



JOURNAL OF PRACTICAL PROBLEMS OF ECO- NOMICS AND FINANCE

Volume 1, Issue 1, ISSN:0000-0000



EDITORIAL BOARD OF THE JOURNAL:

A.V. Umarov (chairman), E.B. Saitov (deputy chairman), A.K. Isxakov, K.K. Bustonov, B.O. Muminov, A.M. Babadjanov, Ali Konak

Editor-in-Chief

Rauf Salahodjaev

Deputy Editor-in-Chief

N.I. Rustamov

Secretary-in-Chief

N.A. Rasulov

Technical Editor

U.M. Akhmedov

Practical problems of economics and finance

Economic sectors and business development

Scholars of the Republic

B.B. Berkinov, Q.X. Abdurahmonov, Sh.N. Zayniddinov, D.A. Toshmuxamedova, N.R. Yusupov

Foreign Scholars

Joseph Stiglitz, Dani Rodrik, Justin Yifu Lin, Michael Porter, Mariana Mazzucato

Green economy and sustainable economic development

Scholars of the Republic

U.A. G'aniyev, O.T. Islomov, Sh.R. Xolmurodov, A.R. Kadirov, F.A. Yuldashev

Foreign Scholars

Jeffrey Sachs, Nicholas Stern, Johan Rockström, Robert Costanza, Thomas Sterner

Problems of finance and banking system

Scholars of the Republic

A.V. Vaxabov, I.B. Tursunov, O.S. Rasulov, S. Elmirzayev, Sh. Shodmonov

Foreign Scholars

Eugene Fama, Robert Shiller, Aswath Damodaran, Carmen Reinhart, Frederic Mishkin

Accounting and auditing disciplines

Scholars of the Republic

M.A. Raximov, N.M. To'raev, A.S. Ibodullayev, M.A. Shadmanov, Sh.T. G'aniyev

Foreign Scholars

Katherine Schipper, Mary Barth, Stephen Zeff, Christopher Nobes, David Alexander

Human capital, management and marketing

Scholars of the Republic

Q.X. Abdurahmonov, N.M. Mahmudov, R.I. Nurimbetov, A.A. Karimov, F.M. Muxamedov

Foreign Scholars

Philip Kotler, Gary Becker, Michael Armstrong, Henry Mintzberg, Peter Drucker

Investments, world economy and international economic relations

Scholars of the Republic

A.V. Vaxabov, Sh.Sh. Shodmonov, I.I. Isakov, S. Yuldashev, B.R. Xodjayev

Foreign Scholars

Ali Konak, Paul Krugman, Jagdish Bhagwati, Dani Rodrik, Richard Baldwin, Ha-Joon Chang

Digital economy and economic security

Scholars of the Republic

A.R. Qosimov, B. Mardonov, S. Elmirzayev, O. Xakimov, A. Karimov

Foreign Scholars

Erik Brynjolfsson, Andrew McAfee, Carl Benedikt Frey, Hal Varian, Thomas Davenport

When reprinting materials, it is necessary to indicate that they were taken from "Social Sciences: Theory and Practice" (<https://science-utas.org/index.php/ppef/en>)

This journal accepts articles in the following categories:

- | | |
|--|---|
| a) <i>Economic sectors and business development</i> | e) <i>Human capital, management and marketing</i> |
| b) <i>Green economy and sustainable economic development</i> | f) <i>Investments, world economy and international economic relations</i> |
| c) <i>Problems of finance and banking system</i> | g) <i>Digital economy and economic security</i> |
| d) <i>Accounting and auditing disciplines</i> | |

The authors are responsible for the accuracy of the materials and evidence in advertisements published in the journal. The editorial opinion may not always coincide with the opinion of the authors. Submitted manuscripts will not be returned. Our address: 100149, Tashkent – 95, Gavkhar Street, №1A. Tel.: (71) 200-05-40, e-mail: info@utas.uz

CONTENT

Siroj Zarina Rustambekovna. Methodological Aspects of Statistical Research of Population Demographic Processes.....	4
Chynara Ergeshova, Maral Saipova. Priority Directions for the Development of the Green Economy in the Commonwealth of Independent States(CIS) in the Context of Achieving the Sustainable Development Goals(SDGs).....	11
Abdirashid Babadjanov. Theoretical and Methodological Features of Corporate Finance, Management Problems: Solutions.....	16
Yulduz Bo'riyeva. Problems of Financial and Banking Systems.....	24
Musurmon Kholmuradov. Management of Asset Operations of Commercial Banks and Ways to Improve Their Efficiency.....	28
Murat Abdiev. The Structure of Equity Capital in Accordance with IFRS in a Market Economy.....	43
Maksatbek Sulaimankulov. Investment Attraction Mechanisms of the Eurasian Economic Union Member States for Mini-Hydropower Plant Construction in the Kyrgyz Republic: Prospects and Policy Implications.....	47
Ainura Khamzaeva, Gulayim Zhakshylyk kyzy. Methods and Criteria for Assessing the Effectiveness of Economic Digitalization.....	56
Baydulla Ganiyev. Industry Development and Business Transformation in the Digital Economy...	61
Abdilbaet Mamasydykov, Perizat Alisheva, Maksatbek Sulaimankulov. Improving Food Market Infrastructure Through the Application of Artificial General Intelligence Technologies.....	66

Methodological Aspects of Statistical Research of Population Demographic Processes

Siroj Zarina Rustambekovna

University of Tashkent for Applied Sciences, Tashkent, 100149, Republic of Uzbekistan

E-mail: zarina36.84@gmail.com  orcid: 0009-0007-7266-3515

Abstract: Abstract: This article comprehensively analyzes the theoretical and methodological aspects of the statistical research of demographic processes within the population. The study thoroughly covers the main statistical indicators and advanced analytical methods used to assess crucial factors such as birth rates, mortality, migration flows, and structural changes in the overall population. Based on the official demographic indicators of the Republic of Uzbekistan in recent years, detailed territorial, regional, and dynamic analyses are carefully carried out. Furthermore, the intricate relationship of these demographic processes with the socio-economic development and stability of the country is deeply investigated and shown. The results of the study emphasize that population dynamics directly influence labor market trends, social welfare programs, and economic sustainability. Consequently, these findings are of great practical and academic importance in improving regional demographic statistics and forming a scientifically based, comprehensive national demographic policy. This research provides valuable insights for policymakers and economists to predict future population growth patterns and address emerging challenges effectively.

Keywords: population demography, demographic processes, statistical analysis, birth, death, migration, demographic indicators, territorial analysis.

1. Introduction

In today's conditions of globalization and rapid socio-economic changes, statistical research of demographic processes of the population (birth, death, marriage and divorce, migration, urbanization, shifts in the age and sex composition of the population) has become one of the most important areas of scientific substantiation of state policy. Any change in demographic dynamics directly affects the labor market, the burden on the education and healthcare system, housing and infrastructure planning, social protection, and territorial development strategies. Therefore, it is urgent to study demographic processes not only through descriptive indicators, but also in a causal relationship using modern statistical approaches.

The methodological basis of demographic statistics is, first of all, to ensure the reliability and comparability of data. In practice, data on demographic processes are usually formed from sources such as population censuses, civil status registers, migration accounts, sample observations, administrative registers and territorial statistical reports. Based on these sources, a system of indicators is used to measure demographic phenomena: general and special birth rates, death rates, infant mortality, natural growth, marriage-divorce rates, migration balance, urbanization level, age-sex pyramid, demographic load coefficient, etc. In this regard, methodologically important issues are such approaches as standardization (by age), compilation of a demographic table (life table), cohort analysis, separation of trends and seasonality, demographic forecasting (cohort-component method), assessment of the influence of factors by regression and decomposition methods.

The article covers these methodological aspects of the statistical study of demographic processes: the correct selection and interpretation of indicators, checking the quality of data (completeness, duplicate entries, late registration), the need for standardization when comparing across regions, and the methodological possibilities of compiling short- and medium-term forecasts are analyzed. At the same time, the assessment of demographic changes in relation to socio-economic factors (income, employment, education level, health indicators, housing conditions, urbanization), and the demonstration of the effectiveness of demographic policy based on statistical criteria also increase the practical significance of the article.

It is worth noting that as of January 1, 2025, the permanent population of the Republic of Uzbekistan was 37.5 million (37,543.2 thousand) people[1].

This figure indicates that demographic growth is continuing and reinforces the need for methodologically in-depth statistical analysis of population structure and renewal processes (birth–death–migration rates, territorial density differences, shifts in age structure).

2. Literature analysis

The issues of statistical research of population demographic processes are widely covered in foreign and domestic scientific literature, and this area mainly covers research aimed at improving the formation of demographic indicators, methods of their analysis, and forecasting methodology.

The concept of demographic growth and life tables, developed by A.J. Coale and P. Demeny, forms the methodological basis of demographic statistics. Their research proposed methods for standardizing mortality and fertility processes, taking into account the age-sex composition, and this approach is still used today as a classical basis for demographic analysis[2].

DS Preston, P. Heuveline and M. Guillot in their work “Demography: Measuring and Modeling Population Processes” pay special attention to the issues of statistical modeling of demographic processes. The authors made a comparative analysis of cohort and period approaches to determining birth and death rates and proposed methods of estimation in conditions of inaccurate statistical data[3].

W. Lutz, SKC KC and J. Goldstein, in their studies on demographic forecasting, further developed the cohort-component method and scientifically substantiated the need to include the factor of the level of education of the population in forecast models. This approach allows analyzing demographic processes inextricably linked to socio-economic development[4].

Bongaarts developed a model of proximate determinants for the statistical study of fertility. This model increases the accuracy of demographic analysis by statistically isolating factors that directly affect the fertility process (marriage, contraception, birth spacing)[5].

The methodological guides and World Population Prospects reports prepared by the United Nations Population Division are an important source for comparative statistical analysis of global demographic processes. These studies propose common standards, indicators and forecasting scenarios for international comparison of data[6].

In the domestic scientific literature, the statistical study of demographic processes is mainly covered in connection with the characteristics of the socio-economic development of Uzbekistan. In particular, K. Abdurakhmonov, in his research, analyzed the processes of population renewal in close connection with the labor market and employment indicators, and revealed the economic significance of the demographic load coefficient based on statistical methods[7].

Also, in his scientific work on demographic statistics, R. Alimuhamedov studied regional differences in birth and death processes and substantiated the importance of relative indicators, indices, and dynamic series analysis in their assessment. The author emphasizes the need to combine official statistical data with sample observations in assessing demographic processes in the conditions of Uzbekistan[8].

In addition, ASSodikov's scientific work is devoted to the issues of long-term forecasting of changes in the size and composition of the population, in which the possibilities of using the cohort-component method in national statistical practice are shown. This approach is of significant scientific and practical importance in planning demographic policy at the regional level[9].

In general, research by foreign and domestic scientists shows that the correct choice of indicator system, the coherence of methodological approaches, and the accuracy of forecasting methods are of crucial importance in statistical research of population demographic processes. These scientific views constitute the theoretical and methodological basis of the research conducted in this article.

3. Methodology, discussion and results

In this study, the statistical study of population demographic processes is carried out on the basis of official statistical data. The information base of the study is the indicators published in the Statistical Committee of the Republic of Uzbekistan, the UN Department of Population (UN DESA), and open demographic databases. The main analysis period covers the demographic dynamics of recent years.

The research process uses general scientific and special statistical methods. In particular, when assessing demographic processes, absolute and relative indicators of birth, death, natural growth,

marriage and divorce, and migration are considered. In order to ensure comparison across regions and time, dynamic series analysis, structural analysis, and age standardization methods are used.

Also, the cohort approach and the demographic loading coefficient are used to determine changes in the population structure. Trend analysis and simplified forecast elements are used to assess the trends of demographic processes. The results are summarized in graphical and tabular form, and the relationship of demographic processes with socio-economic development is statistically explained.

In recent years, demographic processes have been characterized by complex and multidirectional trends both globally and in the Republic of Uzbekistan. The results of the study show that demographic changes are now manifested not only in terms of population growth or decline, but also in terms of shifts in population composition, territorial distribution, migration flows, and age structure.

World experience shows that in most developed countries, the main demographic problem is the decline in the birth rate and the aging of the population. In the European Union countries, Japan and South Korea, the total birth rate is below the replacement level, which leads to a reduction in labor resources and an increase in the burden on the social security system. Therefore, demographic policies in these countries are aimed at supporting families, encouraging female employment, and replenishing labor resources through migration.

In developing countries, on the contrary, rapid population growth and accelerated urbanization processes are observed. High fertility rates in Asian and African countries are creating additional pressure on education, health care and employment systems. At the same time, the increase in international migration is having a significant impact on the global demographic balance. As a result, it is becoming increasingly important to fully take into account migration flows and use comparable indicators in statistical analysis of demographic processes.

Another important trend at the global level is the widespread introduction of demographic forecasting and numerical statistical methods. Forecasting models developed by the UN and other international organizations are based on the cohort-component method and take into account age, gender, and education levels in a comprehensive manner. This makes it possible to link demographic processes with long-term strategic planning.

The results of the study show that the Republic of Uzbekistan has been experiencing stable demographic growth in recent years. The increase in the population is mainly due to a high birth rate and positive natural growth. At the same time, the high share of young people in the population is an important demographic advantage for the country. This situation, while having a positive impact on the labor market, education system and economic growth potential, also reinforces the need to ensure employment and increase investments in human capital.

Territorial analyses show that demographic processes are not uniform across the republic's regions. While some regions have high birth rates, others are experiencing population changes due to migration. This confirms the need to use territorial and structural analysis methods when assessing demographic indicators, not limited to average values.

Social and institutional reforms implemented in the republic in recent years have a direct impact on demographic processes. In particular, the modernization of the healthcare system and the expansion of maternity and childhood protection programs are contributing to a decrease in mortality rates. Reforms in the education system are creating the basis for the qualitative development of the younger generation, which in the long term will lead to an improvement in demographic indicators.

Analysis of migration processes shows that external labor migration still remains an important factor. However, in recent years, internal migration and urbanization processes have intensified, leading to an increase in population density in large cities and industrial centers. This situation requires the widespread use of demographic statistical analysis in planning housing, transport and social infrastructure.

Statistical research of demographic processes of the population is a complex and multifaceted scientific process, which requires methodologically sound approaches. First of all, the information base of such studies should be based on reliable and comparable statistical data. Data on demographic processes are usually formed on the basis of population census results, civil status records (births, deaths, marriages and divorces), migration accounts, selective socio-demographic observations, and

administrative registers. The completeness and coherence of these sources determine the reliability of the results of demographic analysis.

The formation of a system of indicators is of particular methodological importance in the statistical study of demographic processes. In the research process, along with absolute indicators such as population size, birth and death rates, relative and special indicators such as general and age-specific birth and death rates, natural growth, marriage and divorce intensity, and migration balance are used. These indicators allow for a deep and systematic analysis of the processes of population renewal.

When comparing demographic indicators across regions and time periods, it is necessary to take into account differences in age and gender composition. Therefore, direct and indirect standardization methods are used in statistical research to ensure comparability of indicators. In this case, reliance on a standard population structure allows for an objective assessment of demographic processes.

The time factor is an important feature of demographic processes, and dynamic series and trend analysis are widely used in their study. These approaches identify long-term trends in demographic indicators, the degree of stability, and the rate of change. At the same time, structural analysis serves to identify changes in the age, gender, and urban-rural population composition of the population, and territorial analysis allows us to reveal the causes of demographic imbalances.

The cohort approach is one of the important methodological foundations in demographic research. This method allows us to identify generational differences in birth, death, and migration processes by observing specific birth cohorts over time. The results of cohort analysis are important in justifying demographic policy in the long term.

Also, in assessing demographic processes from a probabilistic point of view, indicators such as life tables, survival probabilities, and average life expectancy are considered. These methods serve to statistically analyze changes in population health and life expectancy. In the statistical study of migration processes, indicators such as inflow and outflow flows, migration intensity, and migration balance are used to assess their impact on demographic composition.

Forecasting methodology plays a special role in the in-depth analysis of demographic processes. Forecasts based on the cohort-component method allow taking into account various scenarios (inertia, optimistic and pessimistic) and serve to predict changes in the population size and structure in the future on a scientific basis. In addition, correlation, regression and decomposition methods are used to determine the relationship of demographic processes with socio-economic factors.

At the final stage, it is important to interpret and visualize the results of statistical analysis in a scientifically sound manner. The results obtained are presented in a clear and understandable form using tables, graphs, demographic pyramids and cartographic images. At the same time, the use of research results in accordance with international statistical methodologies, in particular the standards of the UN, the World Bank and Eurostat, allows for a comparative analysis of demographic processes on a global scale.

In general, the methodological aspects of statistical research of demographic processes of the population are based on the integral combination of data quality, indicator system, analysis and forecasting methods. These methodological approaches are of significant scientific and practical importance in deeply understanding demographic processes, assessing their impact on socio-economic development, and formulating effective demographic policy.

The table below presents the number of births in the Republic of Uzbekistan as of January 2024 and 2025 by region. The table allows you to identify regional differences in demographic processes, conduct a comparative analysis of birth dynamics, and assess the statistical characteristics of the population renewal process. The indicators are expressed in absolute numbers, and the growth rates are expressed in percentages, which serve to reveal the differences in the demographic situation by region.

Table 1

Number of births¹

Regions	2024	2025	Compared to January 2024, %	Difference (+/-), person
Republic of Uzbekistan	71,930	75,603	105.1	+3 673
Republic of Karakalpakstan	3 479	3 485	100.2	+6
Provinces:				
Andijan	6 557	6 670	101.7	+113
Bukhara	3 431	3,606	105.1	+175
Jizzakh	3 157	3 172	100.5	+15
Kashkadarya	7,607	8,497	111.7	+890
Navoi	1,986	2 107	106.1	+121
Namangan	6 202	6 610	106.6	+408
Samarkand	8 468	9,023	106.6	+555
Surkhandarya	6 298	7 009	111.3	+711
Syrdarya	1,739	1,798	103.4	+59
Tashkent region	5,948	5,773	97.1	-175
Fergana	7,752	8 465	109.2	+713
Khorezm	3,589	3,816	106.3	+227
Tashkent city	5,717	5 572	97.5	-145

Statistical analysis of the table data shows that as of January 2025, the number of births in the republic amounted to 75,603 people, an increase of 5.1% compared to January 2024. This confirms that the process of population renewal in Uzbekistan continues steadily. In demographic statistics, such an increase is an important component of natural movement and is explained by positive trends in the age structure of the population and family behavior.

The analysis by region shows an uneven distribution of birth rates. In particular, a significant increase in birth rates was observed in the Kashkadarya (111.7%), Surkhandarya (111.3%) and Fergana (109.2%) regions. The high proportion of young people in these regions, traditional family values and a significant share of the rural population lead to a relatively high birth rate. From a statistical point of view, this situation indicates the need to separately assess birth rates by region.

At the same time, the decrease in the number of births in Tashkent region and Tashkent city (–175 and –145 people, respectively) is associated with urbanization, late marriage, increased female employment, and changes in reproductive behavior, which reflect demographic trends typical for developed regions. These differences scientifically justify the need to use territorial and structural analysis methods in the statistical study of demographic processes, not limited to average republican indicators. Table1

In general, the tabular data show the importance of analyzing fertility rates based on dynamic, regional, and comparative approaches in statistical research of population demographic processes. This serves as an important statistical basis for scientifically substantiating demographic policy, planning social infrastructure by region, and compiling long-term demographic forecasts.

One of the important aspects of statistical research of demographic processes is the determination of their correlation with socio-economic development. Changes in the number and structure of the population directly affect the formation of labor resources, the expansion of the consumer market, the

¹Monthly publication of the Statistical Agency under the President of the Republic of Uzbekistan. Socio-economic situation of the Republic of Uzbekistan January 2025. p. 9.

load on the education and health systems, as well as the development of territorial infrastructure. Therefore, modern demographic statistical research requires a comprehensive approach aimed at identifying their causes and consequences, not limited to calculating birth or death rates.

In recent years, the issue of territorial differences in the study of demographic processes has gained particular scientific importance. In the case of Uzbekistan, the intensity of birth and migration differs significantly across regions. This situation indicates the need to use territorial indicators in addition to average republican indicators when assessing demographic processes. In-depth analysis of such differences using groupings, indices, and variation indicators in statistical studies increases the accuracy of scientific conclusions.

In the statistical study of demographic processes, urbanization and migration factors are becoming increasingly important. The increase in internal migration flows is leading to an increase in population density in large cities and industrial centers, and a decrease in demographic pressure in some regions. These processes are causing uneven formation of birth rates across regions. Statistically, such situations are assessed through indicators such as the migration balance, the urban-rural population ratio, and the level of urbanization.

Also, in demographic studies, taking into account such factors as population quality indicators, life expectancy, maternal and child health, and education level is becoming an important methodological task. Modern statistical approaches allow us to assess demographic processes not only quantitatively, but also qualitatively. This enriches the concept of "demographic growth" with the concept of "demographic development".

The importance of forecasting methods in the in-depth study of demographic processes is also increasing. Forecasts based on the cohort-component method allow us to predict future changes in the population size and age structure. The results of statistical forecasts serve as an important scientific basis for the development of state social policy, employment programs, planning the network of educational institutions, and regional development strategies.

Modern approaches to statistical research of population demographic processes are based on a combination of multi-source information bases, territorial and structural analysis, forecasting and assessment of the impact of factors. These methodological approaches are important for a deep understanding of demographic processes, assessing their impact on socio-economic development, and formulating scientifically based demographic policies.

The results obtained and their discussion show that statistical research of demographic processes of the population is an important tool not only for describing the current situation, but also for scientifically substantiating future development directions. The experience of the world and Uzbekistan confirms that demographic processes are becoming increasingly complex, and in their assessment, along with classical indicators, modern statistical and forecasting methods need to be used.

In this context, the results of demographic statistical analysis serve as an important scientific and practical basis for formulating the state's socio-economic policy, developing regional development programs, and making decisions aimed at improving the well-being of the population.

4. Conclusion and suggestions

This study analyzed the theoretical and methodological aspects of statistical research of demographic processes of the population based on a comprehensive approach. The results of the study showed that demographic processes, births, deaths, migration and changes in the population structure have a direct and long-term impact on the socio-economic development of the country. Therefore, their accurate measurement, analysis and interpretation in statistical terms is an important condition for the formation of scientifically based demographic policy.

The study revealed that in recent years, Uzbekistan has been characterized by stable population growth, a high proportion of young people, and regional differences in fertility rates. Regional analyses have shown that fertility rates are not uniform, and that fertility rates are relatively low in regions with a high level of urbanization. This situation confirms the need to widely apply territorial and structural analysis methods in assessing demographic processes, not limited to average indicators.

It was also found that the quality of the information base and methodological coherence are of great importance in statistical research of demographic processes. Integration of official statistical data with sample observations and administrative registers serves to increase the accuracy and reliability of demographic indicators. The use of modern statistical and forecasting methods allows for a scientific assessment of the future development trends of demographic processes.

