International Journal of Innovative Research and Scientific Studies, 8(7) 2025, pages: 838-849

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Development of public administration methods in the field of green economy: The case of Kazakhstan

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Abstract

In the context of global environmental challenges and climate change, the transition to a green economy is becoming a strategic priority for Kazakhstan. The national concept, adopted in 2013, is focused on abandoning the carbon model, increasing resource efficiency and developing environmentally sound technologies. To achieve these goals, it is necessary to transform public administration with the introduction of flexible, digital and knowledge-based mechanisms, as well as a system of monitoring, forecasting and public participation that promotes sustainable development. The purpose of the study is to determine the dynamics of final electricity consumption in agriculture and forestry of the Republic of Kazakhstan in the context of the implementation of the state policy of transition to a green economy and to develop state planning tools aimed at improving energy efficiency and reducing the carbon footprint. The design of the study is the analysis of a time series of statistical data for the period 2011-2024 in order to identify trends in electricity consumption in agriculture, and the construction of a predictive model for 2025-2027 based on mathematical and statistical methods. The article examines the dynamics of final electricity consumption in agriculture and forestry of the Republic of Kazakhstan for the period 2011-2024 in the context of the formation of state policy in the field of green economy. A statistical analysis of the time series has been performed, including checking for a trend component, calculating the Irwin criterion, and constructing a linear regression model using the least squares method. The presence of a stable upward trend has been established, which is confirmed by the results of the analysis of the sequences and residuals of the model. The forecast values for 2025-2027 indicate a further increase in consumption, which underlines the relevance of digitalization and the introduction of energy-efficient technologies in agriculture. The developed model makes it possible to estimate future loads on the energy system and can be used in the state planning system when developing measures to reduce the carbon footprint in the agro-industrial complex. The results obtained confirm the need for flexible management solutions at the regional level aimed at supporting sustainable resource management practices and developing a digital infrastructure for monitoring energy consumption in the agricultural sector.

Keywords: Energy efficiency, Green economy, Innovation, Public administration, Sustainable development, Technology.

DOI: 10.53894/ijirss.v8i7.10718
Funding: This study received no specific financial support.
History: Received: 20 August 2025 / **Revised:** 22 September 2025 / **Accepted:** 25 September 2025 / **Published:** 6 October 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

The transition to sustainable development requires a transformation of traditional models of public administration, especially in the context of implementing the principles of a "green" economy. In the context of global climate challenges and depletion of natural resources, states are forced to seek a balance between economic growth, environmental protection and social stability. Kazakhstan, with its significant natural resources and territorial extent, is faced with the need to build a new paradigm of public administration focused on sustainability, energy efficiency and environmental safety. The National Strategy for Green Growth (Concept of Transition to Green Economy) was adopted in Kazakhstan in 2013 and became a key document defining the vector of the country's development until 2050. It provides for the reform of all sectors of the economy taking into account the requirements of environmental efficiency, the introduction of renewable energy sources, the modernization of agriculture, water supply and waste management, requiring the improvement of both the legislative framework and public administration tools, including strategic planning mechanisms, public-private partnerships, environmental and economic monitoring and digitalization of environmental processes. Despite the progress achieved - an increase in the share of renewable energy sources in the energy sector, the development of "green" financial instruments and Kazakhstan's participation in international environmental initiatives - there are a number of institutional and managerial barriers that hinder the realization of the potential of the green economy. These include fragmentary legislation, weak interdepartmental coordination, limited environmental expertise and insufficient digitalization of environmental information. In this regard, the purpose of this study is to analyze existing public administration methods in the field of green economy in the Republic of Kazakhstan, assess their effectiveness and develop proposals for their improvement, taking into account the best international practices and national specifics.

2. Literature Review

The transition to a "green" economy requires a profound transformation of approaches to public administration, especially in a strategically important area - energy. The transformation of the energy system covers not only technological and infrastructural changes, but also requires the creation of effective political, regulatory and institutional mechanisms to ensure the integration of environmental priorities into public policy. Public administration in these conditions should be focused on encouraging investment in renewable energy sources, increasing energy efficiency, developing innovations and forming sustainable behavioral models in the economy.

World practice shows that one of the key areas is the creation of comprehensive instruments of state regulation, including long-term planning, green taxation, subsidies for environmentally friendly projects, environmental certification and the integration of digital solutions into the management of environmental processes. Energy economic assessment, as emphasized by Carley and Konisky [1] can become one of the effective methods for assessing the effectiveness of projects and justifying state support in bioenergy, agriculture and waste recycling [1]. The experience of the European Union countries, in particular Germany, Austria and Sweden, demonstrates how government involvement in the financing and regulation of renewable energy sources contributes to the development of low-carbon energy and technological modernization. Similar trends are observed in countries with different levels of development, which highlights the universality of the problem and the need for government coordination [2].

