for renewed efforts and policies to encourage sustainable practices among businesses. Ensuring consistent growth

in producing environmentally friendly products remains a key challenge that must be addressed to achieve a more robust green economy.

A correlation matrix was constructed to understand the relationships between different green economy indicators. Correlation analysis allows us to identify which indicators are interrelated and how strongly. Below is a correlation matrix of key green economy indicators (Table 2).

TABLE 2. Correlation matrix

No	A1	A2	A3	A4	A5	A9	A10	A11	A12	A13	A14	A15
A1	1.00	0.99	0.99	0.97	0.97	-0.90				-0.81		
A2	0.99	1.00	0.99	0.96	0.96	-0.89				-0.80		
A3	0.99	0.99	1.00	0.97	0.97	-0.90				-0.80		
A4	0.97	0.96	0.97	1.00	0.99	-0.88				-0.79		
A5	0.97	0.96	0.97	0.99	1.00	-0.88				-0.79		
A9	-0.90	-0.89	-0.90	-0.88	-0.88	1.00	0.81	0.85	0.85	0.97	0.87	0.92
A10						0.81	1.00	0.83	0.83	0.95	0.86	0.89
A11						0.85	0.83	1.00	0.83	0.94	0.88	0.93
A12						0.85	0.83	0.83	1.00	0.94	0.89	0.91
A13	-0.81	-0.80	-0.80	-0.79	-0.79	0.97	0.95	0.94	0.94	1.00	0.94	0.97
A14						0.87	0.86	0.88	0.89	0.94	1.00	0.96
A15	-0.69	-0.69	-0.69	-0.67	-0.67	0.92	0.89	0.93	0.91	0.97	0.96	1.00

Note: compiled by authors

The analysis of the results are divided into positive and negative correlations. High positive correlations was observed among following groups of indicators.

1) Number of organizations with green innovations (A1), Level of green innovation activity (A2), Share of green innovations (A3), Product innovations (A4), Business process innovations (A5). Therefore, increases in any of these aspects are closely related to increases in the others. For instance, a higher number of organizations with green innovations likely leads to higher levels of green innovation activity and an increased share of green innovations in the total number of innovations.

2) Investments in environmental protection (A9) with Share of environmental taxes (A10), Energy taxes (A11), Transport taxes (A12), Pollution taxes (A13), Resource use taxes (A14), Total environmental taxes (A15). Investments in environmental protection (A9) show a strong positive correlation with various environmental taxes. This suggests that higher investments in environmental protection are associated with higher environmental taxes across various categories. It could imply that as investments in environmental protection increase, there is a parallel rise in tax revenue from environmental taxes.

3) Share of environmental taxes (A10), Energy taxes (A11), Transport taxes (A12), Pollution taxes (A13), Resource use taxes (A14), Total environmental taxes (A15). There are strong positive correlations among these different types of environmental taxes. This indicates a consistent pattern where increases in one type of environmental tax are likely accompanied by increases in other types. For example, higher energy taxes are correlated with higher transport, pollution, and resource use taxes. Negative correlations was observed among following group of indicators.

1) Number of organizations with green innovations (A1), Level of green innovation activity (A2), Share of green innovations (A3), Product innovations (A4), Business process innovations (A5) with Investments in environmental protection (A9), Pollution taxes (A13), Total environmental taxes (A15). These green innovation metrics have a significant

negative correlation with investments in environmental protection (A9), pollution taxes (A13), and total environmental taxes (A15). This suggests an inverse relationship where higher investments in environmental protection and higher pollution or total environmental taxes might correspond to lower green innovation activity and vice versa. This could imply that organizations might be less inclined to innovate in a green manner when there are higher taxes or when significant investments are directed towards environmental protection. The strong positive correlations among green innovation metrics (A1, A2, A3, A4, A5) suggest that policies promoting one aspect of green innovation likely benefit other aspects as well. Integrated policy approaches can be highly effective. The positive correlation between investments in environmental protection (A9) and various environmental taxes (A10, A11, A12, A13, A14, A15) indicates that as investment increases, so do tax revenues from these areas. Policymakers can leverage this relationship to design incentives for higher investments in environmental protection, potentially leading to higher tax revenues. The negative correlations between green innovation metrics and investments/taxes suggest that a balance needs to be struck. While taxation and investment in environmental protection are crucial, they should be structured in a way that does not stifle green innovation activities. The analysis highlights the complex interdependencies between different aspects of the green economy and underscores the importance of a balanced, multi-faceted approach in policy-making.

Below, Table 3 presents results for forecasting of key indicators.