Based on the conclusions obtained, it is considered appropriate to put forward the following practical and scientific proposals:

1. In order to improve demographic statistics, it is necessary to develop a single integrated information system between population censuses, civil registry data, and administrative registers.
2. To better understand demographic processes across regions, it is necessary to expand the use of standardized indicators by age and gender.
3. It is recommended to actively implement statistical modeling and forecasting methods in assessing the demographic impact of urbanization and migration processes.
4. When formulating demographic policy, it is advisable to plan regional social infrastructure, education, and employment programs based on the results of statistical analysis.

In conclusion, a deep and systematic study of the methodological aspects of statistical research of population demographic processes is of significant scientific and practical importance in ensuring the long-term socio-economic development of the country, increasing the well-being of the population, and implementing effective demographic policy.

List of references used

1. Statistika qo'mitasi. (2025). *O'zbekiston Respublikasining doimiy aholisi soni*. <https://stat.uz/uz/matbuot-markazi/qo-mita-yangilkarlar/60425-o-zbekiston-respublikasining-doimiy-aholisi-soni>
2. Coale, A. J., & Demeny, P. (1983). *Regional model life tables and stable populations* (2nd ed.). New York, NY: Academic Press.
3. Preston, S. H., Heuveline, P., & Guillot, M. (2001). *Demography: Measuring and modeling population processes*. Oxford, UK: Blackwell Publishers.
4. Lutz, W., KC, S., & Goldstein, J. R. (2014). Demographic dimensions of sustainable development. *Population and Development Review*, 40(4), 551–576. <https://doi.org/10.1111/j.1728-4457.2014.00015.x>
5. Bongaarts, J. (1978). A framework for analyzing the proximate determinants of fertility. *Population and Development Review*, 4(1), 105–132. <https://doi.org/10.2307/1972149>
6. United Nations, Department of Economic and Social Affairs, Population Division. (2024). *World population prospects 2024: Methodology and assumptions*. New York, NY: United Nations. <https://population.un.org/wpp/>
7. Abdurakhmonov, Q. X. (2019). *Labor economics and employment* (2nd ed.). Tashkent: Economics.
8. Alimuhamedov, R. A. (2017). *Demography and demographic statistics*. Tashkent: Science and Technology.
9. Sodiqov, A. S. (2021). Issues of forecasting population and demographic processes in Uzbekistan. *Economics and Statistics*, 3, 45–52.
10. Monthly publication of the Statistical Agency under the President of the Republic of Uzbekistan. (2025). *Socio-economic situation of the Republic of Uzbekistan: January 2025* (p. 9).
11. Akhunova, M. A., & Lunin, B. V. (1970). *Istoria istoricheskix nauk v Uzbekistane*.
12. Shelestov D.K. Istoricheskaya demography.-M., 1987.-S. 223-230; Timm.Ye. S.Dvijeniye naseleniya goroda Tashkent za 5 let. 1923-1927. -T., 1928; the same authorl. Opit izucheniya yestestvennogo dvijeniya naseleniya v kishlakax. -T., 1929, etc.
13. Aminova R.X. October I resheniye jenskogo voprosa V Uzbekistane. -T., 1975; Oktyabr I resheniye jenskogo voprosa v USSR (1917-1937 gg.). -M., 1978; Sosialniye aspekti jenskogo truda v promishlennosti Uzbekistana // Sovremenniye problemi razvitiya rabochego klassa Uzbekistana. -T., 1989. -S.67-77.8.
14. Kubinova N.R. Sosialnaya Structura obtshyestva na territorii Uzbekistana: tradisii i transformasii. Autoreferat dissertasii dokt. ist. nauk. -T., 2009. -S. 4 -5.9.
15. Aminova R.X., Akhunova M.A., Lunin B.V. Istoricheskaya nauka v Uzbekistane. -Tashkent," Science", 1987. -S. 156

Priority Directions for the Development of the Green Economy in the Commonwealth of Independent States(CIS) in the Context of Achieving the Sustainable Development Goals(SDGs)

Chynara Ergeshova¹, Maral Saipova²

¹Candidate of Economic Sciences, Associate Professor

²PhD Student OshTU

¹E-mail: ergeshova_2019@mail.ru, ¹ orcid: 0000-0001-5946-5951

²E-mail: maral.saipova@mail.ru, ² orcid: 0009-0008-0953-5366

Abstract. The article examines the key strategic guidelines, statistical indicators, and practical results of the transition of the CIS member states to a green growth model. The author conducts a systemic comparative analysis of national environmental programs and low-carbon strategies of the Commonwealth countries adopted for the periods up to 2026–2030, in direct connection with the global agenda of the UN Sustainable Development Goals (SDGs). The paper identifies and methodically systematizes the main technological, regulatory, and sectoral priorities for various sub-structural groups of the CIS countries (major hydrocarbon exporters and climate-vulnerable states). Particular attention is paid to the instruments of ESG financing, carbon regulation, and harmonization of national taxonomies. Based on the analysis, a set of specific recommendations and practical proposals is proposed to deepen interstate cooperation within the CIS to minimize the technological gap and form unified standards for sustainable development. Additionally, the study highlights the socio-economic challenges of this ecological transformation and offers strategic solutions for establishing long-term regional environmental stability and shared prosperity across member states.

Keywords: green economy, CIS countries, Sustainable Development Goals (SDGs), renewable energy sources (RES), circular economy, ESG transformation, low-carbon development, carbon neutrality, environmental taxonomy.

Introduction

The integration of green economy principles into the national long-term strategies of the Commonwealth of Independent States (CIS) is currently the only option for ensuring macroeconomic stability, national security, and global competitiveness. The CIS geoeconomic space is currently facing dual climate, trade, and economic challenges. On the one hand, global cross-border carbon regulation mechanisms require accelerated decarbonization of export-oriented industries in the major economies of the Commonwealth. On the other hand, the regions of Central Asia and the Caucasus are under increasing pressure from direct climate risks: climate aridity, soil degradation, critical glacier melting, and growing water shortages directly threaten the food and energy security of local states [5; 8].

According to the UN Sustainable Development Goals Report, CIS economies are undergoing a profound institutional and technological transition in key environmental areas, requiring a large-scale relocation of domestic and foreign capital into sustainable infrastructure. The Commonwealth states have developed a new-generation regulatory framework. This includes comprehensive national documents—the Development Strategy of the New Uzbekistan and the Green Economy Development Program in the Kyrgyz Republic until 2029—as well as specialized long-term low-carbon development strategies for the Russian Federation and the Republic of Kazakhstan. The purpose of this article is to provide a comprehensive scientific and theoretical analysis, classification, and critical assessment of priority vectors of "green" development in the CIS in the context of the implementation of the 2030 SDG agenda, as well as to develop recommendations for deepening their integration.

Research Methodology

The theoretical and methodological basis of the work is formed by the conceptual provisions of the theory of sustainable development, green growth and ecological modernization. The information and empirical base of the study was formed by the program and forecast documents of the CIS Executive Committee, national voluntary reviews (NVRs) of countries on the achievement of the SDGs, analytical and statistical materials of the Interstate Statistical Committee of the CIS, the World

Bank, as well as fundamental scientific works of leading economists of the Commonwealth studying the processes of greening of macroeconomic systems [5; 6; 7]. The research utilized methods of comparative, structural-functional and trend analysis, as well as the method of logical-structural modeling.

Research results and discussion

Systematization of national strategies and actual macroeconomic indicators allows us to identify five key priorities for green growth in the CIS region, each of which is organically integrated into the architecture for achieving the global SDGs by 2030:

1. Diversification of fuel and energy complexes and accelerated development of renewable energy sources (SDG 7: Affordable and clean energy, SDG 13: Climate action)

Reformatting national energy balances is a cross-cutting priority for all Commonwealth states, but approaches to its implementation vary depending on the structure of the national economy. As S. M. Nasirdinova notes, overcoming dependence on fossil fuels is not only an environmental but also a critical economic driver of regional development [10].

A group of countries—the largest hydrocarbon exporters (the Russian Federation, Kazakhstan, and Azerbaijan)—are focusing on gradually reducing the share of coal-fired generation and capturing greenhouse gases. Kazakhstan has officially declared a goal of achieving carbon neutrality by 2060. Russia is focusing on developing nuclear energy as a low-carbon option, large-scale hydropower generation, and the creation of pilot clusters of hydrogen technologies and carbon capture and storage (CCS) systems.

A group of climate-vulnerable countries (Uzbekistan, Kyrgyzstan, Tajikistan): Demonstrating high rates of alternative generation implementation. Uzbekistan is implementing a large-scale program to increase the share of renewable energy sources in its overall energy mix to 40% by 2030. Kyrgyzstan and Tajikistan are accelerating the construction of small and medium-sized hydroelectric power plants (SDG 7.2) to overcome domestic winter power shortages [3; 8].

The actual state and target guidelines for the strategic development of the fuel and energy complex in the CIS countries are systematized by the author in Table 1.

Table 1

Indicators of green energy and decarbonization development in key CIS countries

State	Current share of renewable energy sources in the energy balance, %	Target for the share of renewable energy sources by 2030, %	Strategic target year for achieving carbon neutrality	Main technological priority within the fuel and energy complex
Russian Federation 10.0 2060	~3.5 (excluding large hydroelectric power plants)	10,0	2060	Nuclear energy, hydrogen technologies, CCS systems
Republic of Kazakhstan	~5,2	15,0	2060	Reduction in the share of coal, large-scale construction of wind and solar power plants
Republic of Uzbekistan	~10,0	40,0	2050 (target)	Solar energy, modernization of grid infrastructure
Kyrgyz Republic	~90,0 (based on large hydroelectric power plants)	Development of small renewable energy sources	At the development stage	Construction of small and micro hydroelectric power plants, development of solar power plants [3; 10]
Republic of Belarus ~8.1 12.0	~8,1	12,0	At the development stage	Development of bioenergy, integration of nuclear power plant capacities

Source: compiled by the author based on national development strategies of the CIS countries until 2030 and data from the Interstate Statistics Service of the CIS.

2. Transition to circular models and waste management (SDG 12: Responsible consumption and production)

The problem of municipal solid waste (MSW) and industrial waste accumulation is critical for industrialized and urbanized areas of the CIS. Current national plans (for example, the National Circular Economy Strategy of the Republic of Belarus) are shifting from landfill disposal to a closed-loop model through the legislative implementation of the extended producer responsibility (EPR) principle, as well as the construction of high-tech automated waste sorting facilities and eco-technoparks (Russia, Kazakhstan, Belarus).

3. Sustainable, adaptive and organic agriculture (SDG 2: No Hunger, SDG 15: Terrestrial Ecosystem Conservation)

In the agricultural sector of the CIS countries, the key focus has shifted to adapting production to progressive droughts and soil degradation. As A. B. Karbekova emphasizes, the degradation of pastures and arable lands in Central Asia requires urgent institutional regulation and financial support for resource-saving technologies [11]. In the Central Asian subregion, the priority is the implementation of digital precision water distribution systems and drip irrigation (SDG 6.5) as a response to the hydrological crisis of the transboundary Syr Darya and Amu Darya rivers. In the European part of the CIS (Belarus, Moldova), the sector of strictly certified organic agriculture (Organic Agriculture) is actively scaling up for export markets.

4. Decarbonization of the transport framework and the concept of “Smart Cities” (SDG 11: Sustainable Cities and Communities)

Urbanized centers of the Commonwealth countries are the main sources of fine particle and greenhouse gas emissions [9]. Comprehensive greening of transport systems includes the conversion of public transport to electric buses, stimulation of the domestic electric vehicle market through tariff and customs regulation within the EAEU/CIS, and the development of an interstate infrastructure of high-speed electric charging stations (ECS) along key international transport corridors (ITCs).

5. Green Finance Institutions and ESG Transformation (SDG 17: Partnerships for Sustainable Development)

The development of national markets for green, social, and adaptation bonds is the primary investment driver for change. A key achievement of the current stage has been the development and launch of processes to harmonize national green taxonomies. Kazakhstan (through the Astana International Financial Center (AIFC)) and Russia have created a developed infrastructure for deploying ESG instruments, attracting sovereign and private financing for climate projects. Statistical parameters for green and sustainable bond issuance are presented in Table 2.

Table 2

Volume and structure of issuance of green and sustainable financing instruments in the CIS countries

Country / Venue	Green/Sustainable Bond Market Size (Estimate)	Key financing sectors	Taxonomy standards used	Key institutional participants
Russian Federation	~450 billion rubles.	Transport infrastructure, energy, housing and utilities.	National Taxonomy of the Russian Federation (VEB.RF), ICMA	VEB.RF, Sberbank, Moscow Government.
Republic of Kazakhstan (AIFC),	~\$1.2 billion	Construction of renewable energy sources, energy efficiency, eco-transport	Taxonomy of the AIFC, CBI (Climate Bonds Initiative)	EDB, Damu, Samruk-Kazyna
Republic of Uzbekistan	~\$850 million	Water conservation, energy efficiency, solar power plants	International standards (ICMA), sovereign ESG bonds	Ministry of Economy and Finance of the Republic of Uzbekistan
Republic of Belarus	~15 billion Belarusian rubles.	Modernization of industrial enterprises, forestry.	Belarus EAEU standards (at the harmonization stage).	Belarusbank, Ministry of Finance of the Republic of Belarus.

Source: compiled by the author based on analytical reports from the Eurasian Development Bank and Expert RA.

Constraints and barriers to integration. Despite the pronounced positive dynamics, a number of systemic limitations hindering "green" transit in the CIS can be identified. I. P. Glazyrina and I. A. Zabelina point to institutional asymmetry and uneven distribution of environmental costs between the countries of the region [5]. The main barriers include technological asymmetry of states, a shortage of long-term "cheap" borrowed capital, and the absence of a single cross-border carbon market, which hinders the mutual recognition of carbon units obtained in various jurisdictions of the Commonwealth [6; 7]. Ch. M. Ergeshova rightly states that sustainable regional development and overcoming institutional barriers are impossible without a thorough modernization of local infrastructure [8].

Recommendations and practical proposals for the development of a green economy in the CIS countries

Based on a comprehensive structural and comparative analysis of the national development strategies of the Commonwealth countries, the author has developed and proposes for implementation a set of practical recommendations and proposals aimed at deepening interstate cooperation and accelerating the achievement of the SDGs by 2030:

Establishment of a Unified Climate Platform and a Common Carbon Market for the CIS. An interstate agreement on the mutual recognition of national systems for the validation and verification of carbon units is needed. A practical proposal: establish a Carbon Regulation Coordination Center under the auspices of the CIS Interstate Environmental Council. This will reduce business costs in cross-border trade and protect exporters from discriminatory tariff barriers imposed by third countries.

Synchronization and mutual recognition of green taxonomies. It is recommended to accelerate the process of harmonizing criteria for classifying projects as "green" or "adaptive." A practical proposal: develop a Unified Model Taxonomy of Sustainable Finance at the CIS Interstate Council for Standardization, Metrology, and Certification, building on the methodological developments of the EAEU and VEB.RF. This will ensure the seamless flow of environmental investments between the exchanges of Moscow, Astana (AIFC), and Tashkent.

Formation of a Commonwealth Green Technology Bank. To overcome sanctions restrictions and reduce dependence on Western equipment, it would be beneficial to pool the scientific potential of countries. A practical proposal: launch an Interstate Technology Consortium (involving institutes from the National Academies of Sciences of Belarus, Russia, Kazakhstan, and Kyrgyzstan) for the joint development and commercialization of technologies in industrial waste disposal, wastewater treatment, and digital precision irrigation control.

Launching regional programs for targeted ESG funding for climate-vulnerable areas. Large supranational development financial institutions (the Eurasian Development Bank (EDB) and the CIS Interstate Bank) are encouraged to diversify their investment portfolios. A practical proposal: introduce a specialized line of subsidized credit lines (with a reduced interest rate of 3-4% per annum in national currencies) for small and medium-sized enterprise projects implementing resource-saving technologies in climate-vulnerable regions (including the Batken and Naryn regions of Kyrgyzstan and the arid Aral Sea region in Uzbekistan and Tajikistan).

Conclusion

The implementation of the green agenda in the CIS countries in the context of achieving the SDGs demonstrates a qualitative shift from declarative, targeted initiatives to systemic structural reforms of national economies. The success of long-term environmental transition in the Commonwealth directly depends on the depth and speed of institutional integration. Priority steps for the medium term should include the creation of a single CIS carbon market, mutual recognition of organic certification systems, unification of national green taxonomies, and the joint development of clean technologies through scientific and industrial partnerships, which will enable the countries of the region to build a sustainable framework for economic sovereignty.

List of references

1. Strategy for Economic Development of the Commonwealth of Independent States through 2030 // CIS Executive Committee. Minsk, 2020.
2. The Sustainable Development Goals Report 2025 // United Nations. New York, 2025. 84 p.
3. Green Economy Development Program in the Kyrgyz Republic for 2025–2029: Resolution of the Cabinet of Ministers of the Kyrgyz Republic of September 1, 2025, No. 544.
4. National Action Plan for the Development of a Green Economy in the Republic of Belarus for 2021–2025. Minsk, 2021.
5. Glazyrina, I. P., Zabelina, I. A. Green Economy and Modernization in the CIS Countries: Institutional Aspects // *Economy of the Region*. 2022. Vol. 18, No. 3, pp. 712–725.
6. Prokudin A. V. Prospects for Decarbonization and Energy Transition in the CIS Countries until 2030 // *World Economy and International Relations*. - 2024. - No. 4. - P. 55-64.
7. Salieva R. N. Problems of Legal Regulation of the Development of Renewable Energy Sources in the CIS // *Journal of Foreign Legislation and Comparative Law*. - 2025. - No. 2. - P. 102-110.
8. Ergeshova Ch. M. Institutional Factors and Priorities of Sustainable Socio-Economic Development of the Regions of the Kyrgyz Republic // *Bulletin of the Kyrgyz University of Economics named after M. Ryskulbekov*. - 2023. - No. 2 (59). - P. 44-50.
9. Mazirbaev K.K., Zhusupov B.Zh. Transition to a green economy: challenges and opportunities for Kyrgyzstan // *Bulletin of Osh State University. Economics*. - 2024. - No. 1. - P. 88-95.
10. Nasirdinova S.M. Prerequisites for the development of "green energy" in the Kyrgyz Republic // *Bulletin of KSTU named after I. Razzakov*. - 2022. - No. 4. - P. 45-52.
11. Karbekova A.B., Saipidinov I.M., Karbekova M.Zh. Prospects and assessment of the potential for the development of a green economy in key sectors of the Kyrgyz Republic // *Eurasian Journal of Scientific and Multidisciplinary Research*. - 2025. - No. 3(I). - P. 149-161.
12. M. Shahbaz, M. Zakaria, S.J.H. Shahzad, M.K. Mahalik The energy consumption and economic growth nexus in top ten energy-consuming countries: fresh evidence from using the quantile-on-quantile approach *Energy Econ.*, 71 (C) (2018), pp. 282-301
13. T.M. Tawfik, M.A. Badr, O.E. Abdellatif, H.M. Zakaria, M. EL-Bayoumi The environmental and economic benefits of a hybrid renewable energy system considering demand side management *Int. J. Renew. Energy Res.*, 12 (2) (2022), pp. 1063-1075
14. E. Giannakis, D. Tsiotas, C.T. Papadas Unveiling the relationship between regional economic resilience and input-output network topology: evidence from the European Union *Reg. Sci. Policy Pract.* (2024), Article 100018
15. O. Cengiz, M. Manga Does economic globalization trigger de-industrialization in Western Balkan countries? Empirical evidence based on augmented mean group estimator *Reg. Sci. Policy Pract.*, 16 (4) (2024), p. 12709

Theoretical and Methodological Features of Corporate Finance, Management Problems: Solutions

Abdirashid Babadjanov

University of Tashkent for Applied Sciences, Tashkent, 100149, Republic of Uzbekistan

E-mail: pirbobo@mail.ru;  orcid: 0000-0003-0164-0475

Abstract: This article examines the basic concepts of corporate finance, management problems, theoretical and methodological features, methods, macro-micro issues and solutions. It thoroughly includes methodological features and practical principles, methods and means of modern corporate financing. It is necessary to determine the complex methodology of corporate finance research, initial theoretical concepts, and key hypotheses. Theoretical aspects of corporation finance are comprehensively considered, in particular, modern problems of its financial activities. There are different financial methods, each of which has its own advantages and disadvantages. Modern enterprises are strongly advised to study these basic methods and choose the best for their companies' growth. The scientific solution of corporate finance reflects the main indicators of the functioning of the corporation in the short term in two most important categories: income and net profit. Ultimately, the operational efficiency of a corporation can benefit existing corporate assets and create a significant value added at the same time.

Keywords: corporate finance, financial resources, innovation, financial decisions, methodology, method, solution.

1. Introduction

The efficient operation of the financial system amid the nation's economic reforms is closely correlated with the efficacy of its actions at every level. The efficient structuring of financial interactions within corporate finance, regarded as the principal component of the financial system, is crucial for commercial entities.

The growth of corporate finance as the pivotal component of the financial system is evident, and it is important to recognize that the efficient management of corporate financial operations need ongoing focus in the socio-economic advancement of society.

A critical prerequisite for the effective management of firm finances is the assessment of its financial state. It is defined by the accessibility of financial resources essential for the proper operation of business entities, their appropriate allocation and efficient utilization, as well as financial interactions with other legal entities and persons [1].

Corporate finance theory is primarily a fundamental study that examines the issues and solutions related to the allocation of monetary resources over time, in the face of obligations and uncertainty. If we are studying the theoretical aspects of corporate finance, then first of all it is worth paying attention to: efficient market theory analyzes the equilibrium behavior of price fluctuations over time in speculative markets; portfolio theory considers acceptable procedures for choosing securities for an investor's entire portfolio of securities; the theory of capital asset pricing analyzes the factors that determine the cost of assets in conditions of uncertainty; agency theory analyzes the control of incentive conflicts in contractual relationships.

Most of the theory of corporate finance is based on the search for ways and means to increase the value of an enterprise through external and internal sources.

From an economic perspective, corporate finance constitutes "a collection of economic relations that emerge during the formation, distribution, and utilization of funds, which are generated through the production and sale of goods, services, and works" [2].

In conjunction with the theory of corporate finance, the primary responsibilities of corporate finance management should be emphasized. These encompass: the generation of adequate financial resources; the optimization of financial resource utilization; cash flow enhancement; profit

maximization within an acceptable financial risk framework; the maintenance of the enterprise's financial equilibrium; consistent growth in the enterprise's economic potential; and cost minimization.

The formation of tasks in general depends on the specifics of the activity in which the enterprise is engaged, its size, market situation, political, economic factors, etc

The main task of corporate finance is the rational distribution of financial and credit resources so that business entities can develop, profit and reduce risks.

Consequently, corporate finance determines the prospects for the development of enterprises, depending on the demand for products being produced.