For Kazakhstan, which is implementing a sustainable growth policy within the framework of the Concept of Transition to a "Green" Economy until 2050, the development of public administration mechanisms capable of effectively responding to the challenges of the climate agenda is especially important. This is not only about supporting the renewable energy sector, but also about creating regulatory conditions for the greening of industry, agriculture and transport, as well as assessing the socio-economic effects of "green" investments [3].

As studies show, to achieve environmental goals, management methods should be based on a synergistic approach [4] combining energy, economic and social indicators [5]. In Kazakhstan, this is especially important given the high resource dependence, regional inequality and the need to maintain social stability. Kazakhstan is already taking steps in this direction: the development of national standards in the field of organic production and eco-certification, as well as work to create a system for tracking environmentally friendly products [6] contribute to the formation of a sustainable agro-industrial sector [6]. One of the challenges for public administration methods remains the dilemma between business support and strict environmental control [7]. As noted by Meckling, et al. [8] criticism of state support for "green" energy is often based on ideological barriers rather than objective economic calculations [8]. However, against the backdrop of

climate threats and obligations under the Paris Agreement, the role of the state in managing investment flows and reducing the carbon footprint is becoming decisive [9]. Financing climate initiatives, as international practice shows (OECD, IRENA, UNEP), should cover not only R&D, but also scaling up technologies, building infrastructure, digitalization and supporting local initiatives, especially in remote and vulnerable regions [10]. Kazakhstan will have to strengthen coordination between levels of government, ensure monitoring of the effectiveness of measures and increase the transparency of support mechanisms.

According to Vogt-Schilb, et al. [11] the development of public administration methods in the field of green economy should be based on:

- Multi-level strategic planning;
- Digital monitoring and evaluation systems (ESG, e-ecology);
- Institutional strengthening of interaction between ministries, akimats and the private sector;
- Mobilization of "green" investments through innovative financial instruments;
- Participation of citizens and NGOs in environmental management [11].

These approaches will allow Kazakhstan not only to fulfill international environmental obligations, but also to form a sustainable model of socially-oriented and resource-saving development.

Another reason for reconsidering the role of the government is the need to invest in technologies that require large capital investments today, but have great potential in the future to reduce emissions [1].

The development of green energy requires significant investments, and at many stages it may be unprofitable. In such conditions, the oil and gas sector remains the most profitable for investors and the government. The need to achieve "green" growth involves not only effective coordination between government bodies, national and international investors, but also broad participation of society. As a result of such coordination, sustainable economic growth is achieved, which is able to withstand adverse economic and environmental changes due to the joint implementation of public policies.

By investing in renewable energy sources and reducing their environmental impact, companies can reduce their carbon footprint and reduce the risks of climate change. Businesses can create a more equitable and sustainable workforce by promoting diversity and inclusion. By implementing good governance practices, companies can ensure that resources are used responsibly and ethically [12, 13]. ESG factors can have a significant impact on sustainability [14, 15]. With the popularization of the sustainable development movement, the trend towards balanced management that helps develop a green economy is growing. Most companies are interested not only in success, but also in strengthening the potential of human and natural resources [16]. Knowledge about the impact of regional economic well-being on global resource use and environmental emissions has increased significantly in recent years. The key point, according to Yang, et al. [17] is the consideration of consumption-based environmental impacts, which is associated with regional consumption, exploitation of natural resources and impact on the environment, both within the region and beyond [17].

The system of performance assessment of government agencies as a whole contributes to the improvement of internal processes in them, organizational development and growth of their efficiency [18]. The public financial management system includes the processes of planning, execution, control and audit of public financial transactions. It ensures the efficient use of public resources, transparency in financial processes and reporting, as well as control over budgetary funds. A well-organized public financial management system, including planning, execution, control and audit processes, promotes the rational use of public resources and the achievement of strategic goals.

Foreign experience of public administration in the field of green economy in digital indicators allows us to clearly assess how different countries form and implement methods of environmental regulation, mechanisms for stimulating sustainable development and climate risk management, as well as what results they achieve in the transition to a low-carbon economy. This experience makes it possible to compare the instruments used, institutional models and volumes of "green" investments, which is especially important for developing effective management decisions in the context of the Kazakhstani model of sustainable growth (Table 1).

Table 1.
Foreign experience of public administration in the field of green economy.

