



Green Entrepreneurship and Sustainable Business Development in Central Asian Emerging Economies: Evidence from the Green Entrepreneurship Development Index

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Abstract

In recent years, climate change, the contraction of natural resources, and increasing ecological risks progress in the global economy stable development principles based new business models to the formation motivation This is giving. In this process, green entrepreneurship is a solution to ecological problems to reach directed innovative entrepreneurship activity as economic growth, resource-effective use, and environmental protection, to achieve goals, a crucial mechanism is considered. This research examines the development of green entrepreneurship in Central Asia. To evaluate the impact of complex to evaluate Research within Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan, green entrepreneurship development institutional, economic, and financial basics of green entrepreneurship development was also conducted. In the analysis of state politics, green financing mechanisms, the development level of renewable energy sources, institutional environment quality, and green business activity such as from indicators used. Research methodology, qualitative-comparative analysis, institutional assessment, and countries in the section, analytical rating based on the methods. Research results of Central Asian countries in the middle green entrepreneurship development at the level of noticeable differences showed. Kazakhstan and Uzbekistan green economy policy and investment environment according to relatively high the results demonstration reached if, Kyrgyzstan and Tajikistan again recovering energy potential with separated It is located in Turkmenistan. and institutional and financial restrictions green business development slowing down main factors as Also green financing instruments, in particular green loans, bonds and public-private partnership mechanisms development level green entrepreneurship to the activity directly impact to show was found. Research in the Central Asian countries for green entrepreneurship to encourage, to recover energy development, improve the institutional environment improvement and regional ecological cooperation aimed at practical recommendations was conducted. Taking results green to the economy to pass processes and in the region, long-term stable business development provides scientific and practical importance.

Keywords: green entrepreneurship; sustainable business development; green economy; Central Asia; developing economies; green innovations; re recovering energy; green financing; institutional environment; ecological sustainability; green investments; stable development goals (SDGs)

1. Introduction

One of the most pressing challenges facing the global economy in the first quarter of the 21st century is the issue of reconciling economic growth with the principles of environmental sustainability. Climate change, the decline in biodiversity, the depletion of natural resources, and the increase in environmental pollution are calling into question the long-term sustainability of the traditional model of economic development. The 2030 Agenda for Sustainable Development (SDGs) adopted by the United Nations, emphasizes the need to ensure a balance between economic growth, social well-being, and environmental protection. Therefore, many countries around the world are seeking to reformulate economic policies based on the concept of a “green economy”.

Green entrepreneurship occupies a special place in the transition to a green economy. Green entrepreneurship refers to innovative business activities aimed at solving environmental problems in addition to generating economic profit (Hall et al., 2010; Gast et al., 2017). This activity is based on increasing energy efficiency, using renewable energy sources, reducing waste, introducing the principles of a circular economy, and rational use of resources. As a result, green entrepreneurship not only creates new economic value but also serves to reduce environmental risks and ensure the long-term well-being of society.

In recent years, interest in studying the impact of green entrepreneurship on economic development has increased significantly among international organizations and academic circles. Studies show that enterprises that use eco-innovations and green business models achieve high competitiveness, investment attractiveness, and market stability in the long term. At the same time, green entrepreneurship is considered an important factor in creating new jobs, accelerating technological modernization, and reducing the carbon intensity of the economy (Acs et al., 2012; Hall et al., 2010). Especially for developing economies, green entrepreneurship can serve as an important source of economic diversification and innovative development, while solving environmental problems.

The Central Asian region is of particular scientific and practical importance in the transition to a green economy. The economies of Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan, which are part of the region, have long developed based on natural resources. In particular, hydrocarbon resources play an important role in the economies of Kazakhstan and Turkmenistan, agriculture and mineral resources in Uzbekistan and Tajikistan, and hydropower in Kyrgyzstan. Such an economic structure, on the one hand, has ensured economic growth, but on the other hand, it has increased the risk of environmental problems and inefficient use of resources.

In Central Asia, environmental problems such as water scarcity, increasing desertification, air pollution, and the Aral Sea crisis pose a serious threat to the sustainable development of the countries of the region. In particular, the drying up of the Aral Sea is recognized as one of the largest environmental disasters in the world, negatively affecting the socio-economic conditions of millions of people. In addition, the shrinking of glaciers and reduced water flows as a result of climate change are creating additional pressure on the agricultural and energy sectors. These factors are pushing the countries of the region to transition to an environmentally sustainable economic model.

At the same time, Central Asia also has great potential for the development of green entrepreneurship. The area is one of the most promising regions in the world in terms of solar radiation levels. Kazakhstan and Uzbekistan have extensive wind energy potential, while Kyrgyzstan and Tajikistan have large hydropower potential. In addition, areas such as eco-tourism, organic agriculture, waste recycling, and energy efficiency technologies are creating new segments of green business (Kirchherr et al., 2017; Gast et al., 2017). Effective use of these opportunities will not only increase the competitiveness of the region's economies but also contribute to environmental sustainability.