TABLE 3. Forecasting Key Green Economy Indicators for 2023-2025

Indicator	**2023**	**2024**	**2025**
Number of enterprises with environmental innovations	2,43	-30,21	-62,86
Level of activity in the field of environmental innovations	0,01	-0,09	-0,2
Share of environmental innovations in the total number of innovations	-0,23	-1,39	-2,54
Product innovations	8,43	-2	-12,43
Business process innovations	21,43	7,86	-5,71
Number of issued licenses in the field of environmental protection	24243	26707	29171
Production in value terms (mln.tenge)	47,217,240	51,456,290	55,695,340
Production of environmentally friendly products (mln.tenge)	57,458	53,953	50,448
Investments in environmental protection (mln.tenge)	217,609,040	238,253,100	258,897,200
Share of environmental taxes (%)	2,41	2,34	2,26
Energy taxes (mln.tenge)	1,899,864,00	2,021,703,000	2,143,543,000
Transport taxes (mln.tenge)	89,118,720	93,753,890	98,389,060
Pollution taxes (mln.tenge)	113,179,500	119,231,000	125,282,600
Resource use taxes (mln.tenge)	610,514,100	669,205,700	727,897,300
Total environmental taxes (mln.tenge)	2,712,676,000	2,903,894,000	3,095,112,000

Note: compiled by authors

The results for forecasting of key green economy indicators were divided into positive and negative trends. Decline in Green Innovations. Number of organizations with green innovations (A1). The forecast shows a sharp decline from 2.43 in 2023 to -62.86 in

2025. This suggests a troubling trend where fewer organizations are engaging in green innovations, and by 2025, it appears the trend could potentially reverse negatively. Level of green innovation activity (A2) and Share of green innovations (A3). Both indicators follow a similar negative trend, declining from 0.01 and -0.23 in 2023 to -0.20 and -2.54 in 2025, respectively. This indicates a decrease in both the activity and the share of green innovations in the overall innovation landscape.

Mixed Trends in Innovation Types. Product innovations (A4) and Business process innovations (A5). Product innovations are expected to decrease significantly, from 8.43 in 2023 to -12.43 in 2025. Business process innovations show a similar decline but remain positive in 2023 and 2024 before turning negative in 2025. This mixed trend suggests variability and potential challenges in maintaining green innovation in both products and business processes. Increase in Licenses and Environmental Protection Investments. Number of issued licenses in the field of environmental protection (A6). The forecast shows an increase in issued licenses, from 242.43 in 2023 to 291.71 in 2025, indicating growing regulatory activities in environmental protection. Investments in environmental protection (A9). Investments are projected to rise from 217,609,040 mln tenge in 2023 to 258,897,200 mln tenge in 2025, reflecting a steady commitment to environmental protection initiatives.

Growth in Environmental Taxes. Share of environmental taxes (A10). The share of environmental taxes shows a slight decline from 2.41% in 2023 to 2.26% in 2025. Energy taxes (A11), Transport taxes (A12), Pollution taxes (A13), Resource use taxes (A14), and Total environmental taxes (A15). All these tax categories show an increasing trend over the forecast period, indicating a growing financial focus on taxing environmental impacts. Total environmental taxes, for example, are projected to increase from 2,712,676,000 mln tenge in 2023 to 3,095,112,000 mln tenge in 2025.

The negative trends in green innovations and activities highlight the urgent need for policies and support mechanisms to encourage more organizations to adopt green innovations. The positive trends in issued licenses and investments in environmental protection suggest that regulatory frameworks and investment efforts are on the rise. These need to be sustained and possibly enhanced to offset the declining innovation trends. The increase in various environmental taxes underscores their strategic use as tools for environmental policy. Policymakers should ensure these taxes effectively support environmental goals without discouraging innovation

5. CONCLUSIONS

The results of the study indicate an alarming decrease in the number of enterprises engaged in environmental innovations and a decrease in the level of activity related to environmental innovations. Despite this downward trend, investments in environmental protection and environmental taxes have shown positive growth, indicating a favorable trend towards a greener economy. However, the forecast indicates an alarming decline in the number of “green” innovations, which requires targeted policy measures to reverse this trend.

In order to cope with the reduction in the number of "green" innovations, it is extremely important to implement policies that encourage such activities. This may include providing subsidies for research and development in the field of "green" technologies, providing tax incentives to companies that implement sustainable methods, and supporting startups focused on environmentally friendly products and processes. Strengthening support and incentives for environmental innovation can help drive growth in this area and ensure the advancement of sustainable technologies.

The growth of investments in environmental protection is a promising development. In order to maintain and expand this positive trend, it is important that Governments and the private sector cooperate in the implementation of large-scale environmental projects. Public-private partnerships can effectively use resources and

expertise to solve critical environmental problems and ensure significant progress in efforts to ensure sustainable development.

The increase in environmental taxes reflects the growing financial interest in combating environmental impacts. However, it is important to design such taxes so that they promote sustainable practices without discouraging eco-friendly innovation. Part of the proceeds from environmental taxes could be reinvested in funds supporting green innovation, or used to provide financial assistance to enterprises transitioning to more sustainable activities.

This study is limited by the fact that the study mainly focuses on quantitative data, and it lacks qualitative information that could provide a deeper understanding of the contextual and human factors influencing the development of the green economy. In future studies, it would be useful to include qualitative analysis, such as interviews with stakeholders or case studies, in order to enrich the results obtained and provide a more complete picture of the challenges and opportunities in promoting a sustainable green economy.

Overall, the study provides valuable information on the current state and future forecasts of the green economy, emphasizing the need for balanced policy and strategic support. Policymakers, businesses and stakeholders should take these findings into account to promote a sustainable green economy, taking into account both the positive and negative trends identified in the study.

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