No.	Country	Volume of funds covered by the audit	Saving money	Audit Result
1	USA	In 2023, the Government Accountability Office (GAO) audited federal programs worth more than $4.7 trillion.	According to the GAO, the audits conducted in 2022 resulted in budget savings of about $55.6 billion.	Every dollar invested in a GAO audit results in about $100 in savings.
2	Great Britain	The National Audit Office (NAO) assesses how efficiently and effectively public money is spent. In 2022, the NAO audited over £1 trillion of public money.	In 2021-22, the NAO's auditors helped deliver £1.1bn in savings, delivering significant improvements to financial management.	On average, the NAO delivers savings of £10 for every £1 spent on audit.
3	Germany	Germany's Federal Court of Auditors (Bundesrechnungshof) audited more than €400 billion in government spending in 2022.	Thanks to the recommendations of the Federal Court of Auditors, the German federal government was able to save around €2.7 billion in 2022.	About 90% of all government spending is audited annually.
4	France	The French Court of Auditors (CourdesComptes) evaluates programmes with a total funding volume of more than €300 billion annually.	In 2021, audit recommendations resulted in savings of approximately €1.5 billion.	On average, more than 85% of government expenditure is regularly audited.
5	South Korea	The Board of Audit and Inspection is auditing government spending, which in 2022 was estimated at about $570 billion.	In 2022, the audit recommendations resulted in savings of approximately $1.2 billion.	South Korea's Audit Office has found more than $3.4 billion in wasteful and ineffective spending over the past three years.
6	Australia	The Australian Audit Office (ANAO) audited government programs worth more than AU$550 billion in 2022.	In 2021-22, ANAO recommendations resulted in savings of approximately AU$800 million.	About 95% of all federal government spending is audited annually.

These data reflect the importance and effectiveness of government governance mechanisms in the green economy. Countries that have implemented comprehensive and system-based approaches to environmental regulation achieve significant emission reductions, increased energy efficiency, and rational use of natural resources. This, in turn, helps to strengthen the sustainability of national economies, increase the transparency of environmental decisions, and effectively use budget and investment resources in green sectors.

The studies by Shi and Xu [19] emphasize the important role of strict environmental regulation in stimulating enterprise innovation and enhancing trade competitiveness. This is the key to achieving a triple win-win situation that promotes sustainable development, environmental sustainability, and foreign trade growth.

Due to the different levels of economic development in different countries, developed countries pay more attention to sustainable development and implement stricter and better environmental standards [20]. An increasing number of countries are including environmental factors as an important part of the state regulation process [21, 22]. Improving state policy in the field of innovative development and its focus on the creation and active implementation of innovations in the field of greening and environmental protection are key to the sustainable development of Kazakhstan and its participation in global competition. In the context of the Republic of Kazakhstan, the development of digital solutions in the field of ecology and natural resource management can help the country more effectively solve environmental problems, ensure sustainable nature management and strengthen the transparency of government processes, which, in turn, contributes to the sustainable development of the Republic of Kazakhstan.

3. Methodology

In the framework of this study, complex methods were used that provide both a theoretical substantiation of the problem and practical modeling of public administration processes in the context of the green economy:

3.1. General Scientific Methods

- Analysis and synthesis - were used to systematize scientific approaches to the green economy, study the regulatory framework and strategic documents of the Republic of Kazakhstan;
- Induction and deduction - were used to derive logical connections between political measures and their impact on environmental and social indicators;

- Comparative analysis - was used to compare domestic and foreign experience in the field of state regulation of environmentally sustainable development.

3.2. Methods of Economic and Statistical Analysis

- Time series analysis - was used to study the dynamics of electricity consumption in agriculture and forestry, as one of the sustainability indicators;
- The least squares method (LSM) - was used to build a linear regression model and forecast energy consumption indicators;
- Residual analysis - was carried out to assess the adequacy of the model;
- Irwin criterion - was used to identify anomalous observations and confirm the stability of the trend;
- Construction of confidence intervals - was carried out to determine the predictive reliability of the model at a significance level of 0.05.

3.3. Institutional Analysis

- assessment of the management and regulatory environment in which the state policy in the field of green economy in Kazakhstan is implemented;
- analysis of coordination mechanisms between levels of government, as well as the participation of non-state actors (NGOs, business, citizens) in environmental management.

3.4. Methods Of System and Structural Analysis

- were used to study the public administration system and its components (instruments, entities, levels) involved in the transition to sustainable development;
- a structural analysis of program documents regulating the development of renewable energy sources, waste management, energy efficiency, and the protection of natural resources was carried out.

3.5. Empirical Methods

- Content analysis of strategic and regulatory documents (Green Economy Concept, Environmental Code, state programs); - processing of statistical data from the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, the Ministry of Ecology, the Ministry of Economic Development of the Republic of Kazakhstan and other sources.