In recent years, Central Asian countries have adopted a number of strategic documents on the transition to a green economy. Kazakhstan is implementing the “Concept of Transition to a Green



Economy”, while Uzbekistan has identified energy efficiency and the development of renewable energy as a priority within the framework of the “Uzbekistan-2030” strategy. Kyrgyzstan has adopted a green economy concept, while Tajikistan and Turkmenistan are also gradually developing programs aimed at environmental sustainability. Nonetheless, the practical implications and effects of such policies and their contribution to the development of green entrepreneurship in different countries are very diverse.

The review of the current scientific literature suggests that the theoretical background of green entrepreneurship, the experience of developed countries, and green economy policy in general have been adequately researched. Nonetheless, the amount of comparative research regarding the level of development of green entrepreneurship in Central Asian countries, the institutional and financial factors influencing it, and the importance of the phenomenon for sustainable business development remains quite low. For example, there is a shortage of research comparing Central Asian countries using one analytical platform and revealing the major determinants of green entrepreneurship development.

Given this scientific gap, the main objective of this study is to comprehensively assess the impact of green entrepreneurship on sustainable business development in the developing economies of Central Asia. To achieve this goal, the following tasks were set:

- to identify the level of development of green entrepreneurship in Central Asian countries and differences between countries;
- to analyze economic, institutional, and financial factors influencing the development of green entrepreneurship;
- to assess the impact of public policies, green financing mechanisms, and the innovation environment on green business activities;
- to develop practical recommendations for accelerating the transition to a green economy and sustainable business development in the countries of the region.

The article has the following structure. The second section analyzes the theoretical and empirical literature on green entrepreneurship and the green economy. The third section covers the research methodology and data sources used. The fourth section presents the results of a comparative analysis of Central Asian countries. The fifth section discusses the results obtained in terms of international experience and theoretical approaches. The sixth section develops strategic recommendations for countries. The final section presents the main scientific conclusions of the study and future research directions.

2. Literature Review

2.1. Green entrepreneurship theoretical basics

Green entrepreneurship (or sustainable entrepreneurship) is the latest twenty years during which entrepreneurship and sustainable development theories intersected, forming a scientific direction. This concept provides economic benefits to take into account in line with the solution to ecological and social problems aimed at business activity. Traditional entrepreneurship theories mainly benefit from maximizing and marketing the possibilities aimed at, if yes, green entrepreneurship, ecological responsibility, and a reasonable business use model as an inseparable part.

Green entrepreneurship's theoretical foundation is based on many scientific approaches. Of them, one market imperfection, Cohen and Winn (2007) and Dean and McMullen (2007) have proposed ecological problems as a result of market failure result as explained. They're to the mind according to the environment delivered damage, often products and services, but the price reflection does not. As a result, ecological problems create new market opportunities, and entrepreneurs this from opportunities use through economic both beneficial and ecological to the result achievements possible (Cohen & Winn, 2007; Dean & McMullen, 2007).

The second important theoretical approach, stable innovations, Schaltegger and Wagner (2011), green entrepreneurship, economic, ecological, and social value to create, aimed at innovative activity as an interpretation. This approach to the "triple bottom line" principle is based on enterprises' activity, the results not only include financial indicators, but also ecological and social effects through the offer they will reach.

According to Porter and van der Linde (1995), working on the issue of the ecological competitiveness hypothesis, green entrepreneurship made an important contribution to the theory. This supports the hypothesis that, according to strictly ecological requirements, enterprises' innovations are forced to reach far within the period of their competitiveness. This approach is especially developing in economies with a green business policy to develop the impact that important professions will reach.

Institutional theory is also green. entrepreneurship explanatory main from concepts one North (1990) and Bruton and others (2010) entrepreneurship of activity success, institutional environment quality, with closely related concepts that emphasize. Legislation base, financial institutions, property rights, and state management quality green business initiatives formation, and to develop directly impact.

Table 1. Green entrepreneurship's main theoretical approaches

Approach	Main content	Authors	Importance for research
Market imperfection theory	Environmental challenges create new business opportunities	Cohen & Winn (2007); Dean & McMullen (2007)	Explains the economic foundations of green business formation
Sustainable Innovation Theory	Ecological, economic, and social values are created simultaneously	Schaltegger & Wagner (2011)	Allows you to assess green business performance
Ecological competitiveness hypothesis	Environmental requirements stimulate innovation	Porter & van der Linde (1995)	Explains the impact of government policy on business
Institutional theory	The institutional environment determines the development of entrepreneurship	North (1990); Bruton et al. (2010)	Explains the differences between countries

Source: Author by scientific literature based on compiled.