2. Theory and practical application of materials acquisition

Corporate finance is one of the most common areas in the modern economy. Corporate finance is regarded as the discipline that examines the economic relationships, concepts, and methodologies involved in the development, distribution, and utilization of a company's financial resources.

There are two different settings in which we shall examine the notion of corporate finance: first, as a scientific subject; second, as a practical activity inside the corporate financial management system. Corporate finance is a large and varied term in its content.

Theoretical foundations and practical application aspects of corporate finance.

Theoretical foundations:

- *Functions of Corporate Finance Management.* These encompass augmenting earnings, sales, and market share, optimizing capital structure, enhancing investment efficiency, and safeguarding the company's financial stability to avert bankruptcy.

- *Principles of corporate finance organization.* Of these: financial independence, self-financing, commercial settlement, material interest, economic responsibility of enterprises for the results of their activities and the division of working capital into own and borrowed funds.

- *Corporate finance goal.* The main goal of any open Joint-Stock Company is to improve the well-being of owners. The basis of increasing the well-being of investors is an increase in the value of a joint-stock company, which is manifested in the growth of quotes of its shares.

Corporate finance, as a scientific discipline, encompasses a framework of theoretical knowledge, theories, models, and practical methodologies, techniques, and tools derived from them, utilized in the formulation and execution of management decisions regarding the allocation, distribution, and utilization of financial resources.

Practical applications:

- *Optimization of capital structure.* The company "Queen Laboratories" plans to expand production and is faced with a choice: to attract additional funds by issuing shares or obtaining a loan. The finance director conducts an analysis using corporate finance tools: calculates the average weighted value of capital for various financing scenarios, assesses the impact of each option on the financial impact and risks of the company.

- *Investment decisions.* Prime shipping agency-International transport and expedition company is considering investing in a new solar panel production line.

- *Management of working capital.* It is important to ensure effective use of short-term assets and liabilities to maintain liquidity and solvency.

- *Financial analysis and reporting.* Includes assessment of the financial condition of the company, preparation and interpretation of financial statements.

From a practical point of view, corporate finance can be viewed as a system of actions aimed at optimizing the financial model of an economic entity. Although the financial model can be constructed in various ways, the best way to implement it is through the financial statements of the enterprise, specifically the balance sheet.

In the long term, the dominance of a new paradigm is inevitable - a financial model of measurement and management of corporate finances, since it incorporates many advantages of the account model and complements them with new priorities and technologies [3].

It is a scientific discipline that examines the financial management of an organization or analyzes the array of economic relationships and methodologies involved in the development and use of finance.

Financial management, as a scientific field, offers a framework of theoretical knowledge, theories, and methodologies that are employed in the preparation and execution of management choices on the formation, distribution, and utilization of finances.

3. Corporate finance is one of the driving directions for the development of the economy of our country. In recent years, it is necessary to take into account the fact that many enterprises aimed at the production of products in high demand in the domestic and foreign markets, increasing entrepreneurial activity, are becoming more acute in the issue of technical and technological, and at the same time economy.

The literature review in the study is a systematic presentation of theory and practical methods. It considers the practical experience of practitioners that can be applied in this topic. The concept of corporate finance is revealed from different perspectives in scientific publications of foreign and domestic scholars.

According to Borisov, Corporations emerged due to the need for large-scale production, which required large capital and gave rise to new ways of attracting financial resources [4].

The list of goals and objectives that a company carries out in the implementation of its financial and economic activities can be extensive. It is important to determine which of these goals is priority and which is secondary. Financial goals are determined by the main areas of activity of corporate finance [5].

Advantage of the corporate business form. The solution of management problems becomes easier; the completeness of organizational design, the regulation of responsibilities and powers allows the correct distribution of control functions between corporate management bodies, which makes it possible to professionalize management processes [6].

An analysis of the practice shows that there is a growing number of developments used in the world for the development of corporate finance. The practice has become widespread, according to which financial and credit institutions work within the framework of digital platforms that allow them to interact with borrowers and investors, providing them with smart services [7].

The result of a general analysis of the financial condition and its changes over the reporting period is a preliminary assessment of the financial condition. This assessment includes a description of the financial indicators of the enterprise in a specific period, forecasting their dynamics, and possible changes in the future [8].

The purpose of this educational-theoretical Manual of Atabievani, the study of the features and problems of the financial activities of organizations; to acquire knowledge on the determination of financial quantities are the main ways of financial and economic activities of organizations, their formation indicators and sources; management decisions aimed at optimizing the financial relations [9].

A risk situation management system is proposed, which contains management decisions on the formation of a database of a risk situation management system, diagnosis and processing of a risk situation, control and development of recommendations for improving the effectiveness of risk situation management [10].

The theoretical foundations of corporate finance include a system of principles and methods of developing and implementing management decisions related to the optimal formation of capital from various sources and ensuring its effective use in the economic activities of the enterprise.

From a practical point of view, corporate finance can be considered as a system of actions to optimize the financial model of an economic entity.

3. Corporate finance managing problem

Corporate finance usually covers the following issues in the field of financial managing of a company:

Investment decision making: capital value and evaluation of investment projects;

Corporate transactions: mergers and acquisitions, separation of business from corporation;

The capital structure of the enterprise: the roles of its own and borrowed capital, the features of issuing new shares and attracting debts, the influence of the secondary market on the activities of the company;

Dividend policy: Difficulty finding the Optimal dividend policy. It is necessary to maintain a balance between the current profit consumption and its future growth. Instability of the size of Dividend payments. This is due to the instability of the amount of profit generated.

Use of securities: basic and derivative securities as a means of financing a company;

Working capital management: credit policy in trade, the concept of net working capital, the financing of working capital, the impact of working capital on the value and financial stability of the company;

Risk management: elements of financial analysis and basic principles of risk assessment.

Impact of corporate finance management problems on enterprise activities:

First of all, the lack of a strategic direction of financial managing. Employees do not have the knowledge and skills to use modern strategic management tools.

Secondly, the trajectory of assertive fiscal policy. An adverse external environment may result in elevated financial risks for the firm.

Thirdly, a deficient level of overall business culture, encompassing financial aspects. It does not enhance the discipline of payments and financial accountability in the relationship between counterparties.

Fourthly, the absence of efficient methods and financial risk management systems for crisis prevention.

Fifth, to determine the ratio of the distribution of net profit between dividends and investments. There are certain contradictions between these directions of profit use.

Decisions in the field of financial management of a modern corporation are justified by conclusions and recommendations corresponding to modern achievements of science and practice of corporate governance and corporate finance [11].

Failure to properly control financial flows can even lead to inefficient operation of the enterprise, a decrease in income and an increase in losses. Financial managing helps not only to avoid such problems, but also to achieve stable growth and an increase in income.

4. Methodological features of corporate finance

In Economics, Corporate Finance refers to a system of economic connections that emerge during the creation, distribution, and utilization of cash generated by the financial and economic operations of corporate entities, sometimes referred to as Corporation Finance.

Corporate finance is Dual in nature. On the one hand, they are represented by the financial resources at the disposal of corporate structures, on the other hand by the financial relations that the corporation enters into.

The principle in theory is the basic, initial position of any doctrine, a particular science, as well as the researcher's belief in something, the norm or rule of his thinking and social activity. The methodological principle is the normative coordinate of the methodological paradigm or a value indicator that allows you not to get lost in spaces and see strategic goals [12].

The methodological features of corporate finance in business entities are as follows: multifunctionality of the control mechanism, it performs functions such as prediction, Planning, Organization, accounting, control, analysis and regulation; multi-level management system, it consists of three levels: macroeconomic, microeconomic environment and internal environment of the corporation; focusing on balancing financial resources, the system is aimed at balancing the financial resources of the corporation in time and areas of activity; the use of different control methods these include balance, matrix, normative and control methods; application of financial policy, it is a system of views of owners, investors and leadership to achieve the tactical and strategic goals of financial and economic activity; the use of the principles of the organization of finance, these include economic independence, self-financing, material interest, material responsibility, provision of financial reserves; to carry out distribution and management functions, the distribution function is to distribute the

financial resources of the enterprise in order to fulfill monetary obligations, and the control function is to control the results of the operational and investment activities of the enterprise.

The essence of corporate finance and the principles of their organization are considered. A description of the corporate financial management system is given, its goals, objectives and functions are described. The definition of the financial policy of the company is given [13].

Methodological foundations are the fundamental principles, methods, and approaches that are used in scientific research. They define the logic and structure of the work, as well as help establish a link between theory and practice. As a rule, the methodological framework includes the chosen approach to the study of the research object, the methods used to collect data, analyze information and conclusions.

Methodology in the broadest sense is a mental activity aimed at studying the ways a person transforms reality - the methods of rational actions that must be taken to solve a specific task or achieve a specific goal. The methods are applied in any field of scientific and cognitive activity [14].

5. The corporate finance method

The corporate financing method is a method of raising funds for the development of a company, depending on its needs and capabilities.

Methods of corporate financing:

Capital financing. To raise funds by issuing and selling shares of the company. Shareholders calculate the income in the form of dividends and an increase in the value of shares and put capital in exchange for partial ownership of the company.

Debt financing. Raising funds by issuing debt obligations such as corporate bonds or bank loans. The Company undertakes to pay off the underlying debt for a certain period, along with the agreed interest.

Hybrid financing. Combines elements of capital and debt financing. For example, the issuance of convertible bonds-debt instruments that can be converted into company shares on a predetermined date in the future.

Internal financing. Using company profits to finance projects or expand production.

The tutorial will study the basic concepts of corporate finance, internal and external sources of financing of company activities, the concept of capital structure, maintaining its optimal state; methods for assessing the value of financial assets and the company as a whole, portfolio management are considered [15].

A few more examples of corporate financing methods:

Financial leasing. Take the asset for use in return for periodic payments over a certain period. After the expiration of the contract, the company can purchase the asset.

Venture capital. Financing start-ups and companies in the early stages through venture capital investors who provide capital in exchange for the company's share and are willing to take on the risk associated with the growth and development of the company.

Development trends. In modern conditions, there is a transition from traditional financing methods to more innovative approaches. Companies are increasingly turning to alternative funding sources such as crowdfunding, peer-to-peer lending, and income-based financing. This makes it possible to attract capital more flexibly for business development.

Methods are considered and a classification of methods for planning the interest rate of bonds is proposed. Several groups of methods of such planning have been identified. The analysis of the application of methods of planning the bond interest rate used by enterprises of various national industries is made [16].

6. Scientific solution in corporate finance

This must be done through scientific developments in solving the problems of corporate finance. And it consists in taking into account the following: lack of money for companies, efficient use of resources and the Prevention of bankruptcy. Also, effective management of enterprise finance makes it possible to ensure stable growth and increase income.

It has been proven that the sustainable development of corporate finance depends on their spending on the company and control over their investments [17].

To profit from a scientific solution, it is necessary not only to increase the volume of sales of scientific products, but also to properly control cost price, optimize production processes, and reduce labor and other costs. The following main areas of corporate finance from Table 1 can be used to generate income and solve scientific problems.

Table 1

Scientific solution to corporate finance problems².

The main direction	Getting income	Scientific solution
Investment	Making investment decisions	Availability and completeness of information about the investment object, as well as uniformity of its distribution among all participants in the investment process, as one of the most important conditions for influencing the effectiveness of investment decision-making and as a mirror image; one of the most important conditions for influencing the effectiveness of financial decision-making related to the search for sources of financing investments and assessing the optimality and expediency of attracting them.
Dividend	Dividend policy	A company's dividend policy is a set of rules by which profits are distributed among shareholders. The decision on the Dividend policy depends on the financial situation of the company and its long-term goals. Stages of Dividend policy development: assessment of the financial condition of the Joint-Stock Company, the level of development it has achieved and the factors determining the dividend policy; choosing a method of paying dividends based on an assessment of its strengths and weaknesses in terms of its impact on the development of the joint community; Joint-Stock Company; implementation of calculations on options for determining the coefficient of profit distribution; examination of possible legal risks.
Shares for shareholders	Use of securities	When solving issues of managing working capital, it is necessary to distinguish between the concepts of production, financial and operational cycles. A qualified balance between the rational management of assets that do not minimize risks, but the risks caused by the lack of working capital and the increase in working capital. The optimal level of working capital allows you to maximize profit at the optimal level of liquidity and commercial risk. Liquidity management involves planning the adoption and use of resources in order to be able to pay on time under a short-term obligation.
Working capital	Circulating funds management	Circulating funds management is one of the most important functional areas of the business structure management system. The scientific solution in this area includes a system of principles and methods of developing and implementing management decisions related to the formation of working capital at the lowest cost in a necessary and sufficient volume, as well as increasing the effectiveness of its use. It uses the following scientific solutions to manage working capital: utilizing digital technologies and financial technology solutions: application of the principles of the formation of working capital: use of backup management methods: analysis of the effectiveness of the use of current assets: determining the optimal deadlines for the receivable turnover.
Risk assessment	Risk management	Successful completion of scientific and practical research on risk management, maximizing project work, increasing the effectiveness of the impact of positive risks, reducing the likelihood of risks, as well as reducing the impact of negative risks on employees, specialists and management personnel at each enterprise. Now the risks are analyzed in a qualitative and quantitative way:

²Source: Developed by the author on the basis of scientific research.

		- qualitative risk analysis is the process of prioritizing individual project risks for further analysis or action, which is carried out by assessing the likelihood of the occurrence and impact of risks, as well as other characteristics. - quantitative risk analysis is the process of numerical analysis of the cumulative impact of identified individual project risks and other sources of uncertainty on the overall goals of the project. The inclusion of the results of a qualitative analysis of risks in the Risk Register, since these processes are carried out during the project. After that, the Risk Register provides detailed information about the individual risks identified in the project. Due to the uncertainty and incompleteness of the information available at the enterprise, the state of objective conditions is proposed, which allows you to foresee the consequences through risk management and scientific and practical research.
--	--	---

Under contemporary circumstances, the evolution of a market economy necessitates the enhancement of Corporate Finance Management efficiency, which underpins the establishment of the national financial system. We determined that ongoing enhancement of digital technologies is essential inside corporate financial management and for addressing other challenges that emerge in management decision-making in corporate finance.

In addition, it is important to note that corporate finance issues are resolved through the company's achieved results.

Reduction of tax deductions. The theoretical and practical basis for reducing tax payments at the enterprise or optimizing taxation is, of course, to obtain an economic effect from minimizing the amount of tax payments, which leads to an increase in the amount of net profit and, as a result, to an increase in the efficiency of the enterprise's. By applying tax incentives at the enterprise, managing can form branches and a limited liability company that are under the control of the enterprise.

One of the most important tasks of tax regulation of the economy of the agro-industrial complex is a harmonious combination of tools used in connection with the establishment of tax obligations [18].

Ultimately, effective management of corporate finance sets the stage for the sustainable economic development of the entire country, since the financial results of the entrepreneurial sector are the main source of the formation of the country's state budget revenues.

7. Conclusions

In conclusion, it can be distinguished that the finances of corporations are based on certain principles that are closely related to the goals and objectives of their financial strategy and tactics. That is, it consists of self-sufficiency and financing, economic independence, planning, flexibility.

Problems that arise in making management decisions in corporate finance. Problems in the field of corporate finance: problems with digitization and economic instability; the emergence of mass cyber threats; obsolescence of Information Systems; insufficient development of the financial sphere compared to other sectors.

One of the constant problems is the indicators of total assets, which means that the number of workers in the enterprise will grow faster than in total assets, that is, labor productivity will decrease. Therefore, the costs of companies grow faster than income, and thus the decrease in the size of profit leads to an increase in the level of harm.

Corporate finance can maximize the net result and minimize marginal costs and thus optimize its financial relationships. In addition, on the basis of this approach, it performs a comprehensive and systematic calculation of factor indicators.

References

1. Babadjanov A.M. (2024) Analysis and necessity of the financial condition of the enterprise: Financial and Economic. American Journal of Research in Humanities and Social Sciences. Volume 23, – Pp. 12-21. www.americanjournal.org
2. Savelyeva E.V. (2017) The content and principles of corporate finance organization / Savelyeva E.V. //Modern trends in the development of science and technology. - No. 2-9. - Pp. 68-69.

3. Khotinskaya G.I., Shokhin E.I. (2010) Corporate Finance: Evolution of Theory and Practice// Bulletin of the Financial Academy. - No. 6(60), - Pp. 28-32.
4. Borisov O.V. (2014) Corporate Finance: the tutorial and workshop for undergraduate academic / O. V. Borisov, N. And. Small [and others]. - Mowcov.: Urait, - 651 p.
5. Atabieva L.A. (2018) Corporate finance: lecture notes for students in the field of 38.03.01 Economics / L.A. Atabieva. Cherkessk: BIC Sev Kav GGTA, – 80 p.
6. Ankudinov, A.B. (2023) Corporate Finance: A Study Guide for Seminars/A.B. Ankudinov, E.I. Khairullina, A.A. Kamalova, I.G. Khairullin, and M.S. Galimova. Kazan: Kazan University Press, – 125 p.
7. Menshikov E.I., Konobeeva A.B. (2021) Theoretical and practical aspects of digital tools for corporate finance development // Вестник МФЮА, №4, - Pp. 153-164. doi:10.52210/2224669X_2021_4_153
8. Sizov, V. V. (2018) Corporate Finance: A Textbook in 2 Parts / V. V. Sizov ; Tomsk State Pedagogical University. Tomsk: TGPU Publishing, - 408 p.
9. Atabieva L.A. (2018) Corporate finance: lecture notes for students in the field of 38.03.01 Economics / L.A. Atabieva. Cherkessk: BIC SevKavGGTA, – 80 p.
10. Tretyak V.V., Nikitina I.A., Panarin A.A. (2022) The risk management system as the basis for ensuring the economic security of an enterprise // Scientific Notes of the International Banking Institute. St. Petersburg. - №1 (39). – Pp. 169-179.
11. Pivoev V.M. (2013) Philosophy and methodology of science. Moscow: Direct-Media, - 321 p. ISBN: 978-5-4458-3477-9
12. Zaitsev V.Yu., Fedchishin Y.I. (2015) Finance corporations: Theoretical and methodological aspect// Economics, Statistics, and Computer Science. - №5, - Pp. 35-45.
13. Bakhtina I.L., Lobut A.A., Martyushov L.N. (2016) Methodology and methods of scientific cognition [Text]: textbook / I.L. Bakhtina, A.A.Lobut, L.N. Martyushov,; Ural State Pedagogical University. Yekaterinburg, – 119 p.
14. Ankudinov A.B. (2015) Modern problems of corporate finance / A.B. Ankudinov, O.V. Lebedev, E.I. Khairullina. Kazan: Kazan. University, – 30 p.
15. Karachun I.A. (2021) Corporate finance in transformational economics: textbook. the manual / I.A. Karachun. Minsk: BSU, -183 p. ISBN 978-985-881-049-8.
16. Prokhorov V.V., Rozhnov I.P. (2024) Methods of long-term planning of corporate financing. Vestnik Universiteta. - №(6): - Pp. 171-179.
17. Rozhkov E.V. (2024) Corporate finance // Modern scientific research and innovations. Moscow. - № 4. URL: <https://web.snauka.ru/issues/2024/04/101801>
18. Orobinskaya I.V. (2014) Tax instruments for ensuring the stable development of agricultural industries / I.V. Orobinskaya // Taxes and taxation. - No. 4 - Pp. 393-400.

Problems of Financial and Banking Systems

Yulduz Bo'riyeva

University of Tashkent for Applied Sciences, Tashkent, 100149, Uzbekistan

E-mail: yulduz.boriyeva.96@mail.ru,  orcid: 0009-0004-5489-3796

Annotation: This paper examines the key problems of modern financial and banking systems under conditions of economic instability and globalization. Special attention is paid to issues such as insufficient capitalization of banks, growing credit risks, low financial inclusion, regulatory challenges, and the impact of digital transformation on banking activities. The study analyzes the influence of macroeconomic factors on the stability of financial institutions and evaluates existing mechanisms for risk management and financial regulation. Based on the analysis, recommendations are proposed to improve the efficiency, sustainability, and resilience of financial and banking systems in both developing and developed economies.

Keywords: financial system, banking system, financial stability, credit risk, regulation, digital banking, economic instability

1. Introduction

The development of financial and banking systems plays a crucial role in ensuring sustainable economic growth and macroeconomic stability [1; 8]. In modern conditions of globalization, digitalization, and increasing economic uncertainty, financial institutions face a wide range of structural and functional challenges [7; 10]. The effectiveness of the banking system directly influences investment activity, capital accumulation, financial intermediation, and the overall resilience of the national economy [1; 8].

In recent years, financial and banking systems have been exposed to various internal and external shocks, including economic crises, inflationary pressures, rapid technological changes, and increased regulatory requirements [3; 9]. Problems such as insufficient liquidity, rising non-performing loans, weak risk management mechanisms, and limited access to financial services remain significant, especially in developing economies [4; 6]. These issues reduce the stability of banking institutions and weaken public confidence in the financial system [2; 5].

Moreover, the rapid development of digital banking, financial technologies (FinTech), and non-bank financial institutions has intensified competition in the financial sector [2; 10]. While digital transformation creates new opportunities for efficiency and financial inclusion, it also introduces new risks related to cybersecurity, data protection, and regulatory gaps [3; 10]. Traditional banking models are increasingly challenged by innovative financial services, requiring adaptation and modernization of existing systems [5; 7].

Therefore, the study of the key problems of financial and banking systems, their causes, and possible solutions is of great scientific and practical importance [9]. This research aims to analyze the main challenges affecting financial and banking systems and to identify directions for improving their stability, efficiency, and long-term development under modern economic conditions [1; 3; 5].

2. Technology for obtaining materials and research method

The research is based on the analysis of statistical, financial, and institutional data related to the functioning of financial and banking systems. The materials used in this study include official reports of central banks, commercial banks, international financial institutions, and statistical agencies. In particular, data from annual reports of commercial banks, publications of the International Monetary Fund (IMF), the World Bank, and national statistical committees were used as primary sources.

To obtain empirical materials, a systematic approach was applied, including the collection and processing of macroeconomic and banking indicators such as bank capital adequacy, liquidity ratios, non-performing loan (NPL) levels, inflation rates, interest rates, and credit growth dynamics. For example, the analysis of banking system stability was carried out using capital adequacy ratios and NPL indicators based on data from selected commercial banks over the period 2018–2023.

The research methodology includes both qualitative and quantitative methods. Quantitative analysis was conducted using comparative and statistical methods to identify trends and correlations in the development of financial and banking systems. Time-series analysis was applied to assess changes in key indicators, such as credit volumes and deposit growth, before and after economic shocks. For instance, a comparative analysis of bank lending activity before and after the COVID-19 pandemic was used to evaluate the impact of crisis conditions on banking performance.