The research methodology includes:

1) Analysis of regulatory and strategic documents (in particular, the National Concept of Transition to a Green Economy).
2) Statistical analysis of the time series of electricity consumption.
3) Checking the data for the presence of a trend component.
4) The application of the Irwin criterion to identify the stability of the time series.
5) Construction of a linear regression model using the least squares method.
6) Model-based forecasting.

The following approaches were applied in the research process:

- A systematic and interdisciplinary approach to the analysis of public policy in the context of sustainable development;
- A regionally differentiated approach to assessing institutional readiness for the implementation of green initiatives;
- Integration of statistical, management and environmental data.

4. Materials

Sustainable development is a strategic vector of state policy aimed at harmonizing the interests of economic growth, environmental protection and improving the quality of life of the population. In the context of the green economy and public administration in the Republic of Kazakhstan, sustainable development covers key aspects such as rational use of natural resources, reducing the carbon footprint, developing renewable energy sources, environmental safety and institutional strengthening of environmental regulation mechanisms. These areas require effective management decisions, integration of digital tools, interdepartmental interaction and attracting private investment in environmentally oriented projects (Figure 1).

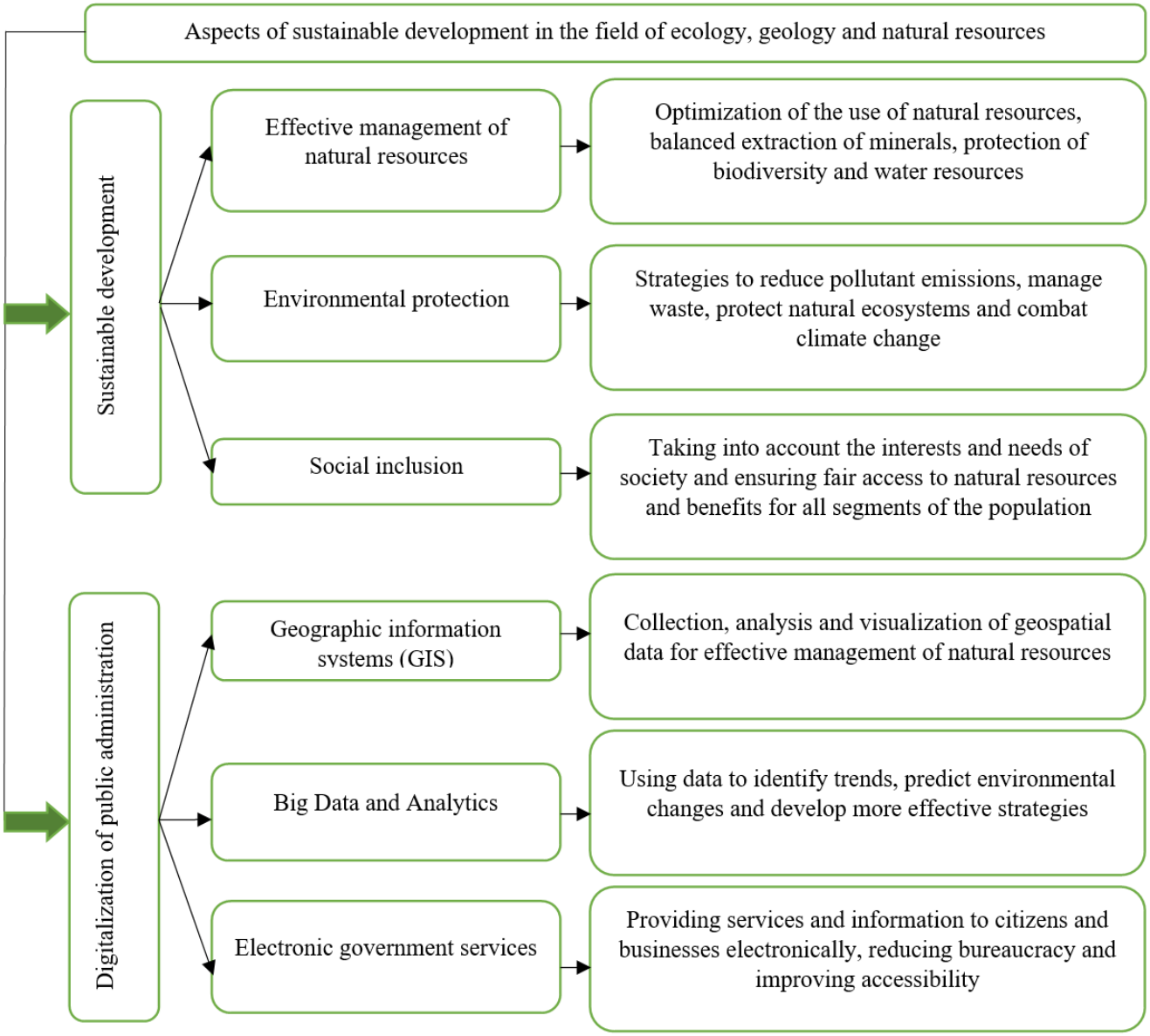

Figure 1.
Aspects of Sustainable Development in the Green Economy.