2. Green economy and sustainable business development

In recent years, the concept of a green economy has become one of the central elements of global economic policy. The United Nations Environment Programme (UNEP) views a green economy as one that fosters human well-being and social equity, while lowering the risk of environmental degradation and resource scarcity. The green economy perspective sees economic development in terms of making use of innovations in ecology rather than harming the environment in order to grow economically. Sustainable business development implies that enterprises implement environmental and social responsibility while maintaining long-term economic efficiency. International experience shows that enterprises that adopt energy efficiency, renewable energy, waste recycling, and the principles of the circular economy are more resilient to changes in market conditions.

OECD, World Bank, and EBRD studies show that the transition to a green economy creates jobs, stimulates innovation, and increases economic diversification. Green business activities are becoming an important tool for economic modernization, while solving environmental problems, especially in developing countries.

2.3. Green entrepreneurship experiences in developing economies

The development of green entrepreneurship in developing countries depends largely on government policies, financial support, and international cooperation. Countries such as China, India, Brazil and South Africa have been able to significantly expand their markets for renewable energy and environmental innovations by implementing green economy transition strategies (International Energy Agency, 2024; International Renewable Energy Agency, 2024).



International experience shows that the most important factors for the development of green business are:

- stability of public policy;
- availability of green financing instruments;
- support for research and innovation;
- quality of the institutional environment;
- effective application of environmental standards.

On the contrary, limited financing opportunities, underdeveloped regulatory frameworks, and institutional gaps remain serious obstacles to the expansion of green business activities.

2.4. Specific features of green entrepreneurship development in Central Asia

Central Asian countries are at different stages of transitioning to a green economy. Kazakhstan is the first country in the region to adopt the green economy concept and attract significant investments in renewable energy (Asian Development Bank, 2023; European Bank for Reconstruction and Development, 2024). Uzbekistan, on the other hand, has been implementing large-scale solar and wind energy projects in recent years (International Renewable Energy Agency, 2024; International Monetary Fund, 2024)..

While Kyrgyzstan and Tajikistan have high potential for hydropower resources, investment and infrastructure constraints are slowing down their green economy development. In Turkmenistan, the economy's high dependence on the hydrocarbon sector is somewhat hindering the development of green businesses.

The common feature of the region is that, despite the natural resource potential for the transition to a green economy, institutional and financial mechanisms are not yet sufficiently developed. Therefore, identifying the main determinants of green entrepreneurship development and assessing differences between countries is of scientific and practical importance.

3. Proposed Data and Research Methodology

3.1. Information sources and research coverage

This research evaluates the status of green entrepreneurship development and its impact on sustainable business in five Central Asian developing economies: Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan. Data was collected from international institutions, national statistical agencies, and government strategy documents.

Sources of home information include the World Bank, Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), United Nations Development Programme (UNDP), International Renewable Energy Agency (IRENA), OECD, and national development strategies of Central Asian countries on the concept of green economy.

The period of research, 2020–2024, was chosen. This period is characterized by an increase in the implementation of significant political and institutional reforms with regard to the transition of Central Asian countries to a green economy. Hence, this period allows studying modern trends in the development of green entrepreneurship.

Five countries were selected as research objects:

- Uzbekistan;
- Kazakhstan;
- Kyrgyzstan;
- Tajikistan;

Turkmenistan.

Even though the economic development status, natural resource base, and institutions are different in these countries, they possess certain similar characteristics in history and geography that allow for comparison.

3.2. Methodology for assessing the development of green entrepreneurship

To measure the degree of green entrepreneurship development in this research, an index called the Green Entrepreneurship Development Index (GEDI) was created by the author.

The GEDI includes five key components that determine the development of green entrepreneurship:

1. Public Policy and Strategic Support (PS);
2. Green Finance System (GF);
3. Renewable energy development (RE);
4. Institutional environment quality (IN);
5. Green business activity (GB).

The index is calculated based on the following generalized formula:

$$GEDI = \sum_{i=1} w_i K_i \quad (1)$$

here:

- K_i --normalized value of the component;
- w_i --component weight;
- $\sum w_i = 1$

In the study, all components were assumed to be of equal importance, and each indicator was assigned a weight of 0.20.

And so:

$$GEDI = 0.20PS + 0.20GF + 0.20RE + 0.20IN + 0.20GB \quad (2)$$

The index value ranges from 0 to 1. A value closer to 1 indicates a high level of green entrepreneurship development in the country.

3.3. Structural components of the GEDI index

Component 1. Public Policy (PS)

This component assesses the existence of national strategies, environmental policies, incentives, and government programs for the green economy.

Evaluation criteria:

- the existence of a green economy strategy;
- renewable energy targets;
- environmental regulatory framework;
- government subsidies and incentive programs.

Component 2. Green Finance (GF)

This component represents financing opportunities for green projects.

Evaluation criteria:



- green loans;
- green bond market;
- cooperation with international financial institutions;
- ESG financing mechanisms.

Component 3. Renewable Energy Development (RE)

The component reflects the level of "greenness" of the energy system.

Main indicators:

- share of solar energy;
- share of wind energy;
- share of hydropower;
- QTE contribution to the overall energy balance.

4th component. Institutional Environment (IN)

The institutional environment is one of the important factors determining the effectiveness of green business activities.