Qualitative methods, including content analysis and institutional analysis, were used to study regulatory frameworks and banking reforms. The research examines changes in prudential regulation, digital banking policies, and financial inclusion strategies. As a practical example, reforms aimed at strengthening banking supervision and introducing digital financial services in developing economies were analyzed to assess their effectiveness.

In addition, risk assessment methods were applied to evaluate credit and liquidity risks within the banking system. Stress testing elements were used to model potential scenarios of economic downturns and their impact on bank stability. The combination of these methods made it possible to comprehensively assess the existing problems of financial and banking systems and to formulate practical recommendations for improving their resilience and efficiency.

3. Experimental results and their discussion

The analysis of empirical data shows that financial and banking systems experience significant pressure during periods of economic instability. The results indicate that an increase in non-performing loans and inflation rates negatively affects bank profitability and financial stability, while higher capital adequacy ratios contribute to greater resilience of banks. Comparative analysis of key banking indicators over recent years demonstrates that although credit growth supports economic activity, excessive lending without effective risk management increases systemic vulnerability. The findings confirm that strengthening regulatory frameworks, improving risk assessment mechanisms, and promoting digital banking solutions are essential for enhancing the sustainability of financial and banking systems.

Table 1.

Key indicators of financial and banking system performance

Indicator	2019	2020	2021	2022
Capital adequacy ratio, %	14.2	13.8	14.5	15.1
Non-performing loans (NPL), %	6.5	8.2	7.6	6.9
Inflation rate, %	11.0	12.5	10.8	9.5
Credit growth rate, %	18.4	12.1	16.3	14.7
Return on assets (ROA), %	1.9	1.2	1.6	1.8

The table presents the main indicators reflecting the performance and stability of the financial and banking system over the analyzed period [1; 3]. The data illustrate changes in capital adequacy, credit risk, inflation, and profitability, which are key factors influencing the overall resilience of banks [5; 8]. The dynamics of these indicators show that improvements in capital adequacy and reductions in non-performing loans contribute positively to financial stability, while high inflation and rapid credit growth increase systemic risks [3; 9]. The table provides a basis for evaluating the effectiveness of regulatory and risk management measures in the banking sector [5; 6].

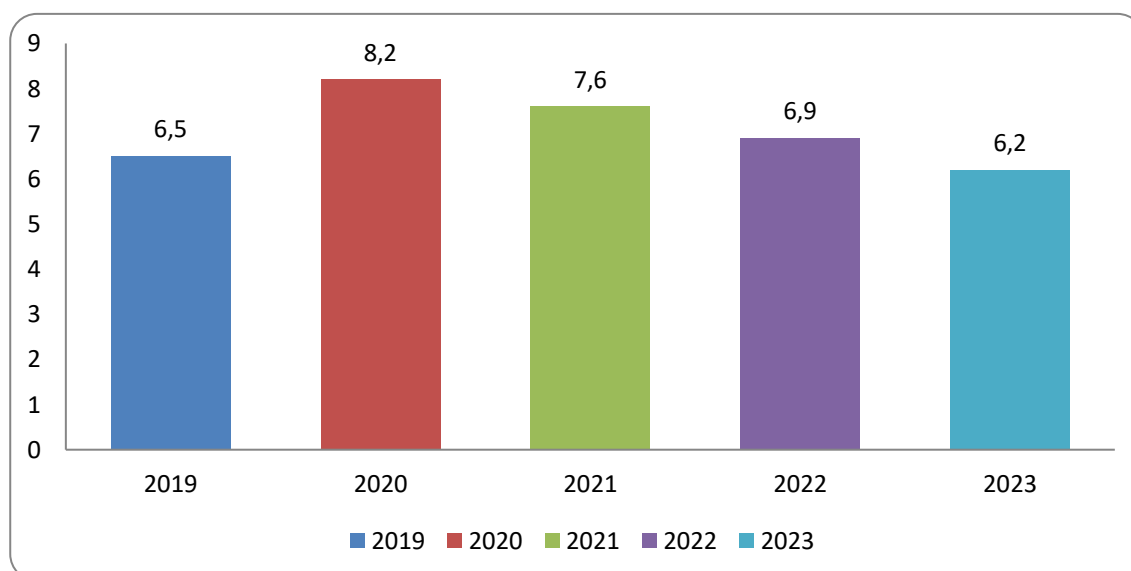


Figure 1. Diagram of Non-Performing Loans (NPL)

The diagram illustrates the dynamics of non-performing loans (NPL) in the banking system from 2019 to 2023. As shown in the diagram, the NPL ratio amounted to 6.5% in 2019, reflecting a relatively stable credit environment. In 2020, the indicator increased significantly to 8.2%, which can be explained by economic shocks and reduced business activity during the crisis period. This sharp rise indicates a deterioration in loan quality and increased credit risk for banks.

In 2021, the NPL level decreased to 7.6%, showing partial recovery of the banking sector as economic conditions gradually improved. The downward trend continued in 2022, when the NPL ratio fell to 6.9%, and further declined to 6.2% in 2023. This reduction reflects the effectiveness of regulatory measures, improved risk management practices, and loan restructuring policies implemented by banks. Overall, the diagram clearly demonstrates how credit risk evolves over time and highlights the importance of financial stability measures in strengthening the banking system.

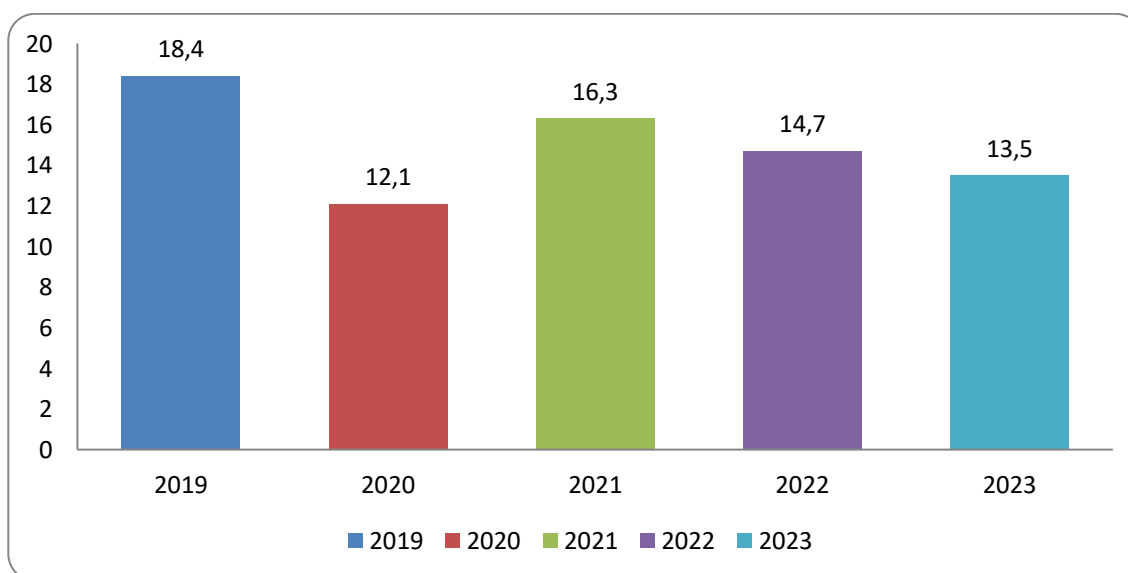


Figure 2. Dynamics of Credit Growth Rate

The line diagram illustrates the dynamics of the credit growth rate in the banking system over the period from 2019 to 2023. As shown in the diagram, credit growth was relatively high in 2019, reaching 18.4%, indicating active lending and strong demand for financial resources. In 2020, the growth rate declined sharply to 12.1%, reflecting the negative impact of economic uncertainty and crisis conditions on lending activity.

In 2021, credit growth recovered to 16.3%, demonstrating a gradual restoration of economic activity and improved confidence in the banking sector. However, in 2022, the growth rate decreased again to 14.7%, followed by a further decline to 13.5% in 2023. This downward trend suggests a more cautious lending policy by banks, influenced by tighter regulatory requirements and increased risk awareness. Overall, the diagram highlights the sensitivity of credit growth to macroeconomic conditions and emphasizes the importance of balanced credit expansion for maintaining financial stability.

4. Conclusions

The study demonstrates that financial and banking systems are highly sensitive to macroeconomic instability, regulatory changes, and external economic shocks [3; 9]. The analysis of key indicators such as non-performing loans, inflation rates, capital adequacy, and credit growth confirms that weaknesses in risk management and excessive lending can significantly undermine financial stability [1; 5; 8]. At the same time, sufficient capitalization and effective supervisory mechanisms play a crucial role in enhancing the resilience of banking institutions [5].

The results indicate that economic crises lead to a deterioration in credit quality and a slowdown in lending activity, while recovery periods are characterized by gradual improvements in financial indicators [3; 9]. Digital transformation and the development of financial technologies create new opportunities for increasing efficiency and financial inclusion; however, they also generate additional risks related to cybersecurity and regulatory gaps [2; 6; 10].

In conclusion, strengthening prudential regulation, improving risk assessment frameworks, and promoting balanced credit growth are essential for ensuring the sustainable development of financial and banking systems [5; 7]. The findings of this study can be used in the formulation of financial policy measures and in further research aimed at improving the stability and efficiency of the banking sector [3; 4].

References

1. Mishkin, F. S. (2019). *The economics of money, banking and financial markets*. New York, NY: Pearson Education.
2. Gorton, G., & Metrick, A. (2010). Regulating the shadow banking system. *Brookings Papers on Economic Activity*, 2010, 261–312.
3. International Monetary Fund. (2022). *Global financial stability report*. Washington, DC: IMF.
4. World Bank. (2021). *Global financial development report*. Washington, DC: World Bank Publications.
5. Basel Committee on Banking Supervision. (2018). *Basel III: A global regulatory framework for more resilient banks and banking systems*. Basel: Bank for International Settlements.
6. Demirgüç-Kunt, A., & Martinez Peria, M. S. (2017). Financial inclusion and banking stability. *Journal of Financial Stability*, 33, 1–15.
7. Stiglitz, J. E. (2018). *Globalization and its discontents revisited*. New York, NY: W.W. Norton & Company.
8. Levine, R. (2005). Finance and growth: Theory and evidence. In P. Aghion & S. Durlauf (Eds.), *Handbook of economic growth* (pp. 865–934). Elsevier.
9. Claessens, S., & Kose, M. A. (2013). Financial crises: Explanations, types, and implications. *IMF Working Paper*, 13/28.
10. OECD. (2020). *Financial markets, insurance and pensions: Digitalisation and finance*. Paris: OECD Publishing.
11. Andersen, E. S. (2018). *Project Management: An Organizational Perspective*. Routledge.
12. Dinsmore, P. C., & Cabanis-Brewin, J. (2014). *The AMA Handbook of Project Management* (4th ed.). AMACOM.
13. Jugdev, K., & Müller, R. (2005). A retrospective look at our evolving understanding of project success. *Project Management Journal*, 36(4), 19–31.
14. Kerzner, H. (2017). *Project Management: A Systems Approach to Planning, Scheduling, and Controlling* (12th ed.). John Wiley & Sons.
15. Mintzberg, H. (1994). *The Rise and Fall of Strategic Planning*. Free Press.
16. Porter, M. E. (1996). What is strategy? *Harvard Business Review*, 74(6), 61–78.

Management of Asset Operations of Commercial Banks and Ways to Improve Their Efficiency

Musurmon Kholmuradov

Independent Researcher, University of Tashkent for Applied Sciences, Tashkent 100149, Uzbekistan

E-mail: musirmonkholmurodov1@gmail.com,  orcid: 0009-0000-1715-213X

Abstract: Ensuring the high quality of the asset portfolio of a commercial bank is currently one of the most critical issues required to guarantee their long-term financial stability, risk management mitigation, and overall liquidity. In modern economic conditions, banks face various financial risks that directly affect their profitability and capital adequacy. In this scientific article, a comprehensive analysis is conducted to evaluate the structural components of bank assets and their vulnerability to market fluctuations. Based on the findings, a thorough attempt was made to develop scientific and practical recommendations aimed at increasing the efficiency of asset management, optimizing the loan portfolio, and maximizing the return on investment. The study focuses on introducing advanced risk assessment methodologies and innovative financial instruments to enhance the premium quality of the assets of commercial banks. Ultimately, the proposed strategies and models serve as a valuable guide for banking authorities and financial managers to maintain a balanced, secure, and highly profitable asset structure.

Key words: Bank, bank assets, risks, national economy, bank portfolio, asset quality ass, banking system, credit portfolio investment.

Introduction

In today's global economy, uneven development continues to create different economic challenges. Because of this, solving problems in the banking system, strengthening economic independence, and maintaining macroeconomic stability have become very important tasks. Another important issue is reducing the negative effects of financial and economic shocks that may occur in the financial and credit sectors. In this situation, the effective management of international bank assets plays a significant role. In recent years, effective asset management has helped many large banks strengthen their positions in the global financial market. As a result, the total value of bank assets has increased significantly. For example, in 2023 the asset volume of Industrial and Commercial Bank of China reached USD 3,473.1 billion. At the same time, the assets of Mitsubishi UFJ Financial Group amounted to USD 2,626.3 billion, JPMorgan Chase – USD 2,490.9 billion, HSBC Holdings – USD 2,374.9 billion, BNP Paribas – USD 2,189.2 billion, Deutsche Bank – USD 1,676.5 billion, and Sberbank – RUB 27.1 trillion. These figures show the rapid growth of bank assets in the global financial system.

Today, one of the important tasks of the global economy is improving the efficiency of asset management in commercial banks. This can be achieved through innovative approaches, improving risk-hedging practices in asset operations, and developing modern methods for assessing the influence of internal and external factors on banking activities. When developing asset management strategies, special attention is given to modern banking technologies and the active use of digital economy elements. These factors have become one of the main focuses of scientific research.

At the same time, researchers are conducting comprehensive studies to integrate marketing and management approaches into asset operation management and to improve asset management mechanisms.

In Uzbekistan, where rapid economic reforms are currently being implemented, the volume of assets in the banking system is steadily increasing, and their share in the country's GDP is also growing. However, the insufficient development of asset management strategies in some commercial banks remains a serious problem. Even though the total volume of banking assets is increasing, weaknesses in management strategies can lead to lower profitability in some large commercial banks.

Another issue is that a large part of bank deposits consists of funds from legal entities. This situation may increase the level of risk in asset operations carried out by commercial banks.

According to the Action Strategy for the Development of the Republic of Uzbekistan for 2017–2021, it is important to increase the capitalization of commercial banks, expand the volume of credit portfolios, improve their quality, finance investment projects, and widen lending opportunities for small businesses and private entrepreneurship.

Review of related literature.

Issues related to the management of banking activities have been studied by many foreign and CIS economists. Important contributions to this field were made by researchers such as J. Sinkey, P. Rose, R. Daft, O. Lavrushin, B. Edwards, R. Claessen, F. Wertz, A. Alaverdov, A. Pechnikova, A. Maksyutov, G. Prosvetov, A. Lukakov and several other scholars.

In his studies on bank management, R. Daft considers bank management as a specific professional activity aimed at achieving strategic goals. According to him, banks can reach their objectives by using financial and labor resources effectively and by applying appropriate management principles, functions, and methods that correspond to the conditions of the market economy.

A. Pechnikova states that asset operations represent the process of placing bank resources. She emphasizes that this process is extremely important for commercial banks. Asset operations help ensure both profitability and liquidity of banks. Through these operations, banks are able to perform two major functions of commercial banking activity.

First, banks direct temporarily free financial resources into promising sectors of the economy. Second, they provide financial support to economic agents who need capital. As a result, asset operations contribute to the development of production and investment activities, the introduction of innovations, and the expansion of housing construction.

In addition to foreign researchers, Uzbek economists have also studied different aspects of bank operations management. Among them are F. Mullajonov, M. Sharifkhodjaev, A. Bekmurodov, N. Karimov, Yo. Abdullaev, Sh. Abdullaeva, N. Jumaev, O. Olimjonov, A. Omonov, T. Qoraliev, B. Berdiyarov, H. Rahmatov, N. Jiyanova and others.

For example, H. Rahmatov connects the development of the banking system with the effectiveness of asset operations and pays special attention to the asset management strategy in banks. According to him, asset management strategy is an important element of the overall financial strategy of a bank. When developing this strategy, banks should analyze various factors that influence financial stability.

Local economists A. Omonov and T. Qoraliev describe asset operations of commercial banks as operations related to the placement of funds formed through banks' passive operations. These operations are carried out for different purposes, mainly to generate income while maintaining the necessary level of liquidity.

Research methodology

The purpose of this research is to develop scientific and practical recommendations aimed at improving the strategies used in managing asset operations of commercial banks.

In order to achieve this objective, different research methods were applied. The study used methods such as analysis, comparison, logical reasoning, and generalization to examine theoretical and practical aspects of asset management in commercial banks.

Statistical information related to the banking sector was also studied to evaluate the current state of asset management. In addition, international experience and the practices of commercial banks in Uzbekistan were analyzed.

Based on the results obtained during the research, appropriate conclusions were made and practical recommendations were proposed for improving the efficiency of asset management strategies in commercial banks.

The scientific novelty of the article consists of the following:

- the factors influencing the processes of managing asset operations of commercial banks and their interrelationships have been studied, and a mechanism for early identification of factors that negatively affect the ability of commercial banks to generate income has been developed;

– a proposal has been substantiated to improve the strategy for effective management of asset operations by enhancing the quality of banking services and attracting customers through the use of asset and liability instruments of commercial banks;

– “Asset operations are the main indicator ensuring the financial stability of commercial banks, encompassing the processes that generate sources of income”;

– “Effective management of asset operations is the single key factor in increasing a bank’s income and competitiveness, ensuring stability, and protecting against risks.”

The examination of the aforementioned theoretical features has scientifically validated the continuity of the sequence of procedures for the proper management of commercial banks' assets and liabilities. (Figure 1).

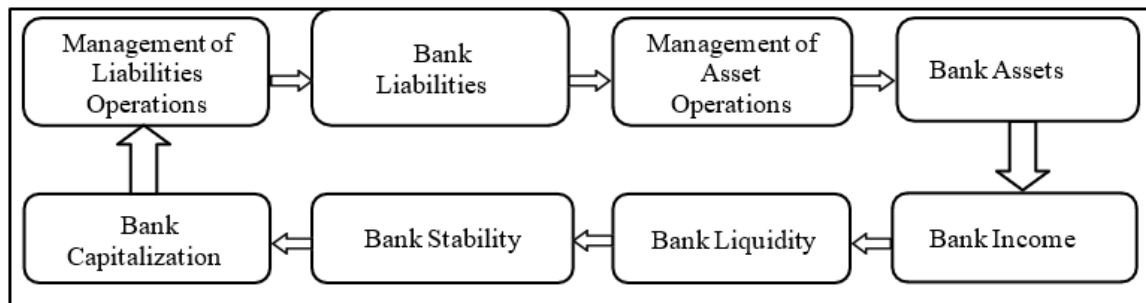


Figure 1. Continuity of the processes of effective management of assets and liabilities of commercial banks.

By ensuring the integrity and coherence of this mechanism, a bank achieves higher profitability, liquidity, stability, and growth in its capital. This, in turn, increases customers’ trust in the bank.

In the research, taking profitability into account, bank assets are analyzed by classifying them into income-generating and non-income-generating types. Figure 2 presents the growth trend in the volume of income-generating and non-income-generating assets of commercial banks over the period from 2010 to 2024.

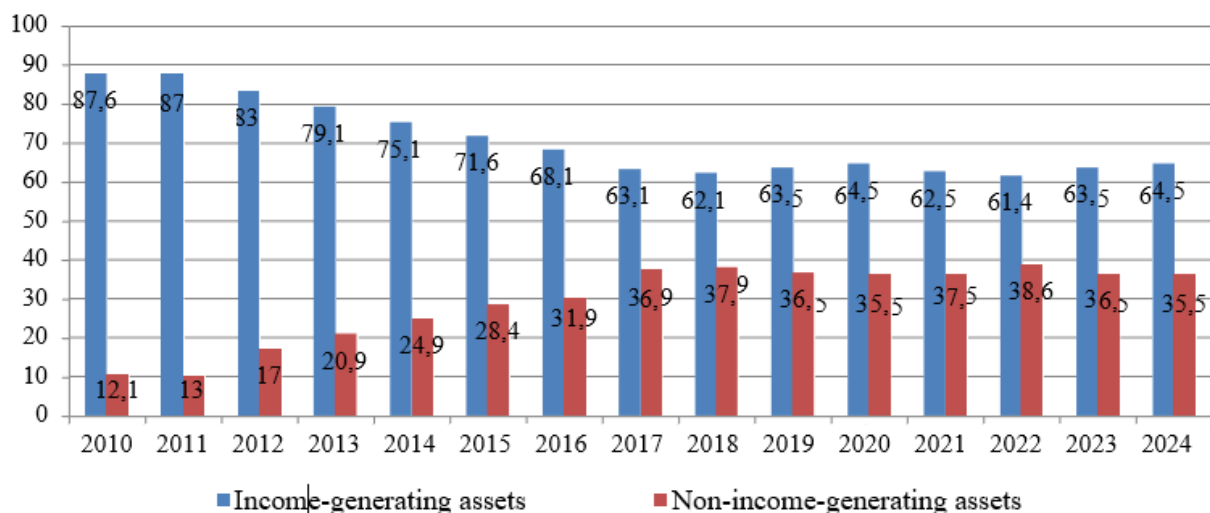


Figure 2. Dynamics of changes in the volume of income-generating and non-income-generating assets of commercial banks (in percent)

According to the data in Figure 2, in 2010 compared to 2024, the volume of income-generating assets decreased by 23.1 percentage points, while the volume of non-income-generating assets increased by 23.4 percentage points. The difference between them amounted to 29 percentage points in 2024. These indicators show that banks are operating on a risk-based basis, since the share of income-generating assets is not sufficiently high. Therefore, particular attention is paid to income-generating and non-income-generating assets in the process of managing asset operations.

We believe that managing asset operations according to their profitability is crucial for addressing several challenges, such as pinpointing avenues for enhancing bank profitability and making informed financing decisions; formulating strategies to diminish the proportion of non-income-generating assets within the overall asset operations; identifying key pathways for asset diversification, particularly emphasizing securities and investment operations, as these assets constitute a minor segment of the bank's balance sheet; and ensuring the appropriate distribution of asset operations across various regions of the country, while considering regional characteristics.

Table 1.

Analysis of the profitability of capital and assets of the National Bank for Foreign Economic Activity of the Republic of Uzbekistan, Uzsanoatqurilishbank JSCB, Mikroreditbank JSCB, and Trustbank PJSC

Indicators	Bank	2016	2017	2018	2019	2020	2021	2022	2023
ROE (Return on Equity)	National Bank	5.27	5.73	7.09	7.40	0.55	0.19	24.2	22.6
ROA (Return on Assets)	Uzsanoatqurilishbank	0.76	0.51	0.69	0.68	0.12	0.04	3.1	2.6

Based on the data in Table 1, it can be observed that the level of profitability of capital and assets of Trustbank PJSC is higher than that of Uzsanoatqurilishbank JSCB, the National Bank for Foreign Economic Activity of the Republic of Uzbekistan, and Mikroreditbank JSCB.