According to Figure 1, the development of public administration methods in the green economy covers the following key areas:

1 Focus on sustainable development implies a balance between economic growth, environmental well-being and social interests, taking into account the needs of both current and future generations. This underlies the formation of public policy in the field of environmental protection and rational use of natural resources.

2 Digitalization of public administration in the green economy includes the introduction of digital platforms, environmental monitoring systems, automated registers of emissions and natural resources, which allows for more informed and prompt management decisions.

3 Increasing transparency and accountability in environmental policy means the availability of data on the use of natural resources, openness of decisions of government bodies and active public participation in environmental management, which increases trust in the reforms being carried out and promotes public support for green initiatives.

The introduction of modern digital solutions and the development of information technologies in the field of public administration of the green economy can ensure significant progress in the implementation of environmental, economic and management tasks (Table 2).

Table 2.
Possibilities of digitalization in methods of public administration of the green economy of the Republic of Kazakhstan.

No	Digital solutions	Justification	Potential effect
1	Digital accounting of natural resources and emissions	Intelligent platforms enable accurate tracking of resource use, emissions and environmental impacts	Increase planning accuracy, prevent overspending and pollution
2	Transparency of environmental regulation	Open digital registries and dashboards enhance government accountability	Strengthening the trust of citizens and investors, reducing corruption risks
3	Automation of state environmental control	Using drones, satellites and sensors to monitor the environment	Improving the efficiency of control, timely detection of violations
4	Integrating disparate data	Collection of information from different departments and systems into a single database	Comprehensive analysis, interdepartmental coordination and forecasting
5	Digital platforms for public participation	Inclusive mechanisms enable citizens to participate in environmental monitoring and decision-making	Formation of a culture of participation and feedback on environmental issues
6	Support of domestic IT solutions for the ecosphere	Development of software products and services in the field of sustainable development	More sustainable and balanced use of natural and investment resources
7	Promoting Sustainable Development through Digital Transformation	Digitalization enables balancing growth and environmental responsibility	More sustainable and balanced use of natural and investment resources

The creation of a single national digital platform in the field of ecology and green economy with the integration of the functionality of environmental agencies, resource cadastre, emission monitoring, renewable energy projects and public feedback will be a key stage of digitalization. This approach will ensure the effectiveness of public administration, strengthen the investment attractiveness of green projects and accelerate Kazakhstan's transition to a sustainable development model. Projects aimed at preserving and restoring biodiversity in various regions of Kazakhstan contribute to improving the environmental situation, reducing the negative impact on the environment and promoting sustainable development in Kazakhstan (Figure 2) [23].