Evaluation criteria:

- quality of regulation;
- control corruption;
- protection of investors' rights;
- ease of doing business.

Component 5. Green Business Activity (GB)

This component represents the practical development of green entrepreneurship.

Indications:

- number of green startups;
- environmental innovations;
- number of processing plants;
- private sector participation in green projects.

3.4. Criteria for clustering countries

Based on the results of GEDI, Central Asian countries were divided into three development clusters.

Table 1. According to the GEDI clustering criteria

Cluster	Index range	Description
High development	0.67 – 1.00	Green entrepreneurship and green economy institutions have developed
Medium development	0.34 – 0.66	The green economy is taking shape, but the potential has not been fully realized
Low development	0.00 – 0.33	Countries with high institutional and financial constraints

Source: Author by scientific literature based on compiled.

This clustering will allow us to identify development gaps between Central Asian countries and develop country-specific strategic recommendations

3.5. Analysis methods

Three main methodological approaches were used in the study.

First, using the comparative analysis method, similarities and differences in the development of green entrepreneurship in Central Asian countries were identified.

Second, through an indicator-based assessment, the GEDI index was calculated, and a ranking of countries was formed.

Third, using a strategic analysis enriched with SWOT elements, each country's strengths, weaknesses, opportunities, and threats regarding green entrepreneurship were assessed.

The use of such methodologies enables conducting a comprehensive evaluation of the trends of development of green entrepreneurship in Central Asia and creating strategic recommendations to ensure its sustainable development.

4. Discussion: Expected Relationships and Policy Implications

4.1. Comparative assessment of green entrepreneurship development in Central Asian countries

Green Entrepreneurship Development Index (GEDI) was elaborated during this research in order to measure the level of development of green entrepreneurship in Central Asia. It appears that there are some considerable differences between countries within this region. These differences can be attributed to different policies, financial infrastructure, renewable energy potential, and institutional environment.

As per estimations, Kazakhstan leads in this region because of its early green economy policy, international investments, and numerous renewable energy projects. Uzbekistan takes second position because of the large-scale economic reforms and programs on the modernization of the energy sector.

Table 2. GEDI indicators of Central Asian countries

<i>Countr y</i>	<i>.S.</i>	<i>F</i>	<i>E</i>	<i>N</i>	<i>B</i>	<i>EDI</i>	<i>G</i>
<i>Kazakh stan</i>	.80	.70	.65	.75	.78	.74	0
<i>Uzbeki stan</i>	.78	.55	.60	.62	.65	.64	0
<i>Kyrgyz stan</i>	.58	.45	.55	.48	.52	.52	0
<i>Tajikist an</i>	.52	.42	.70	.45	.46	.51	0
<i>Turkme nistan</i>	.30	.25	.28	.22	.24	.26	0

Source: Author's calculations.

4.2. Key factors influencing the development of green entrepreneurship

The analysis showed that among the factors influencing the development of green entrepreneurship, state policy and financing mechanisms are the most important determinants. The presence of green economy strategies in countries and their implementation in practice significantly accelerates the pace of formation of green businesses.

In Kazakhstan and Uzbekistan, government-provided tax breaks, subsidies, and investor-friendly conditions for renewable energy projects are helping to boost green business activity. Conversely, the limited availability of green financing instruments is a major obstacle to development in Kyrgyzstan, Tajikistan, and Turkmenistan.



There was also a strong correlation between the quality of the institutional environment and the development of green entrepreneurship. Countries with higher regulatory quality were also found to have higher levels of eco-innovation and green startups.

From the findings, Kazakhstan belongs to the group of highly developed countries. Uzbekistan, Kyrgyzstan, and Tajikistan belong to the medium group of development countries, whereas Turkmenistan belongs to the low development group.

4.3. Priority areas of green entrepreneurship in Central Asia

As a result of the analysis, it was possible to determine the most promising areas of development of green businesses in the countries of the region.

The first is renewable energy sources. Central Asia is one of the most promising regions in the world regarding the potential of solar and wind energy. The construction of solar and wind power stations in Uzbekistan and Kazakhstan is opening up new prospects for green businesses.

The second is water-saving technologies in agriculture. With the growing scarcity of water resources in the region, the use of drip irrigation, smart irrigation, and water-saving agro-technologies becomes a promising business segment.

The third is the recycling industry and circular economy initiatives. Population growth and the increasing pace of urbanization lead to the growth of waste management issues. These circumstances create new opportunities for the development of the recycling industry.

The fourth is eco-tourism and the green service sector. The mountainous regions of Kyrgyzstan and Tajikistan, as well as the rich tourism potential of Uzbekistan, can be used for this purpose.