This raises the question of why the National Bank for Foreign Economic Activity of the Republic of Uzbekistan—which ranks first among the country's banks in terms of capital and asset volumes—has a low level of profitability. This indicates inefficient use of the bank's capital and assets. Similar problems can also be observed at Uzsanoatqurilishbank.

To address these issues, first of all, it is necessary to systematize the activities of bank management bodies, which will make it possible to improve banks' asset operation management strategies. At the same time, management approaches should be developed based on an analysis of internal and external factors affecting asset operations. Identifying the causes of non-performing loans and proposing measures for their management will enable the improvement of asset operation management strategies of banks and, consequently, create opportunities to increase banks' profitability levels.

Research into the analysis of internal and external factors influencing the formation of asset operations involves studying the economic and legal conditions of financial activities within the bank and forecasting their possible changes in the future period. In addition, developing a strategy at this stage requires analyzing financial market conditions and preparing forecasts from the perspective of market segments related to the bank's future activities. The role of strategy in managing asset operations in banks is examined in Figure 3.

Operating on the basis of the factors outlined above has a positive impact on a bank's ability to achieve higher levels of profitability, stability, and liquidity. This, in turn, serves as a driving force for the further development of the national banking system. Consequently, maintaining the stability of the banking system is intricately connected to the management of asset activities that predominantly facilitate firms' economic expansion, modernization, technological advancement, and the manufacture of export-oriented commodities. The extended life cycle of bank clients enhances production sustainability, positively influencing both micro- and macro-level aspects.

The share of total assets of commercial banks in GDP also indicates how relevant and important the establishment of an effective asset operations management mechanism is.

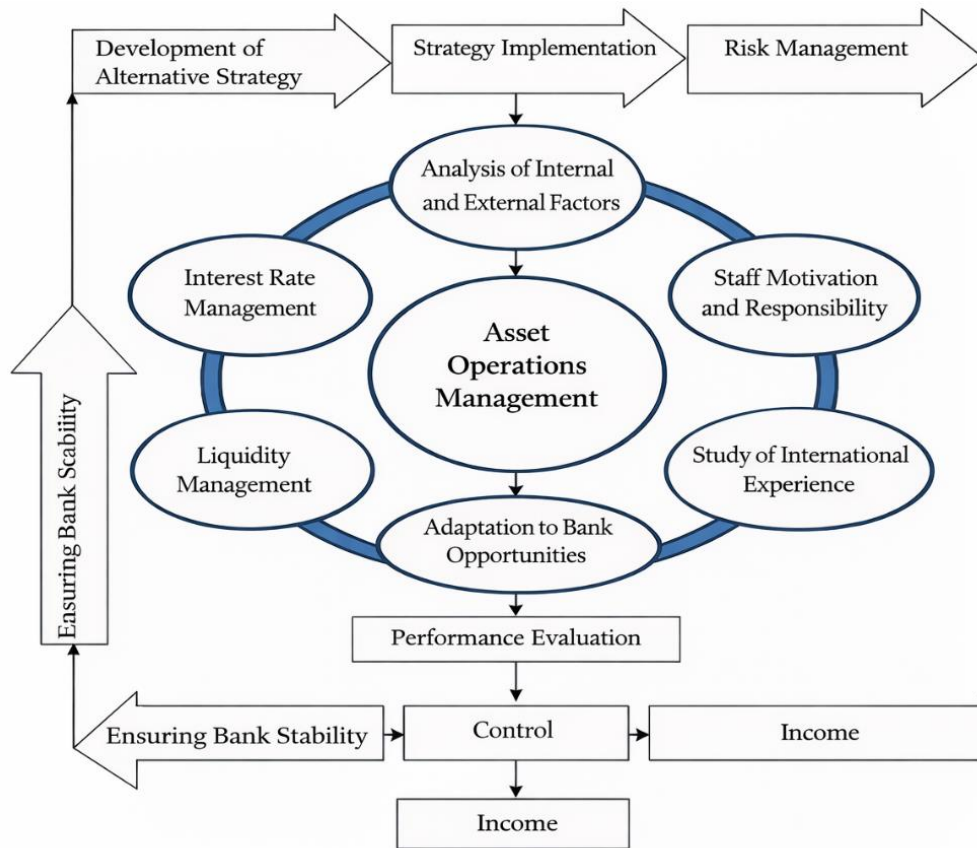


Figure 3. Mechanism for Implementing the Asset Operations Management Strategy

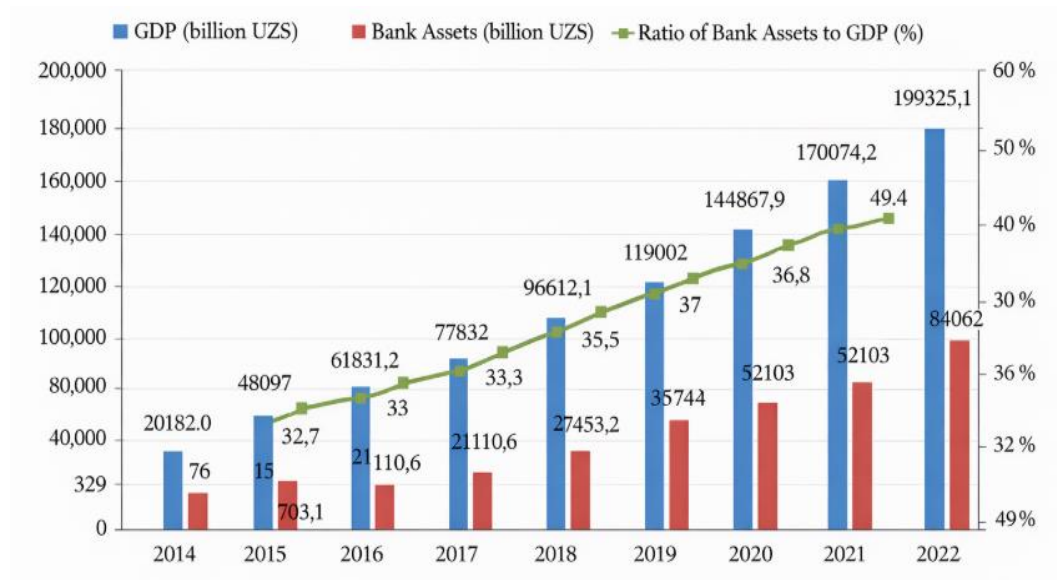


Figure 4. Trend in Changes in the Ratio of Total Assets of Commercial Banks to GDP in the Republic of Uzbekistan (as of January 1, 2024)

According to the data presented in Figure 4, during the period from 2014 to 2023, GDP increased by 6.3 times, while the total volume of bank assets grew by 9 times over the same period. However, for comparison, in 2023 the total assets of the banking system accounted for nearly 49.4 percent of GDP. These circumstances demonstrate the high relevance of improving the strategy for managing asset operations. In this context, measures aimed at eliminating sector-specific problems bring to the

forefront such priority tasks as improving the structure of commercial banks' assets, adapting the assessment of the banking system to international standards, and attracting customers through the introduction of modern banking operations.

The methods of managing asset operations in banks are classified, and all of these methods are currently applied by commercial banks. In the study, this set of methods was improved through proposals aimed at developing management based on the introduction of innovative methods in banks, in accordance with the Decree of the President of the Republic of Uzbekistan dated January 22, 2023, No. PF-5308, "On the State Program for the Year of Supporting Active Entrepreneurship, Innovative Ideas, and Technologies" (Figure 5).

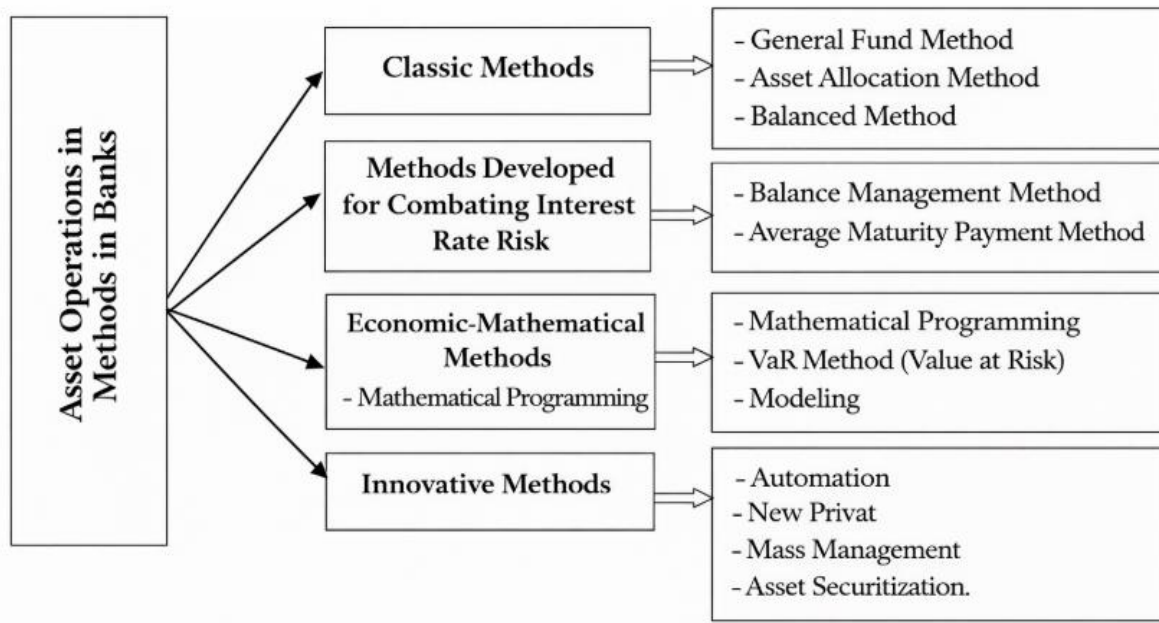


Figure 5. Methods of Managing Asset Operations in Banks

Analysis and results

One of the innovative methods proposed in the scientific article is *New Privat*, through which modern types of services are introduced into the banking system. This creates broad opportunities for attracting customers and increasing bank revenues. This system is mainly implemented with the aim of attracting large clients.

This system is divided into two types:

1. **Pure economic income:** In this case, by directing clients' funds to various investment projects, it is envisaged that the bank and the client will earn profits on the basis of equal partnership.
2. **Socio-economic service provision:** Here, the client's conditions are taken into account, whereby the bank charges interest depending on the service package, while the client, trusting the bank, legally provides information to the bank about their socio-economic issues.

The results of the analysis show that the banks considered as the objects of the study differ in terms of their resource base, structure, and types of clients. Each of these banks pursues a development policy aimed at strengthening its position in the financial market by increasing its assets, enhancing its resource potential, and achieving growth through prudent risk-taking and effective management methods (Figure 6).

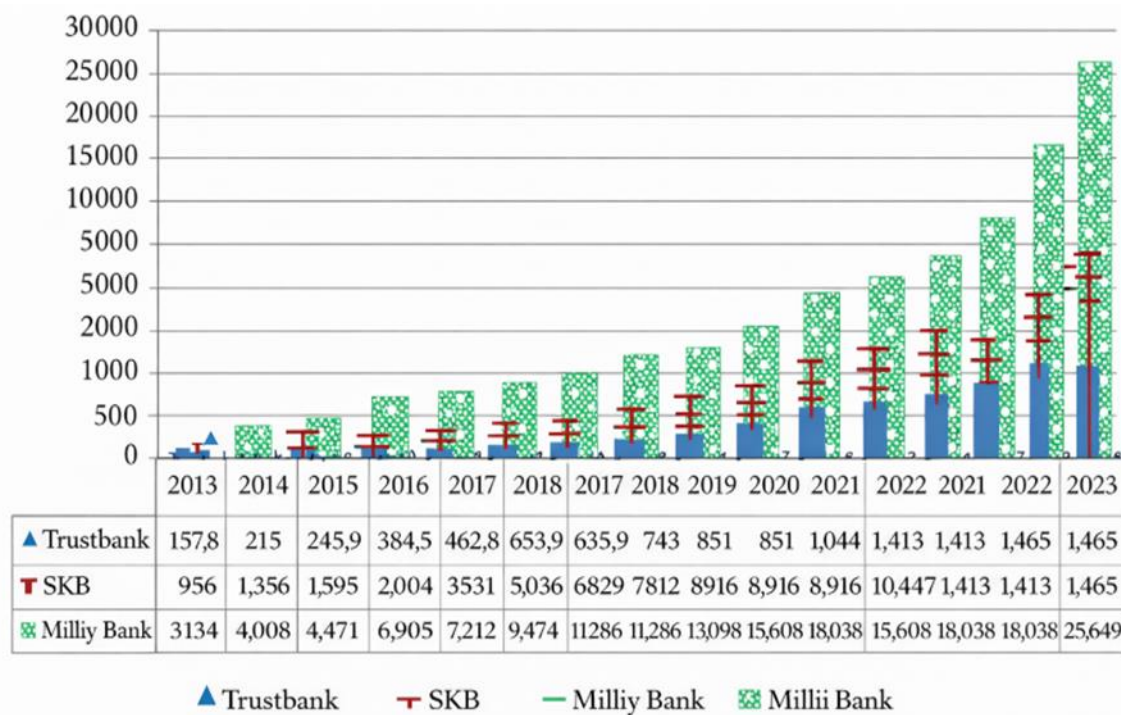


Figure 6. Trend in Changes in the Assets of the Research Objects during 2013–2023 (in billion UZS)

In particular, in 2023 compared to 2013, the growth dynamics of asset volumes amounted to 12.2 percent at the National Bank for Foreign Economic Activity of the Republic of Uzbekistan, 7.8 percent at Uzsanotqurilishbank JSCB, and 10.7 percent at Trustbank PJSC.

Achieving positive results largely depends on the formation of effective asset operations management strategies by commercial banks. In this context, based on an analysis of the structure and share of commercial banks' assets, it is necessary to pay special attention to identifying which types of operations are prioritized in asset operations management (Table 2).

Table 2.

Dynamics of Changes in the Structural Composition of Banking System Assets during 2018–2023 (in percent)

No.	Assets	2018	2019	2020	2021	2022	2023	Change in 2023 compared to 2018
1	Cash and valuables	4.26	3.49	2.38	2.99	3.02	1.91	-2.35
2	Funds with the Central Bank and correspondent accounts	15.66	19.85	20.87	16.69	11.51	14.88	-0.86
3	Funds receivable from other banks	12.73	16.38	13.82	17.99	13.46	11.55	-1.18
4	Funds from purchase and sale operations	3.49	0.55	0.39	0.13	0.08	0.07	-3.42
5	Net investments	3.19	0.88	2.99	2.41	2.23	1.57	-1.62
6	Loans and leasing assets	46.76	48.31	48.43	50.28	61.43	61.78	15.02
7	Purchased bills	0.27	0.10	0.00	0.00	0.00	0.00	-0.27
8	Other financial assets	1.68	2.77	2.16	1.04	1.88	1.78	0.10
9	Fixed assets	3.61	3.26	3.27	3.28	3.08	2.55	-1.06
10	Accrued interest receivable	1.23	0.70	0.65	0.64	0.61	0.71	-0.52
11	Other assets	7.14	3.71	5.04	4.55	2.70	2.68	-4.46
	Total assets	100	100	100	100	100	100	—

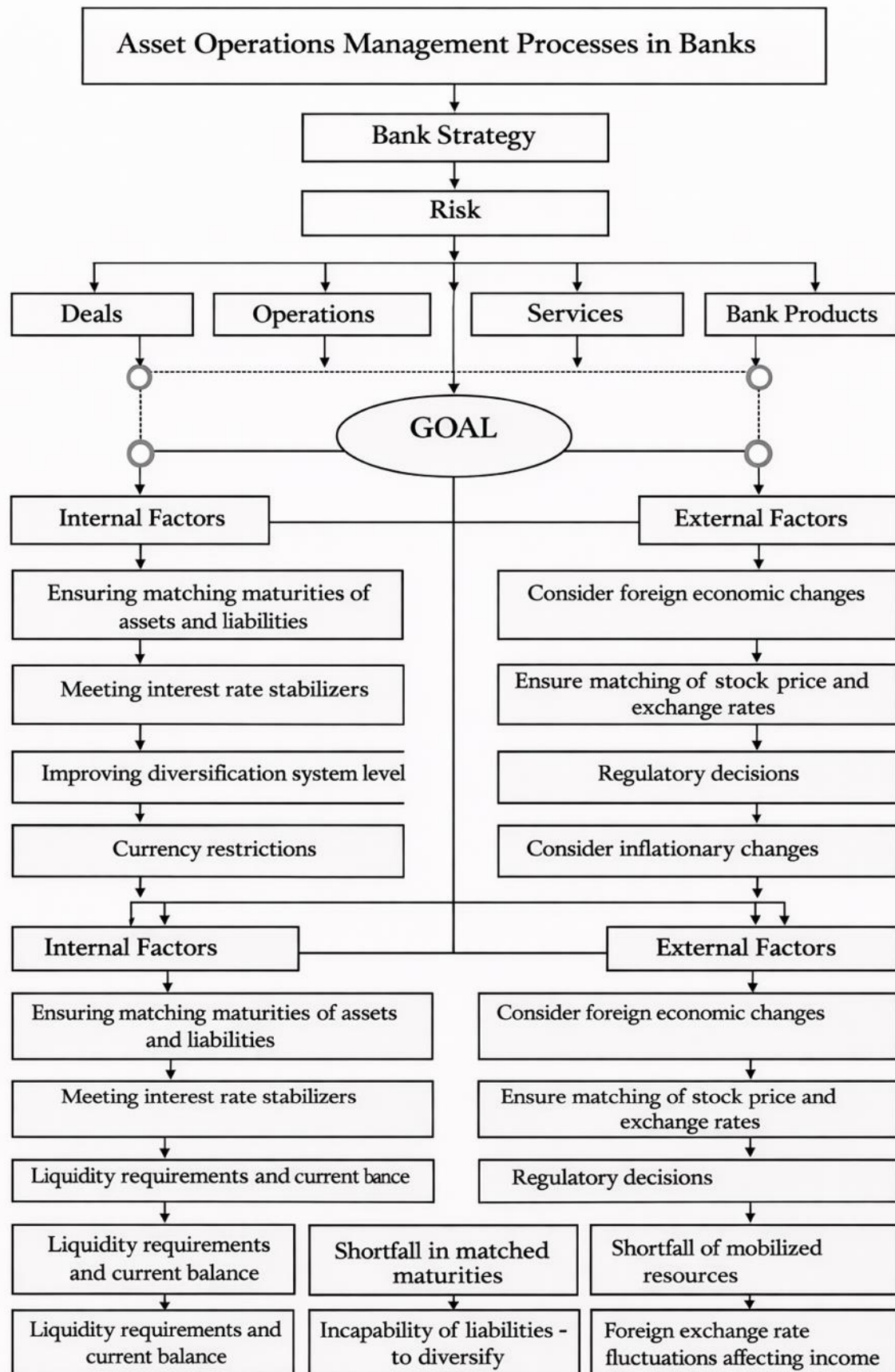


Figure 7. Factors Influencing the Management of Asset Operations of Commercial Banks and Their Interrelationship

Based on **Table 2**, it can be seen that during the period from 2018 to 2023, a positive growth trend of **15.02 percent** was observed only in loans and leasing funds within the structure of banking system assets. Since the main income-generating activity of commercial banks is lending operations, this situation indicates a positive development. However, a decline was observed in other income-generating asset components.

A comprehensive examination of the determinants influencing the management of non-performing loans facilitates the establishment of an efficient framework for safeguarding banking operations from hazards. The application of the strategies for managing non-performing loans outlined in this table aids in decreasing the proportion of problematic loans on the bank's balance sheet.

According to the data in **Figure 7**, identifying the factors influencing the management of asset operations of commercial banks and their interrelationships makes it possible to take into account in advance the factors that negatively affect the ability to generate income through deals, operations, services, and banking products included in the structure of asset operations, and to take the necessary measures accordingly.

In addition, based on the results of surveys conducted in banks, it has been scientifically substantiated that the application of innovative management through econometric analysis is expected to yield positive results.

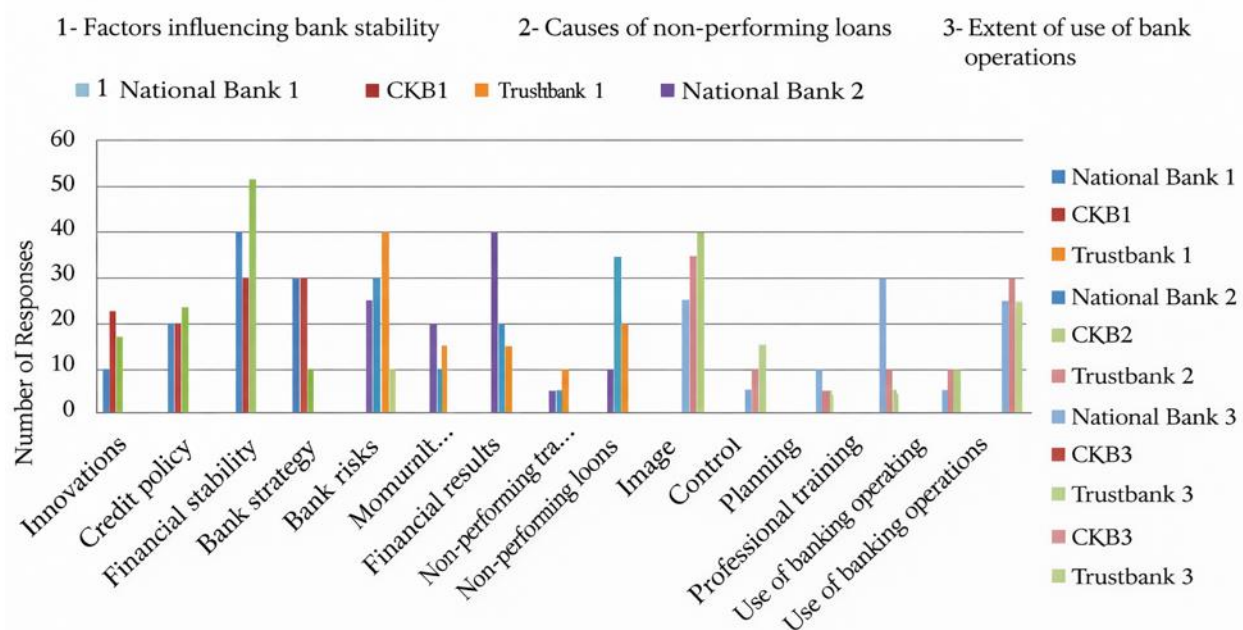


Figure 8. Survey Results from Bank Clients and Employees

The advancement of the financial services sector in our nation necessitates the implementation of innovations inside commercial banks' operations, alongside the optimization of these processes via effective bank management and the formulation of a distinct inventive strategy by each commercial bank. This, thus, aids in guaranteeing that competition within the financial services sector does not adversely affect banks' operations and their stability. A survey was administered to bank personnel and clients. (Figure 8).