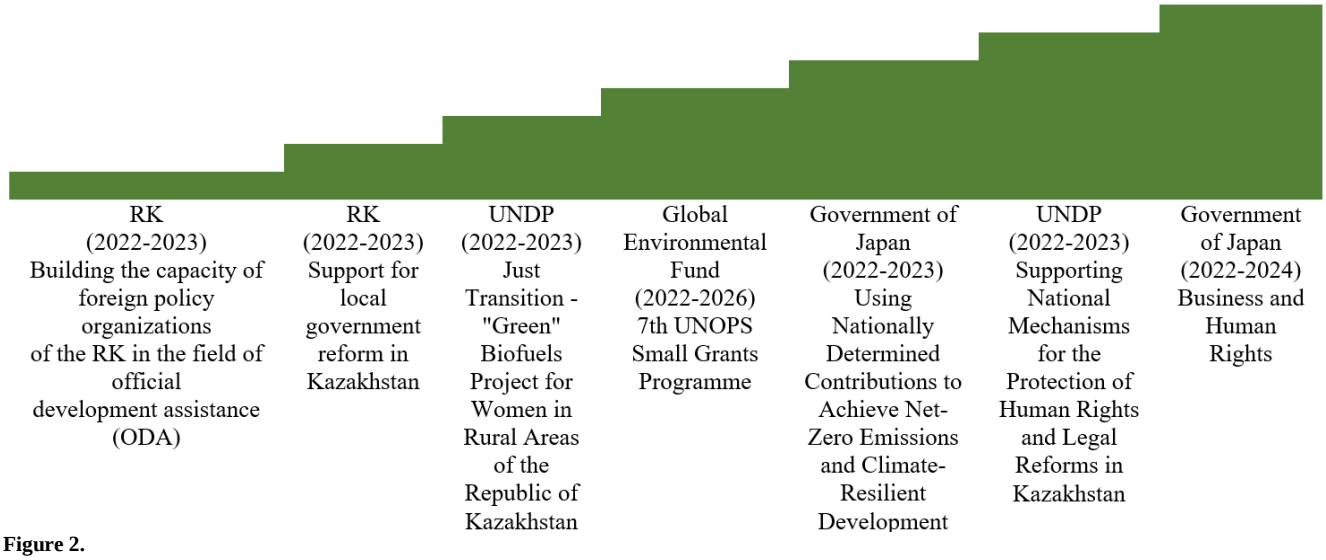

Figure 2.
Development of programs to support ecology and environmental protection.
Source: Compiled by the authors according to https://www.undp.org/

Kazakhstan's transition to a green economy model is a key element in the country's strategy to ensure sustainable economic growth. The state is taking active steps in this direction, covering various sectors of the economy.

The most important tasks at the present stage are the transformation of the energy sector and the development of renewable energy sources (RES). As a result of legislative reforms, Kazakhstan was able to significantly accelerate the development of renewable energy, making RES an important component of its energy balance and sustainable development strategy.

Today, there is a steady increase in the share of electricity generated by RES. Without taking into account large hydroelectric power plants in the total volume of electricity production, the share of RES in 2023 was 5.82%, with the volume of generated energy of 6.6 billion kWh. It should be noted that since 2014, the installed capacity of RES has increased more than 16 times - from 178 MW to 2868 MW by the end of 2023. According to the results of the first half of 2024, 148 renewable energy stations with a total installed capacity of 2903.7 MW are already successfully operating in

Kazakhstan. These stations include 59 wind power plants (WPP), 46 solar power plants (SPP), 40 hydroelectric power plants (HPP) and 3 bioelectric power plants (BioPP) (Figure 1). Together, they provide for the production of 6.47% of the total electricity in the country, which is a significant contribution to the energy balance of Kazakhstan and confirms the country's desire to develop sustainable and environmentally friendly energy sources. According to the Concept for the Transition to a Green Economy [24] the task has been set to reduce the energy intensity of the country's GDP by 25% by 2025 and by 50% by 2050 (from the 2008 level). It should be noted that the 2025 indicator was achieved ahead of schedule: in 2021, a reduction in the energy intensity of GDP by 38.5% from the 2008 level was achieved (Figure 3) [25].

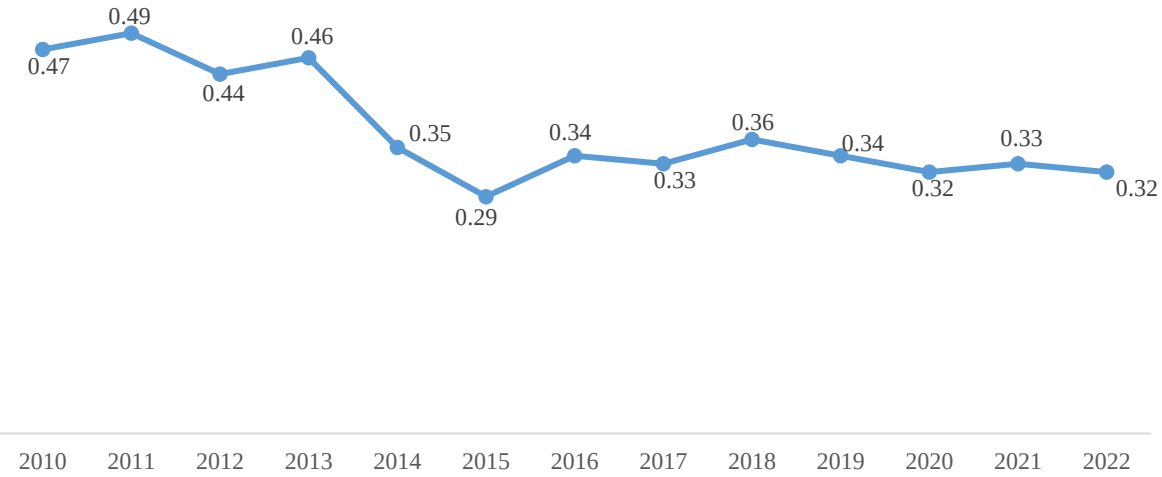

Figure 3.
Energy intensity of Kazakhstan's GDP, tons of oil equivalent/thousand US dollars

In 2023, taking into account the need to adjust plans for further development, as well as with the aim of achieving sustainable development of Kazakhstan through reducing energy intensity and increasing energy efficiency in all key sectors of the economy, the Concept for the Development of Energy Saving and Improving Energy Efficiency in the Republic of Kazakhstan for 2023–2029 was approved. This strategic document covers five key areas: industry, energy, buildings, transport and population. Within each of these sectors, specific indicators have been established aimed at reducing energy intensity and improving energy efficiency.