4.4. Swot Analysis of Green Entrepreneurship Development in Central Asia

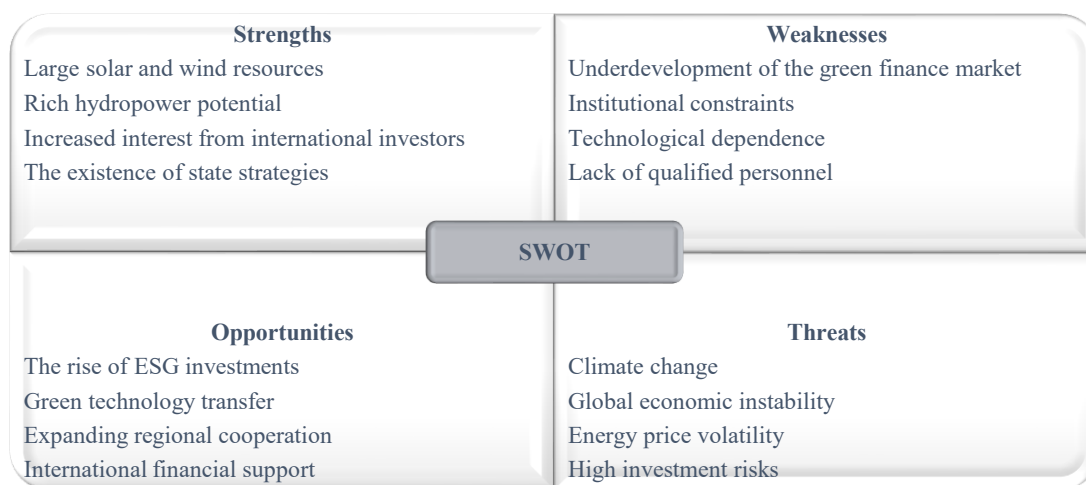


Figure 1. SWOT analysis of the Central Asian green business sector

Source: Author by scientific literature based on compiled.

The results of the SWOT analysis show that Central Asian countries have significant resources and opportunities for the transition to a green economy. However, to fully utilize the existing potential, it is necessary to develop financial infrastructure, deepen institutional reforms, and improve mechanisms to support green innovation.

5. Discussion

Findings of this research indicated that the degree of green entrepreneurship development in Central Asia is rather heterogeneous. The findings were interpreted in accordance with the current theory on the green economy and entrepreneurship in relation to the specifics of the region under consideration.

5.1. Institutional environment and green entrepreneurship development

It was found out that one of the crucial aspects affecting the development of green entrepreneurship is the quality of the institutional environment. This is in line with the theoretical framework of institutional economics elaborated by North (1990). According to this theory, economic development and entrepreneurship are highly dependent upon the efficiency of both formal and informal institutions.

The presence of governmental strategies for the green economy in Kazakhstan and Uzbekistan, a more favorable investment environment, and implementation of environmental reforms contribute to creating a favorable environment for the development of green entrepreneurship. On the contrary, in countries with a high level of institutional constraints, the development of green entrepreneurship is rather slow.

This finding is also consistent with the perspective on institutional determinants of entrepreneurship developed by Bruton et al. (2010). It was found out that the success of green business is not only affected by financial issues, but also by such aspects as efficient governance and legal protection of investors.

5.2. Public Policy and Environmental Competitiveness

Indeed, according to the analysis conducted, one can notice that public policy plays a crucial role in the creation of green entrepreneurship. These findings correlate with the ecological competitiveness theory introduced by Porter & van der Linde (1995). The theory postulates that strict ecological regulations and standards motivate firms to innovate and improve their competitiveness in the long run.

In the Central Asian region, particularly in Uzbekistan and Kazakhstan, there is evidence supporting these theoretical approaches from the practical side. Recent adoption of various regulations and legislative acts concerning renewable energy, energy efficiency, and waste management stimulates private investment.

Nevertheless, the implementation of environmental standards in some countries of the region faces certain restrictions. This fact makes it impossible to use the economic potential of green entrepreneurship. Thus, in developing a green economy strategy, it is necessary not only to approve various regulatory documents, but also to ensure their practical implementation.

5.3. The role of green finance

One of the key findings of the study is the direct link between green finance and green business development (North, 1990; Bruton et al., 2010). It was observed that green entrepreneurship activity is higher in countries with developed markets for green loans, green bonds, and ESG investments.

International experience shows that the transition to a green economy requires the active participation of private capital, along with public funds. Reports from the OECD, EBRD and World Bank also emphasize the crucial role of green financing instruments in economic transformation (European Bank for Reconstruction and Development, 2024).

In Central Asian countries, the green finance market is still at an early stage of development. In particular, the green bond market and mechanisms for financing environmental innovations are not sufficiently developed. Therefore, it is necessary to expand special financial platforms and public-private partnership mechanisms for green investments in the region.



5.4. Regional cooperation and prospects for a green economy

One of the distinguishing characteristics of Central Asia is the interdependence of its economy and ecology. In terms of water resources, the energy sector, and various ecological challenges, the region has a number of transboundary issues.

Aral Sea problem, water shortage, and climate change effects are examples of the problems that are hard to solve for separate countries. Hence, the role of regional cooperation becomes especially important for making the transition towards a green economy.