The survey results indicate that fostering consumer trust in the banking system and sustaining bank stability predominantly rely on the effective management of asset and liability operations. A significant aspect influencing bank stability is non-performing loans, and the causes of their emergence were elucidated by bank staff.

At the National Bank for Foreign Economic Activity of the Republic of Uzbekistan, the main cause of non-performing loans was identified as weak credit monitoring. Employees of Uzsanoatqurilishbank, in turn, pointed out inappropriate actions by bank management related to

lending activities, while employees of Trustbank PJSC acknowledged that business plans play a key role in credit operations.

As a result of the questionnaire survey conducted among bank clients and employees, as well as the financial analysis of banks, directions for the effective management of asset operations were developed.

Table 3.

Proposals of Bank Employees and Clients for Bank Development

Bank Employees	Bank Clients
Applying continuous innovative methods to improve employees' knowledge and skills	Revising loan interest rates and simplifying loan application procedures
Strengthening employee motivation (taking into account employees' contribution to bank development)	Creating favorable conditions for providing short-term loans to small business entities
Increasing the attractiveness of deposits by expanding types and raising interest rates	Expanding modern banking services and reducing paperwork
Attracting clients through offering modern innovative banking services	Increasing the amount of cash withdrawals from ATMs
Introducing a balanced system for both the bank and clients by improving the mechanism for developing credit policy	Increasing deposit interest rates and carrying out formalities for depositors through modern (electronic) methods without requiring their presence
Simplifying loan processing procedures and introducing remote management	Reducing commission fees for SWIFT operations
Diversifying the client base by strengthening marketing and advertising activities	Increasing the share of the secondary market in mortgage and auto loan lending
Revising the bank's lunch break schedule	Setting the bank's lunch break from 13:00 to 14:00

Conclusion

In conclusion, it should be emphasized that expanding the range of innovative banking services and improving their quality creates a basis for increasing the efficiency of banks' operations and further broadening the scope of their services. The main objective of introducing innovative activities into the banking system is to reduce the cost of newly developed services. At the same time, this approach aims to strengthen banks' positions in the financial services market, expand their opportunities to capture a larger market share, and enhance the quality of services provided to customers to a higher level.

By expanding effective methods of managing bank assets, it becomes possible to improve the strategy for managing asset operations. Based on this, an innovative approach to asset operations management has been developed (Figure 9).

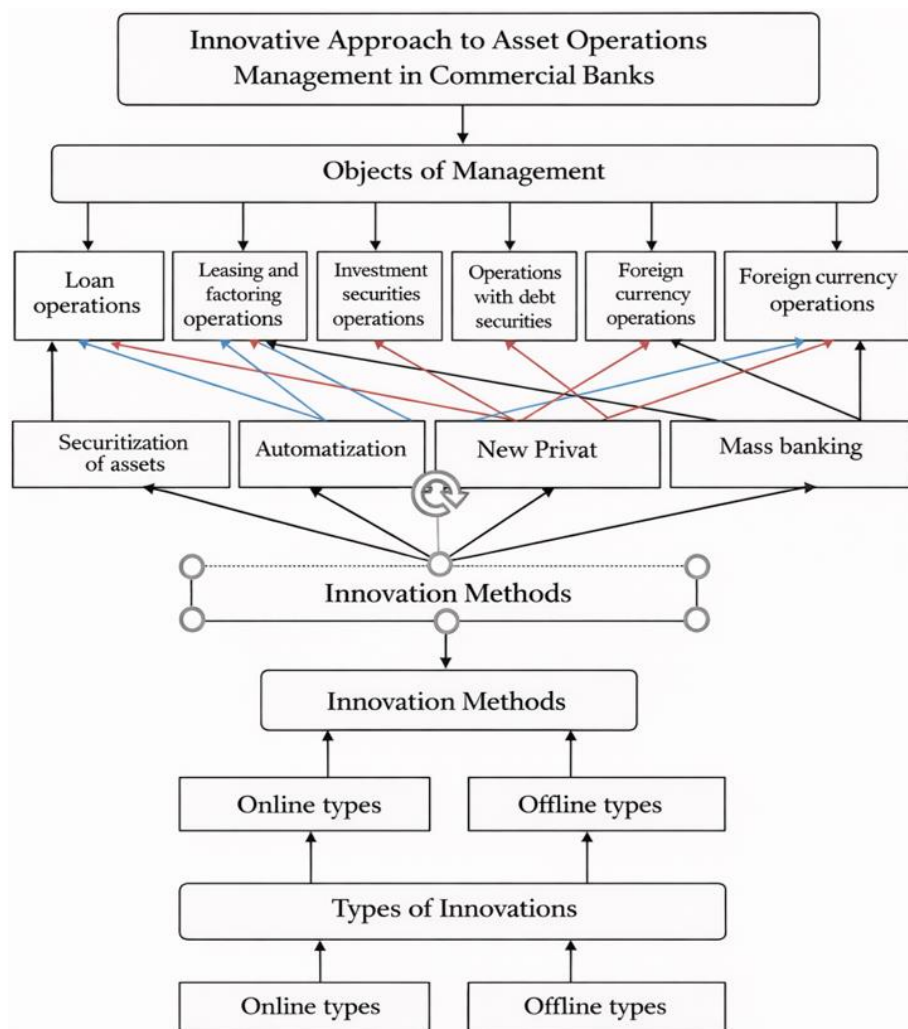


Figure 9. Innovative Approach to Asset Operations Management in Commercial Banks

The application of innovative service methods in commercial banks serves as a basis for shaping an innovative approach to asset operations management.

In the scientific article, the impact of asset operations in banks on economic development was assessed on the basis of economic models.

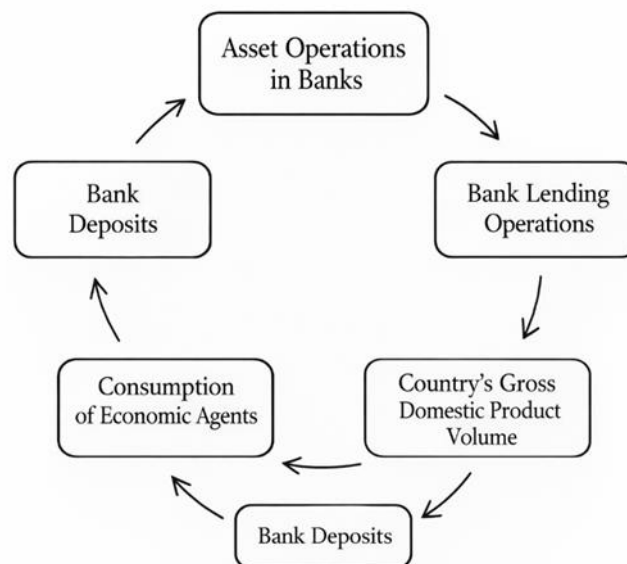


Figure 10. Impact of Asset Operations in Banks on Economic

To test the hypothesis presented in Figure 10, the Granger causality test was applied. The specificity of this method lies in determining the dependence of the endogenous variable on the exogenous variable through an annual lag based on a vector autoregression (VAR) model (Equation 1). Subsequently, the constructed VAR model was tested using the Fisher criterion to determine whether a causal relationship exists or not.

$$\begin{matrix} p & p \\ x_1(t) & a_{11}(j)x_1(t-j) & a_{12}(j)x_2(t-j) & E_1(t) \\ j1 & & j1 \\ p & p \\ x_2(t) & a_{21}(j)x_1(t-j) & a_{22}(j)x_2(t-j) & E_2(t) \\ j1 & & j1 \end{matrix}$$

Based on the results of the Granger causality test, the development of regression models for the interrelationships shown in Figure 9 made it possible to quantitatively assess how changes in certain factors affect changes in other factors. Accordingly, at the initial stage, a correlation matrix was constructed to evaluate the degree of linear relationships among the economic indicators (Table 5).

Table 4.

Granger Causality Test between Bank Asset Operations, Aggregate Demand, and Aggregate Supply

Null Hypothesis	Obs	F-Statistic	Prob.
Credit does not Granger-cause Assets	12	1.56848	0.2736
Assets do not Granger-cause Deposits	12	0.39376	0.6886
Deposits do not Granger-cause Consumption	12	0.86720	0.4608
Consumption does not Granger-cause Value Added (VA)	12	4.94723	0.1558
Value Added (VA) does not Granger-cause Credit	12	21.8222	0.2410

The built correlation matrix indicates that a multiple regression equation incorporating bank asset operations and components of aggregate demand and supply cannot be developed. Multicollinearity is present in the regression model, since the linear correlation among all variables ranges from 0.86 to 0.99, resulting in distortions and inaccuracies in the model's outcomes.

Table 5.

Correlation Matrix of the Relationship between Bank Asset Operations and Aggregate Demand and Aggregate Supply Indicators

No.	Indicator name	Indicator No.	1	2	3	4	5
1	Bank asset operations	1	1				
2	Bank credit operations	2	0.98	1			
3	Gross value added	3	0.97	0.91	1		
4	Bank deposits	4	0.94	0.86	0.98	1	
5	Consumption	5	0.99	0.95	0.99	0.96	1

To represent the interrelationships shown in Figure 9, it is possible to construct pairwise

regression models. Based on several constructed regression matrices, the use of **neural networks** makes it possible to draw conclusions about how a change in one factor will affect the magnitude of change of that factor in the future. For this purpose, regression models must first be developed (**Table 6**).

Based on the results of **Table 6**, it can be noted that, after a certain period following the formation of economic relationships, it is appropriate to use a **neural model** to analyze the extent to which changes in bank asset operations affect bank asset operations themselves. For this purpose, each economic interrelationship was identified using the regression equations constructed in **Table 6**.

Table 6.

Regression Equations between Bank Asset Operations, Aggregate Demand, and Aggregate Supply

Regression equations	R ²	F-statistic	t-Student (t ₁)	t-Student (t ₂)
Credit = Asset × 0.68 + 401.5	0.95	261.0	16.15	3.75
Value Added (VA) = Credit × 6.19 + 8481.6	0.82	54.9	7.40	2.87
Consumption = VA × 0.40 + 1203.5	0.98	897.7	29.96	2.67
Deposit = Consumption × 0.38 – 1337.6	0.92	154.4	12.42	–3.48
Asset = Deposit × 1.21 + 2325.2	0.88	88.7	9.42	5.05

The results of the constructed neural model show that if the national economy follows the given development trend, a **1 percent increase in bank asset operations leads to a 0.77 percent increase in bank asset operations over the course of one year (Figure 11).**

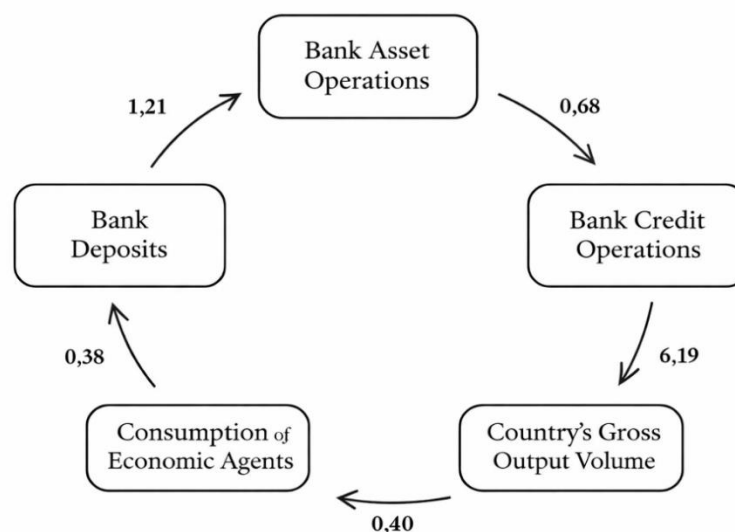


Figure 11. Neural Network Model of Bank Asset Operations

The regression equation constructed between bank credit operations and bank asset operations demonstrates a stable form. This conclusion is supported by the coefficient of determination being equal to **0.95**, the **Fisher criterion** amounting to **261.0**, and the **Student's t-statistics** being **16.15** and

–3.75, respectively. At the same time, according to the model results, under the condition that all other factors remain constant, a **1 percent change in bank asset operations leads to a 0.68 percent change in bank credit operations**.

The regression model illustrating the relationship between value added (as a proxy for aggregate supply) and bank credit operations indicates that fluctuations in bank credit account for 82 percent of the variation in value added, with the remaining 18 percent attributed to other factors. The elevated Fisher criteria, a measure of model stability, validates the robustness of the developed regression model. The Student's t-statistics, which demonstrate the stability of the model's constant parameters, also affirm the accuracy of the calculated parameters. The model results indicate that a 1 percent increase in bank credit results in a 6.19 percent rise in gross value added. The model's findings indicate that a 1 percent rise in gross value added leads to a 0.4 percent increase in aggregate demand among economic actors. The econometric study indicates that the developed model completely fulfills the criteria of an econometric model. The examination of the correlation between bank deposits and aggregate demand reveals that a 1 percent rise in consumption results in a 0.38 percent variation in bank deposits. A 1 percent rise in bank deposits leads to a 1.21 percent increase in bank asset operations.

Conclusions and recommendations

As a result of conducting the scientific research, the following conclusions were drawn: Within the framework of improving the strategy for managing the assets of commercial banks, it is advisable to optimize banks' organizational structures, improve incentive mechanisms for bank governance involving shareholders—particularly large clients—and apply strategic planning methods when introducing new regulatory documents in the banking system, thereby protecting banks from excessive risk exposure.

We believe that managing banks' asset operations according to profitability enables the identification of income enhancement sources and financing decisions; the formulation of strategies to minimize non-income-generating assets within total asset operations; the establishment of primary asset diversification directions, particularly in securities; and the appropriate distribution of asset operations across regions, considering regional characteristics. These solutions address a variety of prevailing issues.

Based on the analysis of the opinions of bank employees and clients, the broader introduction of innovative service types to attract customers, as well as the transition to large-scale online documentation processes in banks in order to save customers' time, primarily contributes to increasing public and business entities' trust in the banking system. Moreover, it enhances the effectiveness of attracting customers to banks.

In order to ensure timely loan repayments, it is necessary to introduce an automatic payment system under which loan interest payments are automatically deducted from clients' accounts. This, in turn, helps prevent the emergence of non-performing loans.

In applying asset securitization, first of all, it is necessary to adopt a law "On Asset Securitization," expand public awareness of the securities market, and promote securitization practices among the population through mass media and online platforms in order to increase the attractiveness of resource mobilization. To ensure the successful implementation of securitization and to reduce investor risks, it is advisable to initially begin securitization through bonds issued against loans granted for investment projects approved under state targeted programs, as such loans generally have a lower risk level. Effective implementation of securitization enables commercial banks to positively address one of the most pressing issues today—resource constraints.

It is appropriate to introduce various innovative methods for managing asset operations. One of the methods proposed in this study is *New Privat*, which facilitates the introduction of modern service types into the banking system. This serves as a factor for attracting customers and increasing bank revenues. This system is primarily designed to attract large clients, whereby banks act as financial advisors in managing large clients' funds and generate profits through this role.

References

1. *World Safest Banks | Top 50 Biggest Banks 2023*. Available at: <https://www.gfmag.com/world-safest-banks-2017-top-50-biggest-banks/>
2. *Consolidated Financial Statements of Sberbank of Russia and Its Subsidiaries for the Year Ended 31 December 2023*.
3. Decree of the President of the Republic of Uzbekistan. *On the Action Strategy for Further Development of the Republic of Uzbekistan*. Decree No. PF-4947, February 7, 2017. Available at: www.lex.uz
4. Sinkey, J. *Commercial Bank Management*. Translated from English. Moscow: Cattalaxy, 1994.
5. Mullajonov, F. *The Banking System of the Republic of Uzbekistan*. Tashkent: Uzbekistan, 2011. 368 p.
6. Sharifkhojaev, M., Abdullaev, Yo. *Management: Textbook*. Tashkent: O'qituvchi, 2001. 704 p.
7. Bekmurodov, A.Sh. *On the Path of Consistently Continuing Uzbekistan's Reform Strategy*. Study guide. Tashkent: Moliya, 2014. pp. 204–227.
8. Karimov, N.G. Opportunities for the development of the scoring method of consumer lending in Uzbekistan. *European Journal of Economics and Management Sciences*, 2016, pp. 55–60.
9. Abdullaeva, Sh.Z. *Bank Risks and Lending*. Tashkent: Moliya, 2002. 304 p.
10. Jumaev, N.Kh. *The Global Financial and Economic Crisis: Essence, Causes, Consequences, and Its Impact on Uzbekistan*. Monograph. Tashkent: University of World Economy and Diplomacy, 2009. 56 p.
11. Olimjonov, O.O. *Financial Management*. Tashkent: Akademiya, 1999. 254 p.
12. Omonov, A.A., Qoraliev, T.M. *Tax Academy, Tashkent Institute of Finance*. Tashkent: Iqtisod–Moliya, 2012. 324 p.
13. <https://uzbekistan2035.uz>
14. <https://thefinancialbrand.com>
15. <https://www.digitalbankingreport.com>
16. <https://www.edgeverve.com>
17. English–Russian Scientific Dictionary. Available at: <http://www.classes.ru/dictionary-english-russian-scienceenru-term-78341.htm>
18. www.lex.uz – Database of legislative acts of the Republic of Uzbekistan
19. www.cbu.uz – Official website of the Central Bank
20. www.banking.com – Regional banks, associations, and publications
21. www.arraydev.com/commerce/JIBC/ – Internet banking and e-commerce journal

The Structure of Equity Capital in Accordance with IFRS in a Market Economy

Murat Abdiev

Doctor of Economics, Professor, Osh Technological University, Kyrgyz Republic, Osh.

E-mail: mabdiev1977@mail.ru, ¹  orcid: 0000-0003-3979-8059

Abstract. This research article comprehensively examines the structure and classification of equity capital in accordance with International Financial Reporting Standards (IFRS) within a modern market economy, clarifying both its theoretical foundations and practical implications. The subject of this study focuses on the financial components, measurement criteria, and reporting disclosure requirements of equity capital in market-driven economic systems. Based on the study's primary findings and a thorough analysis of the nature, characteristics, and economic content of equity capital, a detailed description and breakdown of each capital type are systematically provided. Furthermore, the paper investigates the critical role of corporate equity in ensuring financial stability, evaluating investment attractiveness, and minimizing financial risks for enterprises. The practical part of the research highlights the specific challenges faced by companies when transitioning to IFRS-compliant equity reporting. Ultimately, the results and strategic conclusions of this study offer valuable recommendations for improving accounting policies, enhancing financial transparency, and optimizing capital management structures in contemporary organizations.

Key words: capital, equity, corporation, profit, shares, dividends.

The development of market relations has influenced the emergence of a number of new economic accounting objects. One of these is enterprise capital and, in particular, the enterprise's equity. Equity is an organization's resources—its assets minus the liabilities associated with those assets.

The main difference between corporate accounting and accounting at the individual enterprise and product level is the accounting of capital. On a corporation's balance sheet, equity is reflected in the "Shareholders' Equity" section, which includes the following items:

1. Share capital

- a) advanced capital
- b) reinvested profits

2. Preferred shares

3. Common shares

4. Capital contributions in excess of the par value of common shares. This division of capital into shares in corporations differs from its division in the balance sheets of individual entrepreneurs and companies.

The corporate section "Share Capital" consists of two parts:

- 1) Advanced capital
- 2) Reinvested profits

Advance capital prevents stock investments in the corporation. [1]

Reinvested earnings are the portion of profits received from commercial activities that is reinvested in enterprises not distributed among shareholders. The items grouped under "Advanced Capital" in the balance sheet contain significant information about a corporation's shares.

The unit of ownership in a corporation is a share. A shareholder receives a section certificate certifying their shareholding in the corporation's shares. They can dispose of their ownership as they see fit, but to transfer ownership of a share to another, the certificate must be signed and submitted to the corporation's secretary.

Issued shares are shares that have been continued or sold in another way.

Circulating shares are those shares that have been issued and are outstanding. Shares will not be circulating if they have been repurchased by the corporation or returned to shareholders.[2]

A corporation can issue two types of shares: common and preferred. If only one type of share is issued, it is called common. The aggregate of these shares is called residual capital. This means that in the event of liquidation, all creditors and preferred shareholders have their claims on the corporation's assets satisfied, and only then are the claims of common shareholders considered. In most cases, only common shares grant their holders voting rights, and therefore only common shareholders have the ability to control the corporation's activities.

Dividends are the portion of profits that are distributed among shares. Profits are usually distributed in cash proportional to the number of shares. The board of directors is responsible for declaring dividends. Dividends may be paid at the end of a quarter, half-year, or at another time as determined by the board of directors.

In most states, the board may declare dividends up to an amount equal to reinvested earnings. When dividends are declared, the corporation is essentially paying out the capital invested by the shareholders. Such dividends, called liquidating dividends, are typically paid upon the cessation of operations. However, the presence of a significant amount of profit does not in itself entitle the corporation to distribute dividends, as the corporation may not have cash or other easily distributable forms. In such a case, the corporation would have to borrow to pay the dividends, something the board of directors tries to avoid [4] .

Shareholders should strive to implement a dividend policy that maximizes shareholder wealth. Anyone would agree that if a company lacks sufficiently profitable investment opportunities, it should distribute excess funds among its shareholders. A company is not obligated to pay out its entire utilized balance in every period. In reality, it will want stability and an absolute dividend payout . But over the long term, the total value of net income and senior securities backed by capital growth will correspond to the value of the transformed investment opportunities. To pay higher dividends, a company must believe in shareholder wealth.

In contrast to the effective tax impact studies, the results of financial signaling studies consistently support the hypothesis of a declared dividend effect, with dividend growth predicting an increase in the dividend yield of equity. Therefore, dividends appear to be beneficial to management. Liquidation is the primary criterion for many dividend payment decisions, as dividends represent an outflow of funds. The higher the cash balance and total cash flow, the greater the ability to pay dividends. A growing and highly profitable company may not be liquid, as disruptions can be related to working capital. Since management typically seeks to maintain liquidation reserves to ensure flexibility and protection from uncertainty, it is reluctant to risk reducing these reserves for the sake of paying higher dividends. Liquidation is determined by its individual decision and the decision on a financially determined source of funds to cover this need.