5. Results

Developing a methodology for classifying regions of Kazakhstan by the level of implementation of green technologies and digital solutions in the field of sustainable development would allow for a more accurate adaptation of state environmental policy to regional conditions. Such a system could serve as a basis for the formation of differentiated management approaches aimed at modernizing infrastructure, stimulating innovation and developing a green economy in areas with different levels of environmental and technological maturity. This, in turn, will help determine which regions require priority implementation of digital and "green" technologies, and which government measures - from investment subsidies to digital monitoring - will be most effective. Additionally, the creation of environmentally friendly waste management models, including the processing of agricultural and industrial residues, combined with digital accounting and control systems, can become an innovative breakthrough in the field of energy efficiency and resource conservation. Analysis of energy consumption in the agro-industrial sector confirms that the introduction of such technologies reduces the load on the energy system and contributes to the achievement of national decarbonization goals. State support for such initiatives – through grants, green certificates and digital integration – is an important area for improving management methods in the face of climate and environmental challenges (Figure 4) [25].

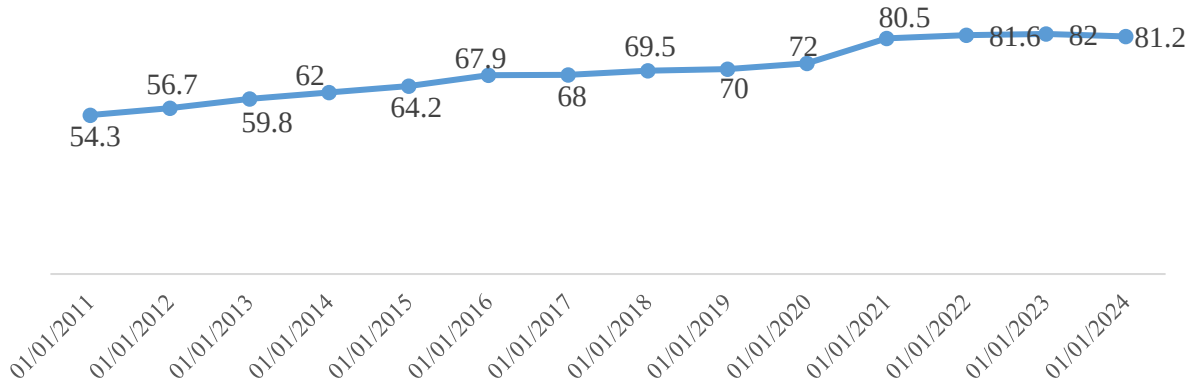

Figure 4.
Final consumption of electricity by agriculture/forestry, thousand tons of oil equivalent.
Source: compiled by the authors according to www.stat.gov.kz

Table 3 presents the calculated values of absolute growth, growth rate (%) and growth rate (%) of electricity consumption in agriculture and forestry of the Republic of Kazakhstan for 2011–2024, which allow:

- To identify the most dynamic periods of growth (for example, 2021 - a jump of +11.8%);
- To record a slowdown or decline (for example, in 2024, consumption decreased by 0.8 thousand toe);
- To use the trend in forecasts and management decisions.

Table 3.
Values of absolute growth, growth rate (%) and growth rate (%) of electricity consumption.

Year	Absolute increase	Rate of increase, %	Growth rate, %
2011	-	-	100.0
2012	2.400	4.419	104.419
2013	3.099	5.467	110.128
2014	2.200	3.678	114.180
2015	2.200	3.548	118.232
2016	3.700	5.763	125.046
2017	0.099	0.147	125.230
2018	1.5	2.205	127.992
2019	0.5	0.719	128.913
2020	2.0	2.857	132.596
2021	8.5	11.805	148.250
2022	1.099	1.366	150.276
2023	0.400	0.490	151.012
2024	-0.799	-0.975	149.539

To determine the forecast values of the indicator “Final electricity consumption by agriculture/forestry” for 2025-2027, a trend model was constructed (Table 4).

Table 4.
Checking for the presence of anomalous observations in a time series.