As follows from the research findings, the joint development of programs in relation to solar and wind energy, hydroelectric projects, green transport routes, and eco-innovation can speed up the green transition of the region.

5.5. Scientific and practical significance of the research

The importance of this work from a scientific point of view is determined by the fact that the Green Entrepreneurship Development Index (GEDI) is designed to measure the development of green entrepreneurship in Central Asian countries. The GEDI enables a uniform evaluation of the institutional, financial, and economic characteristics of the development of green entrepreneurship.

In practice, the results of the research may be useful for government bodies, international financial organizations, investors, and the representatives of the business community to enhance the policy of the green economy and create supporting measures for green businesses.

The results of the research may be used as the scientific and methodological ground for the fulfillment of Central Asian countries' commitments according to the framework of the Sustainable Development Goals (SDGs), the Paris Agreement, and the decarbonization strategy.

6. Strategic Recommendations and Policy Directions

Conclusions drawn from the results of the research indicate that the emergence of green entrepreneurship in Central Asian countries is largely determined by institutional, financial, and technological factors. Consequently, in order to speed up the process of the transition towards a green economy, different approaches should be applied according to the specifics of each country.

6.1. Strategic directions for Kazakhstan

Kazakhstan is one of the countries in Central Asia with the most developed institutional base for a green economy. The country's main advantages are a developed financial market, foreign investment flows, and renewable energy potential.

Therefore, the following priority areas are recommended:

- expanding the market for green bonds and ESG investments;
- Accelerate the strategy of phasing out coal power;
- development of wind and solar energy clusters;
- improving carbon trading mechanisms;
- supporting the export of green technologies.

A priority goal for Kazakhstan is to become a regional center for the green economy.

6.2. Strategic directions for Uzbekistan

Uzbekistan is one of the countries actively implementing reforms to transition to a green economy. In recent years, modernization projects in the energy, agricultural, and industrial sectors are creating new opportunities for green entrepreneurship.

The following strategic priorities are proposed for the country:

- expanding green lending programs for small and medium-sized businesses;
- establishing funds to support green startups;
- popularization of water-saving agricultural technologies;
- development of the waste processing industry;
- strengthening energy efficiency standards;
- establishment of green industrial zones.

The strategic goal for Uzbekistan is to form a center for green industry and green innovation in Central Asia.

6.3. Strategic directions for Kyrgyzstan

Kyrgyzstan's main advantage is its rich hydropower resources and ecotourism potential. However, the investment climate and underdeveloped infrastructure hinder the full use of these opportunities.

Therefore, the following measures are recommended:

- encourage the construction of small and medium-sized hydroelectric power plants;
- development of ecotourism clusters;
- attracting international green investments;
- support for ecological business projects in mountainous areas;
- expanding public-private partnership programs for green energy.

A priority goal for Kyrgyzstan is to develop an economy of ecological services and green tourism.

6.4. Strategic directions for Tajikistan

Despite Tajikistan's enormous hydropower potential, it is unable to fully utilize these opportunities due to investment and technological constraints.

The following strategic directions are recommended for the country:

- attract large-scale international investments in hydropower projects;
- modernization of energy infrastructure;
- development of green agriculture projects in mountainous areas;
- introduction of environmental certification systems;
- creating special financial programs that support green entrepreneurship.

The priority goal for Tajikistan is to ensure a green economic transformation based on hydropower.

6.5. Strategic directions for Turkmenistan

Turkmenistan's economy is highly dependent on the natural gas sector, and the transition to a green economy has been slower than in other countries in the region.

In this regard, the following priority areas are recommended:

- introduction of energy efficiency standards;
- development of solar energy projects;
- implementing institutional reforms that encourage private sector activity;
- improving the investment climate for environmental innovations;
- development of a national strategy for a green economy.

The main goal for Turkmenistan is to gradually reduce dependence on hydrocarbons and increase economic diversification.

6.6. Regional strategic model for Central Asia

In light of the results of the research conducted, the model of Green Entrepreneurship Regional Cooperation (GERCM) is developed in order to promote green entrepreneurship and sustainable business



development in the countries of Central Asia. The model is built according to four consecutive phases that will allow enhancing the cooperation of the regions and promoting a green economy transition.

The first phase is called the Institutional Integration. It is intended to establish the common institution for green development of the region. The activities that should be performed at this stage include the establishment of the regional green economy platform, the creation of the unified environmental standards, and the creation of the regional green business registry.

Financial Integration is focused on the provision of additional opportunities for accessing finance for investments into green projects and business operations in sustainable industries. The main actions in this phase should be the creation of the Central Asia Green Investment Fund, the development of the common green bond program, and the financing of cross-border green investment projects. All of these tools will help to involve both public and private investments, reduce risks for investors, and promote the implementation of sustainable development projects at the national level.