If a company pays higher dividends, it may eventually face the need to increase capital by selling its shares. Under these circumstances, the company's controlling stake may be diluted if its holders are unable or non-shareholders to subscribe for new shares. These shareholders may prefer a low dividend yield and the financing of investment needs from private equity. Such a dividend policy will not maximize overall shareholder wealth, but it may align with the interests of investors as a monitoring body. If competitors or private individuals are closely monitoring the company, low dividends may play into their hands. Competitors may be able to convince shareholders that the company does not maximize their wealth. Furthermore, the fact that they, as competitors, can perform this task better. Consequently, the risk of losing their controlling stake may increase the dividend yield to the benefit of their shareholders. In addition to the dividend yield, stability is another characteristic of the dividend that attracts interest. By stability, we mean the consistency of the relationship between dividends and the line. All other things being equal, stock prices will be higher if it provides a stable dividend over a period of time.

The first date is the official announcement by the board of directors of the intention to pay dividends. The second date is when certain shares are designated as entitled to receive dividends. The

third date is the actual dividend payment to shareholders. At the end of the reporting period, the "declared dividends" account is credited and the "dividend expense" account is debited.

Reinvested profits are thus used to cover the larger amount of dividends declared in a given reporting period. Some companies pay dividends infrequently. This happens when either no profit is made or the profit is used to expand production. In the latter case, the capital is returned to the investor.

A joint-stock company pays dividends as follows: the company's net worth remains at the company's disposal after all taxes have been paid, and other purposes are distributed among shareholders in the form of dividends. A decision regarding the company's net worth must be made by the general meeting of shareholders. Before such a decision is made, the executive body must submit to the general meeting of shareholders a certified annual report, balance sheet, and profit and loss account of the company, approved by the board of directors and the audit committee, for approval. [3]

Dividends may be paid if;

- 1) The authorized capital is fully paid.
 - 2) The amount of the company's net assets after the payment of dividends will be no less than or equal to the sum of the authorized capital and reserve capital.
 - 3) The dividend payment will not reduce the authorized capital.
 - 4) The payment of a dividend will not affect the company's ability to repay debt as it falls due.
- If dividends are due, they are paid on preferred shares in accordance with the terms of issue and the number of shares. However, dividends on preferred shares cannot be paid if doing so would infringe on the rights of shareholders.

The initial board of directors is determined by the memorandum of association for a period lasting until the company's first general meeting. If the board of directors is not elected in accordance with the memorandum of association, a board of directors must be elected within one month of the company's incorporation, and a shareholders' meeting must be held within that month.

The board of directors has the authority to act on behalf of the company. It oversees the management board and performs other functions in accordance with the charter. A candidate for a management change is nominated by two or more major shareholders, or by any member of the board of directors, and must be elected by the general meeting of shareholders.

List of references:

1. Abdiev M.Zh. Preparation of financial statements in accordance with IFRS, in accordance with the developed Concept of financial statements [Text] / M.Zh.Abdiev // Bulletin of Osh State University, -O sh, 2013.-№3 -P.123-126
2. Abdiev M.Zh. Financial accounting [Text]: a textbook for universities / M.Zh. Abdiev . - Osh : 2018. - 210 p.
3. Law of the Kyrgyz Republic "On Joint Stock Companies" [Text]. - Bishkek, March 27, 2003, No. 64.
4. International Financial Reporting Standards - IFRS. Bishkek, 2001. Resolution of the State Service for Regulation and Supervision of the Financial Market under Government of the Kyrgyz Republic dated July 28, 2010 No. 18, "On International Financial Reporting Standards". Bishkek, 2002.
5. Abdiev, M. Zh., & Maatov, K. M. (2017). Improvement of management in agriculture of the Kyrgyz Republic. Economics and Business: Theory and Practice, (2), 4–7. Novosibirsk.
6. Abdiev, M. Zh., Umarov, S. T., & Attokurova, G. A. (2017). General efficiency of mechanisms for using production potential in agriculture. Economics and Business: Theory and Practice, (5), 7–9.
7. Abdiev, M. Zh., & Batyr uulu, A. (2010). Domestic and foreign experience of milk production. Alatau Academic Studies, (1), 164–171. Bishkek.
8. Abdymalikov, K., & Zhumabaev, Zh. (2012). Agricultural economics: textbook. Bishkek.
9. National Statistical Committee of the Kyrgyz Republic. (2019). Kyrgyzstan in figures: 2018: statistical collection. Bishkek.
10. National Statistical Committee of the Kyrgyz Republic. (2019). Agriculture of the Kyrgyz Republic (2014-2018). Bishkek.
11. On the development of agriculture of the KR: Law of the KR. (n.d.). Retrieved from www.cac-civillaw.org
12. Popov, N. A. (2009). Economics of agricultural production. Moscow: EKMOS.

13. Buzdalov I.N. Khozyaistvennyi mekhanizm v agropromyshlennoi sfere stran SEV [Tekst] / I.N. Buzdalov .-M.: Nauka, 1998.-295 s.
14. Gershkovich B.Ya. Material'nye interesy i osobennosti deistviya ekonomicheskikh zakonov v sel'skom khozyaistve [Tekst] /B.Ya.Gershkovich, G.I. Zinchenko. – M.: Ekonomika, 1976.-204s.
15. Zakirov A.Z. Problemy razvitiya APK Kyrgyzstana v usloviyakh rynochnoi ekonomiki [Tekst] / A.Z.Zakirov.-Osh : Oshsk.obl.tip., 2007.
16. Polovinkin P. Ekonomicheskii mekhanizm APK v usloviyakh perekhoda k rynku [Tekst] / P.Polovinkin // APK ekonomika, upravlenie.-1991.-№4.-S.62-68.

Investment Attraction Mechanisms of the Eurasian Economic Union Member States for Mini-Hydropower Plant Construction in the Kyrgyz Republic: Prospects and Policy Implications

Maksatbek Sulaimankulov

Osh Kyrgyz-Uzbek University named after B. Sydykov, Kyrgyz Republic

E-mail: maksatbeksulaimankulov@gmail.com,  orcid: 0009-0001-7303-4282

Abstract: The Kyrgyz Republic possesses substantial small-scale hydropower potential, with an estimated technically exploitable capacity exceeding 8,600 MW from over 80 rivers suitable for mini-hydropower plant (mini-HPP) development. Despite this resource endowment, the country's mini-HPP sector remains significantly underdeveloped owing to constrained domestic capital, regulatory fragmentation, and institutional barriers to foreign direct investment. This paper examines the principal mechanisms through which member states of the Eurasian Economic Union (EAEU) — particularly the Russian Federation, the Republic of Kazakhstan, and the Republic of Belarus — can channel investment into mini-HPP construction in Kyrgyzstan. Drawing on an integrative analysis of EAEU regulatory instruments, bilateral investment treaties, energy sector frameworks, and development bank financing modalities, the study identifies five core investment channels: (1) EAEU multilateral investment instruments, including the Eurasian Development Bank (EDB) and the Eurasian Fund for Stabilization and Development (EFSD); (2) Russian state-backed investment programs under RUSNANO, VEB.RF, and the Russian-Kyrgyz Development Fund; (3) Kazakhstani sovereign and private capital via the Samruk-Kazyna national holding and Kazakhstani commercial banks; (4) public-private partnership (PPP) frameworks aligned with EAEU standards; and (5) green finance and carbon credit mechanisms consistent with the Paris Agreement. The research further evaluates the regulatory environment, identifies key obstacles including tariff policy inconsistencies, land allocation procedures, and limited grid integration capacity, and proposes a set of evidence-based policy recommendations to enhance investment attractiveness. The findings contribute to the broader literature on regional energy integration and transition finance in post-Soviet economies and offer practical guidance for policymakers seeking to leverage EAEU institutional architecture for sustainable energy development.

Keywords: mini-HPP; hydropower investment; Eurasian Economic Union; EAEU; Kyrgyz Republic; renewable energy finance; public-private partnership; green finance; energy transition; regional economic integration.

1. Introduction

The global energy transition, driven by climate commitments enshrined in the Paris Agreement (2015) and reaffirmed at COP26 and COP28, has placed small-scale renewable energy generation at the forefront of sustainable development agendas worldwide. Among renewable technologies, run-of-river mini-hydropower plants (mini-HPPs) — conventionally defined as installations with generating capacity below 30 MW — offer particular advantages for mountainous, water-rich, and electricity-deficient regions: predictable output, minimal carbon footprint, low land occupation relative to reservoir-based hydropower, and compatibility with distributed energy systems [11; 25].

The Kyrgyz Republic represents an archetypal case in this regard. Situated in the heart of Central Asia, the country contains approximately 20% of Central Asia's freshwater reserves and an estimated 142 billion kWh of theoretical annual hydropower potential, of which 73 billion kWh is considered technically exploitable [18]. Notwithstanding this considerable endowment, the installed capacity of mini-HPPs barely exceeds 100 MW, serving primarily rural off-grid communities in the Naryn, Jalal-Abad, and Osh regions [15]. The gap between potential and actual development is attributable to a cluster of interrelated factors: limited domestic public investment capacity, shallow capital markets, insufficient energy tariff revenues to service private debt, cumbersome permitting procedures, and the absence of a coherent framework for attracting foreign investment specifically into the small-scale hydropower segment.

The Eurasian Economic Union (EAEU), established by the Treaty on the Eurasian Economic Union signed in Astana in May 2014 and in force since January 2015, provides a supra-national institutional environment that, in principle, ought to facilitate intra-regional investment flows among its five member states: the Russian Federation, the Republic of Kazakhstan, the Republic of Belarus, the Republic of Armenia, and the Kyrgyz Republic itself. The EAEU framework encompasses provisions on the free movement of capital, harmonized investment protection standards, a common electricity market in development, and several multilateral financial institutions — most notably the Eurasian Development Bank (EDB) and the Eurasian Fund for Stabilization and Development (EFSD) — with explicit mandates covering infrastructure and energy financing [8; 23].

Yet the extent to which EAEU institutional architecture is effectively mobilized to channel investment into Kyrgyzstan's mini-HPP sector remains inadequately examined in the scholarly literature. Studies of hydropower investment in the region tend to focus on large-scale projects such as the Kambar-Ata and Upper Naryn cascades [5; 13], while the mechanics, feasibility, and policy prerequisites of small-scale hydropower investment through EAEU-specific channels have received comparatively little systematic attention.

This paper addresses that gap. Its central research question is: What mechanisms are available through EAEU member states' investment instruments and institutional frameworks to finance mini-HPP construction in the Kyrgyz Republic, and what policy conditions are necessary for these mechanisms to be effectively operationalized? The paper proceeds as follows. Section 2 reviews the relevant literature on regional energy investment, small hydropower finance, and EAEU economic integration. Section 3 describes the research methodology. Section 4 provides a comprehensive analysis of the Kyrgyz Republic's mini-HPP investment landscape, including resource estimates, current installed capacity, and regulatory environment. Section 5 systematically examines five EAEU-based investment mechanisms. Section 6 presents a discussion of barriers and policy recommendations. Section 7 concludes.

2. Literature review

2.1 *Small Hydropower and Sustainable Energy Finance*

The economics of mini-HPP development have been the subject of growing academic interest since the early 2000s, coinciding with the proliferation of feed-in tariff policies and renewable portfolio standards across both developed and emerging economies. Paish (2002) provided one of the earliest systematic assessments of the global small hydropower resource base, establishing a typological framework — micro (<100 kW), mini (100 kW–1 MW), and small (1–30 MW) — that continues to inform regulatory definitions in multiple jurisdictions [20]. Subsequent empirical studies by IRENA consistently identify capital cost reduction, grid connectivity, and streamlined environmental permitting as the three principal determinants of small hydropower investment realization rates [11; 12].

In the context of developing and transition economies, additional barriers — including weak property rights, currency risk, and underdeveloped power purchase agreement (PPA) frameworks — have been documented by Deichmann et al. (2011), who analyzed off-grid electrification investments across Sub-Saharan Africa and South Asia [4]. Their conclusions regarding the importance of institutional quality and regulatory stability resonate strongly with Central Asian contexts. Fankhauser and Jotzo (2018) further demonstrate that blended finance instruments, combining concessional public capital with commercial debt and equity, significantly enhance the risk-adjusted returns that render small renewable energy projects bankable [9].

2.2 *Investment Frameworks in the EAEU Space*

The literature on investment within the EAEU framework is more recent and, to date, less developed than corresponding bodies of work on the EU single market or ASEAN economic integration. Vinokurov (2017) provides a foundational analysis of EDB investment operations, demonstrating that the bank's portfolio has historically been concentrated in transport infrastructure and industrial modernization, with energy projects representing a secondary priority [24]. Libman and

Vinokurov (2012) offer a broader political-economy perspective on Eurasian integration, identifying the asymmetric economic weights of Russia and Kazakhstan relative to smaller member states — including Kyrgyzstan — as a structural impediment to equitable capital allocation [14].

More recent contributions have begun to examine the EAEU's energy governance architecture more specifically. Belova and Kirdina-Chandler (2021) analyse the Treaty provisions on the Common Electricity Market of the EAEU and argue that, despite formal adoption, its practical implementation remains constrained by divergent national tariff regimes and the persistence of bilateral rather than multilateral trading patterns [2]. Nikolaev (2023) reviews the EDB's green financing instruments and identifies a nascent but expanding commitment to climate-aligned projects, including small renewables, in the post-2020 period [19].

2.3 Hydropower Investment in Kyrgyzstan

Country-specific studies of Kyrgyzstan's energy sector are predominantly policy-oriented rather than academically rigorous. The World Bank's Energy Sector Assistance Program assessments (2019, 2022) and the ADB's Country Partnership Strategy for Kyrgyzstan (2023–2027) document the structural deficit between electricity demand growth and generation investment, the chronic underpricing of electricity that erodes commercial viability, and the dependence on the large but aging Toktogul reservoir hydropower complex [1; 26]. Isaev (2022) examines governance failures in the Kyrgyz energy sector through the lens of resource curse theory [13], while Dzyubenko and Sanakoyev (2021) focus on geopolitical dimensions of transboundary water and energy relations in the Fergana Valley [5].

The specific intersection of EAEU investment mechanisms and mini-HPP development in Kyrgyzstan has, to the author's knowledge, not been systematically examined in peer-reviewed literature. This study therefore makes an original contribution to both the regional economic integration literature and the applied literature on small hydropower finance in transition economies.

3. Research methodology

This study employs an integrative mixed-method research design, combining systematic document analysis with comparative institutional analysis and qualitative synthesis of primary and secondary data. This approach is consistent with established methodological frameworks for policy-oriented research in development economics [3; 22].

The primary data sources comprise: (a) official treaty texts, regulatory acts, and strategic documents of the EAEU and its member states, accessed through the official portal of the Eurasian Economic Commission [8; 23]; (b) project and portfolio data from the Eurasian Development Bank and the Eurasian Fund for Stabilization and Development [7]; (c) national energy sector statistics and regulatory documentation from the Ministry of Energy of the Kyrgyz Republic [15; 16], the National Energy Holding Company (OJSC National Electric Grid of Kyrgyzstan) [17], and the State Committee for Industry, Energy and Subsoil Use of the Kyrgyz Republic; (d) bilateral investment treaty texts between the Kyrgyz Republic and EAEU member states; and (e) World Bank, ADB, and IRENA databases on energy investment and renewable energy capacity [1; 11; 12; 25; 26].

Comparative institutional analysis is employed to assess the design features, operational mechanisms, and empirical track records of EAEU-based investment instruments relative to international best-practice benchmarks. This involves a structured comparison across five dimensions: (1) eligibility criteria and project selection procedures; (2) financial terms (interest rates, tenors, and equity requirements); (3) currency and sovereign risk mitigation provisions; (4) environmental and social safeguard standards; and (5) transaction cost and procedural complexity.

The study is subject to standard limitations associated with qualitative institutional analysis, including the challenge of attributing investment outcomes to specific institutional mechanisms in complex, multi-causal environments, and potential gaps in the availability of disaggregated project-level financing data for the mini-HPP segment. These limitations are acknowledged and addressed through triangulation across multiple data sources.

4. The MINI-HPP investment landscape in the Kyrgyz Republic

4.1 Resource Endowment and Technical Potential

The Kyrgyz Republic's topography — characterized by the Tian Shan and Pamir-Alay mountain systems occupying approximately 94% of its territory — generates an extensive network of fast-flowing rivers and streams with high hydraulic gradient, ideal for run-of-river power generation. The Ministry of Energy's 2022 inventory identifies 318 river segments technically suitable for mini-HPP development (capacity range: 0.1–30 MW), with an aggregate estimated capacity of approximately 8,600 MW and annual generation potential of 38 billion kWh [15].

Of particular strategic importance are the Naryn, Chui, Talas, Kara Darya, and At-Bashy river basins, where topographic and hydrological conditions combine favorable head and flow characteristics with proximity to underserved communities and existing road infrastructure. International assessments corroborate this potential: the ADB (2023) estimates that the Kyrgyz Republic could expand mini-HPP installed capacity from approximately 100 MW to over 600 MW by 2035 if adequate financing and regulatory conditions are established [1].

4.2 Current Installed Capacity and Investment Gap

As of January 2024, the Kyrgyz Republic's total installed electricity generation capacity stood at approximately 4,180 MW, of which large-scale hydropower accounted for 3,800 MW (predominantly the Toktogul cascade on the Naryn River), thermal generation for 270 MW, and mini-HPPs for approximately 110 MW distributed across roughly 80 operational stations [16]. The investment gap between current and technically feasible mini-HPP capacity is therefore substantial, implying the need for cumulative capital expenditure on the order of USD 2–4 billion over a 10–15 year horizon, based on international unit cost benchmarks of USD 1,500–2,500 per kW for run-of-river mini-HPPs in mountainous terrain [12].

4.3 Regulatory and Institutional Framework

The legal framework governing mini-HPP development in Kyrgyzstan has undergone significant but incomplete reform since the sector's privatization in the late 1990s. Key legislative instruments include the Law on Renewable Energy Sources (2008, amended 2017), the Law on Concessions (1992, amended 2019), the Law on Public-Private Partnerships (2021), the Electricity Law (1997, amended 2022), and the National Strategy for Sustainable Development (2021–2026). Collectively, these instruments establish a licensing regime, a feed-in tariff mechanism administered by the Authorized Body for Energy Regulation, and a concession procedure for the use of water resources [18].

Several regulatory deficiencies, however, continue to constrain investment. First, the electricity tariff applicable to mini-HPP output under the 2017 amendment (approximately USD 0.043–0.067 per kWh depending on capacity) is insufficient to service commercial debt at market rates, necessitating concessional financing or grant components. Second, the land allocation procedure for mini-HPP construction sites requires resolution of overlapping jurisdiction between the State Agency for Land Resources, the Ministry of Natural Resources and Ecology, and local self-governance bodies (ayil okmotus), a process that can extend to three years. Third, grid connection standards and technical requirements for distributed generation integration remain inconsistently applied, adding uncertainty to project timelines [26].

5. EAEU investment mechanisms for Mini-HPP development

5.1 EAEU Multilateral Financial Institutions: EDB and EFSD

The Eurasian Development Bank (EDB), established in 2006 and headquartered in Almaty, Kazakhstan, constitutes the primary multilateral investment vehicle within the EAEU space. With authorized capital of USD 7 billion and six member states — Russia, Kazakhstan, Armenia, Belarus, Kyrgyzstan, and Tajikistan — the EDB's mandate encompasses the financing of integration projects generating positive externalities for the EAEU economic space. The bank's sector priorities explicitly

include energy infrastructure, and its Environmental and Social Policy (revised 2022) incorporates climate risk screening aligned with the TCFD framework [7].

For mini-HPP projects in Kyrgyzstan, the EDB offers several relevant financing instruments: (a) sovereign loans at preferential rates (typically SOFR + 150–250 basis points with 15–20-year tenors) for state-sponsored projects; (b) non-sovereign loans directly to project companies; (c) equity participation in project vehicles; and (d) co-financing arrangements with international financial institutions (IFC, EBRD, ADB). The bank has previously financed the Kambar-Ata-2 preparatory works and several transmission infrastructure projects in Kyrgyzstan [24]. Mini-HPPs, however, require adaptation of standard EDB project assessment criteria to account for smaller deal sizes (typically USD 5–30 million per project), which may require a programmatic or aggregated portfolio approach to achieve transactional efficiency.

The Eurasian Fund for Stabilization and Development (EFSD), managed by the EDB secretariat with USD 8.5 billion in authorized capital contributed primarily by Russia (88%) and Kazakhstan (10%), provides concessional lending and grants to eligible member states [8]. EFSD credit facilities applicable to Kyrgyzstan carry interest rates as low as 1–3% per annum with grace periods of up to five years and total tenors of 15–20 years. An EFSD programmatic credit facility specifically targeting mini-HPP development — analogous to EFSD Program Lending instruments used in Belarus and Armenia — would represent a high-impact deployment of this mechanism.

5.2 Russian Investment Instruments

The Russian Federation, as the EAEU's largest economy, maintains several state-backed investment instruments relevant to Kyrgyz energy infrastructure. The Russian-Kyrgyz Development Fund (RKDF), established in 2015 with an initial capitalization of USD 500 million contributed by Russia, was specifically designed to support investment in the Kyrgyz real economy following the country's accession to the EAEU. As of 2023, the RKDF has disbursed approximately USD 320 million in project financing across agriculture, manufacturing, and energy sectors, with an average loan rate of 6–8% per annum in USD or KGS terms [21].

The RKDF's energy portfolio has been limited primarily to grid rehabilitation and solar energy pilot projects. Expanding the fund's mandate to systematically co-finance mini-HPP project preparation and construction — particularly in remote areas of Naryn and Jalal-Abad oblasts where energy access deficits are most acute — would align with both Russia's stated strategic objectives in the EAEU space and Kyrgyzstan's National Energy Program targets [18]. VEB.RF (the Russian state development corporation) and the Russian Direct Investment Fund (RDIF) represent additional channels for larger-scale project financing and equity investment, respectively, subject to the resolution of sanctions-related constraints on Russian cross-border financial transactions that have emerged in the post-2022 geopolitical environment.

5.3 Kazakhstani Investment Channels

Kazakhstan, as Kyrgyzstan's northern neighbor and second-largest EAEU economy, offers several investment channels that are geographically proximate, culturally compatible, and institutionally accessible. The Samruk-Kazyna National Welfare Fund, which manages state assets in energy, mining, and infrastructure, has expressed strategic interest in Central Asian energy connectivity through its subsidiary Samruk-Energy. Direct equity investment by Samruk-Energy in Kyrgyz mini-HPP projects through joint venture structures would leverage Kazakhstan's considerable hydropower engineering expertise accumulated through the management of the Irtysh, Syrdarya, and Ili river cascades [14].

The Development Bank of Kazakhstan (DBK) and Kazakh private commercial banks — including Halyk Bank, Kaspi Bank, and Bank Center Credit — have established correspondent relationships with Kyrgyz banks and could, in principle, extend project finance loans to bankable mini-HPP project companies under bilateral investment guarantee frameworks. The 2014 Bilateral Investment Treaty (BIT) between Kazakhstan and the Kyrgyz Republic provides substantive investment protection standards — fair and equitable treatment, full protection and security, and prohibition of expropriation without compensation — that support investor confidence [23].