Year	Observed value of Irwin's criterion	Calculation formulas
2011	-	Observed value of Irwin's criterion $\lambda_t = \frac{\lvert y_t - y_{t-1}\rvert}{\sigma_y},\ t = \overline{2,11}$ Critical value of Irwin's criterion $\lambda_{0,05} = 1{,}5$
2012	0.255	
2013	0.330	
2014	0.234	
2015	0.234	
2016	0.394	
2017	0.010	
2018	0.159	
2019	0.053	
2020	0.213	
2021	0.905	
2022	0.117	
2023	0.042	
2024	0.085	

The Irwin criterion values are within the normal range (no value exceeds 1.73, the critical level for anomaly).

The highest value - in 2021 (0.91) - is associated with a sharp increase in consumption (a jump from 72 to 80.5 thousand tons of oil equivalent).

In general, no abnormal jumps were detected, and the data can be considered suitable for further trend analysis and forecasting

During the analysis, it was found that the time series under consideration contains a pronounced trend component.

1) Checking the presence of a trend using the sequence criterion (Irwin)

The summary representation of the criterion for "ascending" and "descending" sequences is formulated as follows (to identify a trend, it is sufficient to violate at least one inequality):

- if $x1<x4$: 54.3 < 62.0 – is being carried out;
- if $x10>x5$: 72.0 > 64.2 - is being carried out.

Thus, it can be concluded that an upward trend is observed

2) Parameters of the selected growth curve, estimated by the least squares method

A linear regression model of the following type was constructed:

$$\hat{y}t=a+b\cdot \quad (1)$$

$\hat{y}t$ - predicted value of final electricity consumption;

t- year number.

Based on the evaluation results, the following equation is obtained:

$$\hat{y}t = -5427.24+2.62\cdot year$$

The model shows a positive slope, which confirms the growth of electricity consumption in agriculture and forestry during the analyzed period.

3) Results of the residual series analysis for model verification:

- Mean value of residuals: ≈ 0 (balance is met);
- Residuals randomly fluctuate around zero, which indicates the correctness of the model;
- Standard deviation of residuals: ~1.91, used in the confidence interval.

4) Confidence interval at the significance level

α=0.05

A 95% confidence interval was constructed for the forecast values for 2025–2027 (Table 5).

Table 5.
Forecast values for 2025–2027.

Year	Forecast value. thousand tons of oil equivalent	Min.	Max.
2025	85.63	81.88	89.37
2026	87.80	84.06	91.54
2027	89.97	86.23	93.72

The coefficient of variation was also calculated for five-year intervals:

$$CV=Q /\bar{x} * 100\%, \quad (2)$$

This will allow us to assess the stability or instability of energy consumption (Table 6).

Table 6.
Variation coefficient for five-year intervals.

No	Year	Coefficient of variation
1	2011-2015	6.69496256738996
2	2016-2020	2.4199316209676804
3	2021-2024	0.7865494850864005

These results confirm a decrease in the volatility of energy consumption in agriculture and forestry, which may indicate stabilization of technological processes and energy intensity of the sector.

Thus, it is highly likely that electricity consumption will continue to grow, confirming the need to implement energy-efficient technologies and digital management in agriculture. Digital technologies and innovative policies aimed at greening and environmental protection not only help solve environmental problems, but also create new opportunities for economic growth and development, as well as for participation in global processes and competition.

In the Republic of Kazakhstan, there is a need not only for large-scale attraction of investments in renewable energy sources and environmental projects, but also for a revision of management tools that can ensure real greening of the economy. This makes the problem of developing modern methods of public administration in the field of green economy particularly relevant, since the success of the implementation of the state environmental strategy, the achievement of international climate commitments and the improvement of the well-being of the population depend on the quality and adaptability of these methods.

6. Conclusion

Public administration in the field of green economy in the Republic of Kazakhstan is in the phase of active development, which is caused by the need to reduce the carbon footprint, rational use of natural resources and fulfillment of international climate commitments.

The conducted analysis of electricity consumption in agriculture and forestry showed a stable upward trend, which confirms the need to introduce energy-efficient technologies and digital tools for monitoring and resource management.

Calculation of the variation coefficient for five-year intervals confirmed that the volatility of energy consumption is decreasing, which may be associated with the modernization of the production base, but also requires constant management support.

Existing environmental policy instruments (RES programs, support for green investments, the Environmental Code) need to improve their implementation mechanisms, especially at the regional level, where there is unevenness in the level of development of "green" initiatives.

Analysis of digitalization in natural resource management showed that the integration of digital platforms, ensuring openness of data and citizen involvement in the process of environmental control significantly increases management efficiency and public trust.

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