Technological Integration is associated with the emphasis on innovation and knowledge exchange as one of the main factors in the green economy transformation. The creation of the centers for transferring green technologies, the creation of the network of innovative start-ups, and the conducting of joint scientific research programs are the main actions in this phase. Thanks to such cooperation, Central Asian countries can quickly introduce new technologies and become more competitive in the green market environment.

Phase Four, Sustainable Development Monitoring, is meant to guarantee the effectiveness and accountability of regional green development policies. It involves the creation of the regional green economy indicator system, the monitoring of SDG indicators, as well as the evaluation of the development of green entrepreneurship within the region. The adoption of such a monitoring system would help in evidence-based decision-making and the assessment of sustainable economic transformation.

The GERCM that is to be developed could create an effective framework for institutional, financial, technological, and monitoring cooperation between Central Asian states. Thus, the model could become a powerful tool for the development of green entrepreneurship and sustainable business development.

Table 3. Strategic priorities matrix

Countr y	Priority sector	Main instrument	Strategic goal
Kazakhstan	Renewable energy	Green bonds	Regional Green Finance Center
Uzbekistan	Green industry and agrotechnology	Green loans and startups	Green Innovation Center
Kyrgyzstan	Ecotourism and hydropower	Public-private partnership	Ecosystem services economics
Tajikistan	Hydropower	International investments	Green energy transformation
Turkmenistan	Energy efficiency	Institutional reforms	Economic diversification

Source: Author by scientific literature based on compiled.

Therefore, the development of green entrepreneurship in Central Asia should not take place via one unified policy but rather through a differentiated approach that will consider the structure of the economy, the resource potential, and the capabilities of each individual country. At the same time, improved mechanisms of regional cooperation may play a significant role in increasing the efficiency of such a transition.

7. Methodological Innovation and Conceptual Model

7.1. Green Entrepreneurship Sustainable Development Framework (GESDF)

Based on the research results, a conceptual model, the Green Entrepreneurship Sustainable Development Framework (GESDF), was developed. This model systematically explains the mechanism of green entrepreneurship's impact on sustainable business development.

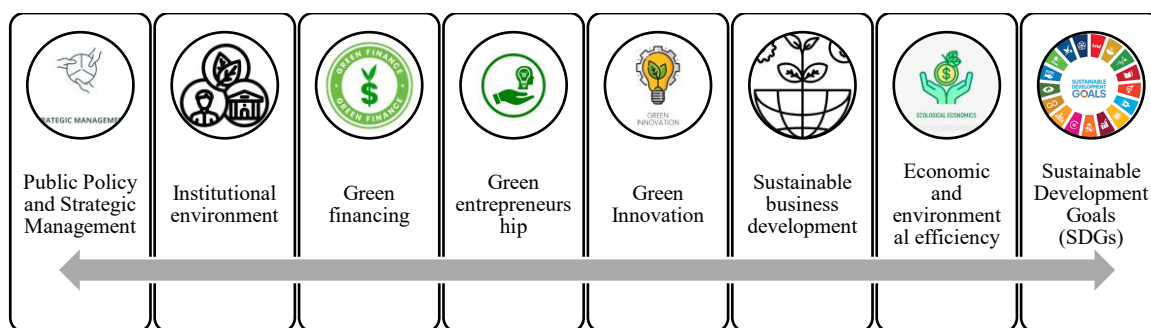


Figure 2. Green Entrepreneurship Sustainable Development Framework (GESDF)

Source: Author by scientific literature based on compiled.

According to the model, green entrepreneurship is seen as a central transformative element of the economic system. Public policies and institutional mechanisms encourage green financing, and financing, in turn, drives green innovation. As a result, sustainable business development and environmental efficiency are ensured.

7.2. Green Entrepreneurship Monitoring System (GEMS)

During the study, a Green Entrepreneurship Monitoring System (GEMS) was proposed to monitor the development of green entrepreneurship.

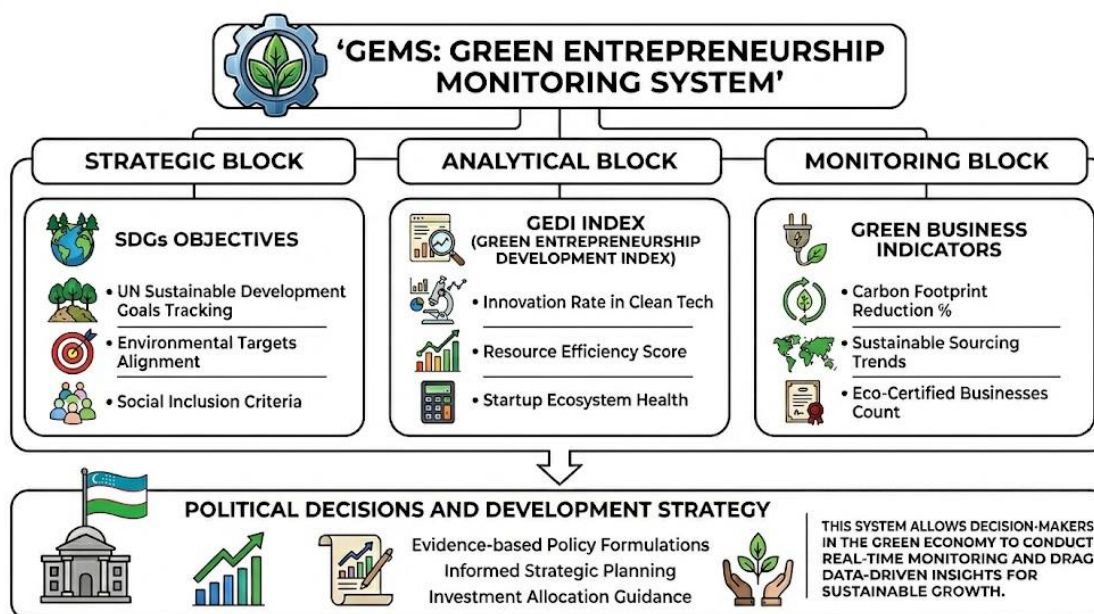


Figure 3. GEMS monitoring system

Source: Author by scientific literature based on compiled.

This system allows decision-makers in the green economy to conduct real-time monitoring.



7.3. Theoretical and practical contribution of the research

The theoretical contribution of the study is explained by the development of a conceptual approach that integrates the institutional, financial, and innovative determinants of green entrepreneurship into a single system. In practical terms, the GEDI, GESDF, and GEMS instruments can be used by government agencies, investors, international financial institutions, and researchers to assess and manage the development of the green economy.

8. Conclusion

In the course of this research, the place of green entrepreneurship within the sustainable development of businesses in Central Asian countries was considered, and the most important trends and problems of the transition to the green economy in this region were revealed. In the course of this research, the theoretical approaches, the experience of other countries, and the specifics of development in the region were studied, and the significance of green entrepreneurship was justified.

In accordance with the findings of this research, the following scientific conclusions can be made.

Firstly, green entrepreneurship is one of the key factors that will ensure sustainable development in the countries of Central Asia. This is becoming an effective approach combining the ideas of economic growth, environmental sustainability, and innovations. Green business, especially those that develop renewable energy sources, resource-efficient agriculture, waste recycling, and environmental services, helps to diversify the economies of the region.

Secondly, considerable disparities in the degree of green entrepreneurship development in the region were revealed. By the results of the Green Entrepreneurship Development Index (GEDI), Kazakhstan proved to be the country with a comparatively highly developed green entrepreneurship ecosystem. Uzbekistan can be classified as a country with a medium-high level of development of green entrepreneurship, and the reforms conducted in recent years create favorable conditions for its development. Kyrgyzstan and Tajikistan, despite their high potential in green energy, can be classified as countries at a medium level of development of green entrepreneurship because of financial and institutional limitations. Finally, Turkmenistan was placed in the low level of development cluster due to the underdevelopment of green economy institutions.

Thirdly, public policies, institutional framework quality, green finance system, and innovation infrastructure were identified as important factors influencing the development of green entrepreneurship. Specifically, it was found that green loans, green bonds, and public-private partnership mechanisms positively affect the level of green entrepreneurship development.

Fourth, the need for a differentiated strategic approach, taking into account the economic structure, resource potential, and institutional capabilities of the countries, rather than a single development model for the Central Asian countries, was substantiated. Within the framework of the study, separate strategic priorities were developed for each country, and their practical significance was demonstrated.

Fifth, as a methodological innovation of the study, the Green Entrepreneurship Development Index (GEDI) and the Green Entrepreneurship Sustainable Development Framework (GESDF) conceptual model were developed. This model allows for a systematic explanation of the interrelationship of green entrepreneurship with public policy, financial infrastructure, innovation, and sustainable development outcomes.

Sixth, the Green Entrepreneurship Regional Cooperation Model (GERCM) was suggested as an alternative option for Central Asian states to develop green entrepreneurship. The suggested model is intended to speed up the formation of the green economy through regional integration, cooperation on investments, technologies, and innovations in the sphere.

Seventh, to be able to efficiently control and assess the activity of green entrepreneurship, the idea of the Green Entrepreneurship Monitoring System (GEMS) has been formulated. Such a system provides possibilities to monitor, assess, and predict the green economy indicators.

To sum up, the results of research demonstrate that the formation of green entrepreneurship in the Central Asian region is not only a way out of environmental problems, but also the tool of modernization, investment attraction, employment creation, and sustainable development in general. Consequently, the further improvement of institutions, finance, and innovation instruments of support of green entrepreneurship in the process of transition to the green economy is to become one of the key aspects of the economic policy of the countries of the region.

It is recommended for future studies to optimize the index GEDI by applying more comprehensive statistical information, to estimate the effect of green entrepreneurship on economic development by means of econometrics, and to conduct empirical studies within each sector mentioned above (renewable energy, green industry, eco-tourism, and circular economy).

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