5.4 Public-Private Partnership Frameworks

The PPP mechanism represents arguably the most versatile investment channel for mini-HPP development, as it enables the combination of public risk mitigation (through government guarantees, concessional financing, and land allocation) with private sector construction and operational efficiency. The Kyrgyz Republic's Law on Public-Private Partnerships (2021) establishes a framework broadly consistent with EAEU PPP standards and UNCITRAL guidelines, providing for Build-Operate-Transfer (BOT) concessions, lease concessions, and joint venture arrangements [18].

Within the EAEU context, PPP frameworks can be structured to allow EAEU member state entities to serve as private partners in Kyrgyz PPPs, benefiting from the investment protection provisions of both the EAEU Treaty [23] and applicable bilateral investment treaties. The EAEU's 2020 Guidelines on Member State Support for PPP Projects provide a template for such arrangements. A streamlined procedure for EAEU-origin private investors to participate in Kyrgyz PPP tenders — including pre-qualification criteria, standardized concession agreement templates, and an integrated dispute resolution mechanism — would significantly reduce transaction costs and enhance the attractiveness of this channel.

5.5 Green Finance and Carbon Market Mechanisms

The global expansion of sustainable finance — encompassing green bonds, sustainability-linked loans, climate funds, and voluntary carbon markets — presents an additional set of investment channels that can be accessed through EAEU frameworks and aligned with Kyrgyzstan's nationally determined contributions (NDCs) under the Paris Agreement. Kyrgyzstan's updated NDC (submitted 2021) includes a conditional mitigation target of 44% reduction in greenhouse gas emissions by 2030 relative to 1990 levels, contingent on international financial support [10].

EAEU-based green finance mechanisms include the EDB's Green Finance Framework (2021), which enables the issuance of EAEU green bonds certified against ICMA Green Bond Principles [7; 19], and the Astana International Financial Centre (AIFC) Green Finance Centre, which provides a regulatory and capital market infrastructure for climate-aligned securities in the EAEU space. Mini-HPP projects, with their demonstrably low lifecycle carbon emissions (estimated at 4–11 g CO₂-eq/kWh according to IPCC AR6), are well-suited for certification under these frameworks [10], enabling access to concessional climate finance from the Green Climate Fund (GCF), the Climate Investment Funds (CIF), and the GEF-financed Least Developed Countries Fund.

The voluntary carbon market represents an additional revenue stream: mini-HPP operators can generate Verified Carbon Units (VCUs) under Verra's Verified Carbon Standard (VCS) or Gold Standard credits, the revenues from which can contribute to project debt service. The Russian and Kazakhstani national carbon markets, currently in pilot phases, may in due course provide intra-EAEU demand for such credits, creating a region-internal market-based incentive for clean energy investment [19].

6. Barriers, discussion, and policy recommendations

6.1 Principal Barriers

The analytical framework developed in the preceding sections permits identification of five principal barriers to the effective utilization of EAEU investment mechanisms for mini-HPP development in Kyrgyzstan.

First, tariff inadequacy is the most fundamental commercial barrier. The current regulated electricity tariff of approximately USD 0.04–0.07/kWh for mini-HPP output is below the level required to achieve an adequate debt service coverage ratio (DSCR) for commercially financed projects. International benchmarks suggest a minimum viable tariff in the range of USD 0.08–0.12/kWh for run-of-river mini-HPPs in mountainous terrain under commercial financing terms [26]. In the absence of tariff reform, the systemic reliance on concessional or grant financing limits the scale of investment that can be mobilized.

Second, regulatory fragmentation and procedural complexity impose substantial transaction costs. The multi-agency permitting process — spanning environmental impact assessment, water rights

allocation, land registration, and grid connection approval — involves at least seven different government bodies and can require three to five years for project development. This timeline significantly exceeds the 18–24 months standard in comparable investment environments [6].

Third, capacity constraints within the national transmission and distribution system impose a technical ceiling on mini-HPP integration. The aging grid infrastructure, particularly in remote oblasts, lacks the automated frequency regulation and grid stabilization capabilities required to safely absorb significant distributed generation without risk of instability [17].

Fourth, limited institutional capacity within Kyrgyz government bodies — particularly the Ministry of Energy's Investment Department and the PPP Development Centre — constrains the country's ability to prepare bankable project documentation, conduct competitive tenders, and negotiate complex financing agreements with EAEU institutional investors [15].

Fifth, the post-2022 geopolitical environment has created transactional uncertainties affecting Russian investment channels. VEB.RF and Russian state banks face secondary sanctions risk on cross-border transactions, reducing the practical accessibility of Russian state-backed financing in the near term [21].

6.2 Policy Recommendations

On the basis of the preceding analysis, this paper advances the following policy recommendations, addressed to the Kyrgyz government, the EAEU institutional bodies, and EAEU member state investment agencies.

Recommendation 1: Adopt a Cost-Reflective, Differentiated Feed-in Tariff. The Kyrgyz government should revise the mini-HPP feed-in tariff to a level that reflects actual capital and operating costs while ensuring affordability for end consumers through an explicit cross-subsidy design. A capacity-banded tariff structure — distinguishing between micro-HPPs (<1 MW), mini-HPPs (1–10 MW), and small HPPs (10–30 MW) — with periodic review linked to a standardized cost benchmarking methodology, would improve investor confidence and reduce reliance on concessional financing [11; 12; 26].

Recommendation 2: Establish a One-Stop-Shop Investment Facilitation Centre. A dedicated renewable energy investment facilitation unit, co-located with the Ministry of Energy and staffed with specialists in project finance, environmental permitting, and land management, should be established to coordinate the permitting process across all relevant agencies, provide pre-feasibility assessment support to prospective investors, and maintain a pipeline of investment-ready projects [6].

Recommendation 3: Launch an EDB/EFSD Programmatic Facility for Kyrgyz Mini-HPP Development. The EDB and EFSD should establish a dedicated programmatic financing facility — with an initial envelope of USD 200–300 million — specifically targeting mini-HPP development in EAEU member states with high small hydropower potential, with Kyrgyzstan as the pilot recipient. This facility should combine EFSD concessional lending for government on-lending, EDB non-sovereign project finance loans, and a first-loss guarantee mechanism to mobilize additional private capital [7; 8; 19; 24].

Recommendation 4: Develop a Standardized EAEU PPP Template for Mini-HPP Concessions. The Eurasian Economic Commission should develop, in cooperation with the UNCITRAL and IFC model PPP agreement frameworks, a standardized BOT concession agreement template for EAEU-origin investors in Kyrgyz mini-HPP projects, incorporating pre-agreed dispute resolution procedures (ICSID or UNCITRAL arbitration), stabilization clauses, and grid connection guarantees [23].

Recommendation 5: Register Kyrgyz Mini-HPP Projects in EAEU Green Finance and Carbon Credit Markets. The Kyrgyz government, in partnership with the EDB Green Finance Centre and the AIFC, should develop a streamlined registration procedure for mini-HPP carbon credits under the Russian and Kazakhstani voluntary carbon registries. Simultaneously, the government should complete the pipeline of mini-HPP projects eligible for GCF and GEF funding under the Paris Agreement framework, leveraging UNDP and UNEP implementing entity status [9; 10; 19].

7. Conclusion

This paper has demonstrated that the EAEU institutional architecture provides a substantive, if presently underutilized, set of investment mechanisms applicable to mini-HPP development in the Kyrgyz Republic. The EDB and EFSD [7; 8], the Russian-Kyrgyz Development Fund [21], Kazakhstani sovereign and private capital channels [14], EAEU-compatible PPP frameworks [23], and emerging green finance instruments [9; 19] collectively constitute a portfolio of financing options capable, in aggregate, of bridging a significant portion of the estimated USD 2–4 billion investment gap in the Kyrgyz mini-HPP sector.

The realization of this potential, however, is contingent on overcoming a set of well-defined regulatory, institutional, and financial barriers. Chief among these are the inadequacy of the current feed-in tariff [26], procedural complexity in permitting [6], grid integration constraints [17], and limited institutional project preparation capacity [15]. The policy recommendations advanced in this paper address these barriers through a combination of domestic regulatory reform and EAEU-level institutional innovation.

The findings carry implications beyond Kyrgyzstan. The EAEU contains several member states with analogous combinations of substantial small hydropower potential, limited domestic capital, and access to the EAEU's supra-national financial infrastructure — Armenia and Tajikistan (observer) being notable examples [2; 14]. The analytical framework and policy recommendations developed here are, with appropriate contextual adaptation, applicable to these cases as well. More broadly, the paper contributes to the emerging literature on how regional economic integration institutions in the post-Soviet space can be leveraged for the energy transition [2; 19], a research agenda whose policy relevance is increasing as EAEU member states align their long-term energy strategies with the global low-carbon transition.

Future research should address several questions not fully resolved in this study: the empirical impact of EAEU investment protection provisions on actual FDI flows in the energy sector; the comparative cost-effectiveness of different financing instruments; and the distributional effects of mini-HPP development on rural energy poverty in Kyrgyzstan. Rigorous quantitative assessment of these dimensions would further strengthen the evidence base for the policy recommendations advanced here.

References

1. Asian Development Bank (ADB). (2023). Country Partnership Strategy: Kyrgyz Republic, 2023–2027. Manila: ADB. <https://doi.org/10.22617/TCS230117-2>
2. Belova, M., & Kirdina-Chandler, S. (2021). The common electricity market of the EAEU: Institutional design and implementation challenges. *Problems of Economic Transition*, 63(4), 217–241. <https://doi.org/10.1080/10611991.2021.2005411>
3. Bryman, A. (2016). *Social Research Methods* (5th ed.). Oxford University Press.
4. Deichmann, U., Meisner, C., Murray, S., & Wheeler, D. (2011). The economics of renewable energy expansion in rural Sub-Saharan Africa. *Energy Policy*, 39(1), 215–227. <https://doi.org/10.1016/j.enpol.2010.09.034>
5. Dzyubenko, O., & Sanakoyev, I. (2021). Geopolitics of water and energy in the Syrdarya basin: Kyrgyzstan, Uzbekistan and Tajikistan. *Central Asian Survey*, 40(3), 367–385. <https://doi.org/10.1080/02634937.2021.1908552>
6. European Bank for Reconstruction and Development (EBRD). (2021). *EBRD Renewable Energy Framework: Country Assessment — Central Asia*. London: EBRD.
7. Eurasian Development Bank (EDB). (2022). *EDB Environmental and Social Policy* (rev. ed.). Almaty: EDB. <https://eabr.org/en/compliance/esg/>
8. Eurasian Economic Commission. (2023). *Annual Report on the State of Competition in the EAEU Markets*. Moscow: EEC. <https://eurasiancommission.org>
9. Fankhauser, S., & Jotzo, F. (2018). *Economic growth and development with low-carbon energy*. Wiley Interdisciplinary Reviews: Climate Change, 9(1), e495. <https://doi.org/10.1002/wcc.495>
10. Intergovernmental Panel on Climate Change (IPCC). (2022). *AR6 Working Group III: Mitigation of Climate Change — Chapter 6: Energy Systems*. Cambridge University Press. <https://doi.org/10.1017/9781009157926.008>

11. International Renewable Energy Agency (IRENA). (2020). Renewable Power Generation Costs in 2019. Abu Dhabi: IRENA. ISBN 978-92-9260-166-3.
12. International Renewable Energy Agency (IRENA). (2023). Renewable Power Generation Costs in 2022. Abu Dhabi: IRENA. ISBN 978-92-9260-544-9.
13. Isaev, M. (2022). Energy governance and the resource curse in Kyrgyzstan: Structural constraints and reform pathways. *Post-Soviet Affairs*, 38(5), 421–442. <https://doi.org/10.1080/1060586X.2022.2094503>
14. Libman, A., & Vinokurov, E. (2012). *Holding-Together Regionalism: Twenty Years of Post-Soviet Integration*. Palgrave Macmillan. <https://doi.org/10.1057/9781137007100>
15. Ministry of Energy of the Kyrgyz Republic. (2022). *Inventory of Mini-HPP Development Sites in the Kyrgyz Republic*. Bishkek: Ministry of Energy. [In Russian]
16. Ministry of Energy of the Kyrgyz Republic. (2024). *Electricity Sector Statistical Bulletin — January 2024*. Bishkek: Ministry of Energy. [In Russian]
17. National Energy Holding Company (OJSC National Electric Grid of Kyrgyzstan). (2023). *Annual Technical Report on Grid Infrastructure*. Bishkek: NEGK. [In Russian]
18. National Energy Program of the Kyrgyz Republic. (2023). *National Energy Program of the Kyrgyz Republic for 2023–2032*. Approved by Resolution of the Government of the Kyrgyz Republic No. 214 of April 24, 2023.
19. Nikolaev, A. (2023). Green finance in the EAEU: Status, prospects, and institutional constraints. *Russian Journal of Economics*, 9(2), 112–131. <https://doi.org/10.32609/j.ruje.9.114723>
20. Paish, O. (2002). Small hydro power: Technology and current status. *Renewable and Sustainable Energy Reviews*, 6(6), 537–556. [https://doi.org/10.1016/S1364-0321\(02\)00006-0](https://doi.org/10.1016/S1364-0321(02)00006-0)
21. Russian-Kyrgyz Development Fund (RKDF). (2023). *Annual Report 2022–2023*. Bishkek: RKDF. <https://rfca.gov.kg>
22. Teddlie, C., & Tashakkori, A. (2009). *Foundations of Mixed Methods Research*. SAGE Publications.
23. Treaty on the Eurasian Economic Union. (2014). Signed in Astana, 29 May 2014; entered into force 1 January 2015. EEC Official Portal. <https://docs.eaeunion.org>
24. Vinokurov, E. (2017). Eurasian Development Bank: A decade of operation. *Eurasian Economic Review*, 7(2), 267–281. <https://doi.org/10.1007/s40822-016-0062-2>
25. World Bank. (2021). *Hydropower Development Guide for the Mekong Region and Central Asia*. Washington DC: World Bank Group. <https://doi.org/10.1596/35621>
26. World Bank. (2022). *Kyrgyz Republic: Energy Sector Review — Improving Regulatory Frameworks for Renewable Energy Investment*. Washington DC: World Bank Group. <https://openknowledge.worldbank.org>

Methods and Criteria for Assessing the Effectiveness of Economic Digitalization

Ainura Khamzaeva¹, Gulayim Zhakshylyk kyzy²

¹Osh Technological University named after M.M. Adyshev, Institute of Economics and Management, Osh, Kyrgyz Republic, Candidate of Economic Sciences, Associate Professor

²Osh Technological University named after M.M. Adyshev, Institute of Economics and Management, Osh, Kyrgyz Republic

¹E-mail: ainura.hamzaeva@gmail.com, ¹ orcid: 0000-0001-7575-6150

²E-mail: gulayim.zhakshylyk.kyzy@gmail.com, ² orcid: 0000-0003-1514-0930

Abstract. This article thoroughly examines the main methods for assessing the efficiency and overall effectiveness of digital transformation from the specific perspective of its wide-ranging social consequences. This study examines various methods of government regulation of economic digitalization based on the strict criteria of technological consequences in the social sphere and systematically classifies them into structured analytical frameworks. The efficiency criteria for government regulation of economic digitalization are further specified in terms of their direct, long-term impact on public welfare, digital inclusion, and social equity. Based on the results of this comprehensive study, key methodological recommendations are proposed for the strategic development and implementation of future government socioeconomic policy, taking into full account the rapidly evolving digital context. Furthermore, the paper highlights the importance of balancing technological advancement with workforce adaptation and data privacy protection. Ultimately, these findings offer a solid theoretical foundation and practical guidelines for policymakers to minimize the digital divide while maximizing the socio-economic benefits of digitalization for the entire society.

Keywords: digital transformation, government regulation, effectiveness assessment, humanistic approach, assessment criteria, quality of life.

Introduction

In some countries, economic digitalization processes occur naturally but require government intervention, while in others, they are driven by government regulators and require the participation of government bodies. This necessitates a rethinking of the economic essence and methods of government regulation and a revision of their classification, as the current classification is insufficient to accurately reflect the differences between methods of government regulation of the economy in the context of digitalization, and it fails to take into account the social consequences of the application of government regulation methods.

The aim of the article is to study the main methods for assessing the effectiveness of digital transformation from the perspective of its consequences for the social sphere and to develop recommendations for improving state socio-economic policy.

Research Results

The differences between the methods of implementing state economic policy, identified by the criterion of quality of life aspects, in which the technological consequences of the application of these methods in the social sphere are manifested, have been studied in the works of such researchers as Z. Bu, J. Liu, S. Zhang [1], M. Garcia-Murillo, I. McInnes [2], Yu. Li, H. Xu, H. Li, Yu. Xu [3], Zi Xu, Zi Liu and H. Luo [4], J. Yin, S. Ibrahim, N.N.A. Mohd, K. Zhong, K. Mao [5], and our studies [6], [7].

A review of the cited sources allowed us to conclude that without covering the social aspects of its implementation, state economic policy can create threats to public well-being, and digitalization brings significant changes to state economic policy, which must be taken into account when developing its methodological support.

Firstly, the digitalization of social support measures is implemented differently in each area of state economic policy. Therefore, the selection of appropriate methods for implementing this policy must be guided by the technological support for these methods, which largely determines their impact

on society. Given this, it is necessary to develop an additional criterion for classifying methods of state regulation of economic digitalization: aspects of quality of life that manifest the technological consequences of applying these methods in the social sphere.

Secondly, the impact of economic digitalization on the social environment can differ fundamentally depending on society's readiness for technological change and its alignment with current societal needs. Therefore, when determining methods for implementing state economic policy, it is important to consider how well technological transformations in economic activity align with public sentiment. In this regard, another additional criterion for classifying methods of state regulation of economic digitalization is proposed: the nature of technological consequences in the social sphere.

Based on the introduced criteria, the classification of methods of state regulation of the digitalization of the economy, presented in Table 1, has been supplemented.

Table 1

Classification of methods of state regulation of the digitalization of the economy according to the criteria of technological consequences in the social sphere

Classification criterion	Groups of regulatory methods identified according to this criterion	Social consequences
Aspects of quality of life in which the technological consequences of the application of these methods in the social sphere are manifested	methods for increasing happiness in society	– "smart" fight against poverty; – reducing social inequality through digitalization; – digitalization of the labor market; – high-tech development of the "green" economy.
	methods for increasing the attractiveness of regions for living	– digital modernization of territories; – automation of migration regulation; – digital support for tourism.
	methods for improving the economic climate	– development of digital institutions; – transition to an information society.
	methods for developing socially significant sectors of the economy	– digitalization of education; – digitalization of healthcare; – development of telecommunications infrastructure and import substitution of high-tech industries.
The nature of technological consequences in the social sphere	methods that have a positive impact on society	social progress, growth of public welfare;
	methods that negatively impact society	public resonance, widening of the digital divide, decline in quality of life;
	methods that have a neutral impact on society	smooth adaptation of society to the digitalization of the economy.

Source: compiled by the authors.

The polycriterial classification, formed by the addition of new criteria, will allow for a more thorough and rational formation of the methodological apparatus of state economic policy, selecting the most appropriate levers of state influence on the economic system and the processes occurring within it for each aspect of quality of life, with the optimization of technological consequences in the social sphere.

We propose a humanistic methodological approach to assessing the effectiveness of government regulation of economic digitalization, measuring effectiveness in terms of its social impact. This approach ensures a more reliable assessment by taking into account the social component of technological reform. A distinctive feature of the humanistic approach is not the replacement of economic criteria with social ones, but rather their comprehensive consideration by encompassing all levels of the impact of digitalization and its regulation.

The humanistic approach distinguishes between, but comprehensively and equally considers, objective (macro-level, manifested at the level of society and the economy as a whole) and subjective (micro-level, private) criteria. The combination of these criteria informs an interpretation of the effectiveness of government regulation of economic digitalization in terms of its social consequences. The following matrix (Figure 1) has been developed as a scientific and methodological framework for interpreting effectiveness within the humanistic approach.

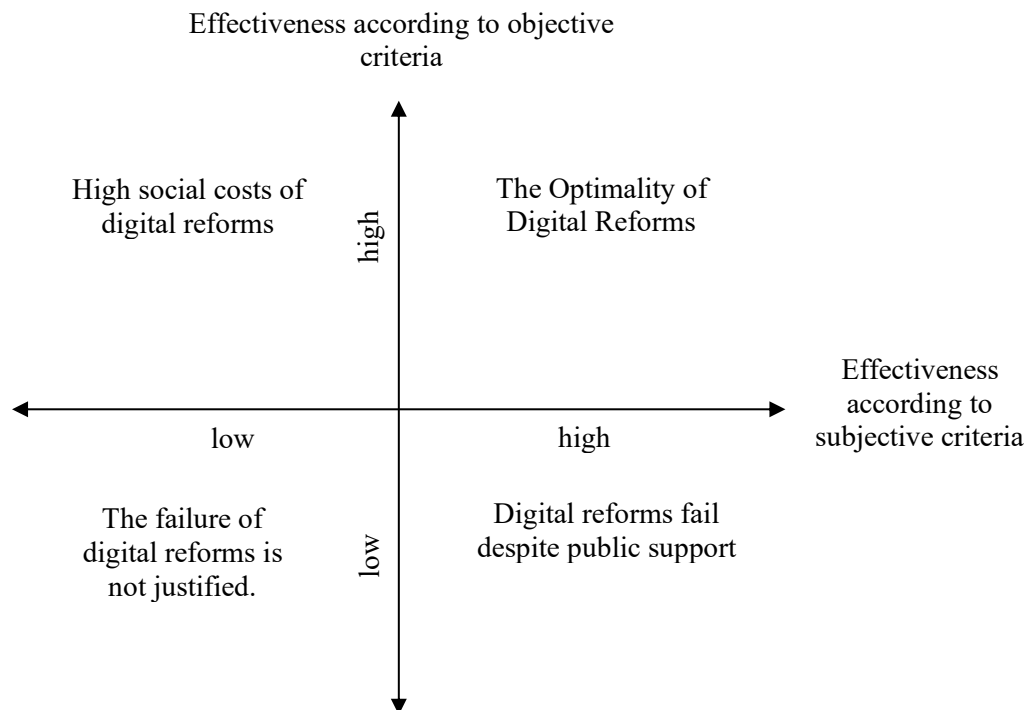


Figure 1. Matrix of interpretation of the systemic effectiveness of state regulation of the digitalization of the economy from the standpoint of consequences for the social sphere in a humanistic approach

Source: compiled by the authors.

As shown in Figure 1, at the intersection of the consequences of the digitalization process for the social sphere, manifested at different levels, four states of the effectiveness of regulating this process emerge within the humanistic approach:

- the optimality of digital reforms, when effectiveness is high according to both objective and subjective criteria;
- high social costs of digital reforms, when effectiveness is high according to objective criteria but low according to subjective criteria;

- failure of digital reforms despite public support, when effectiveness is high according to subjective criteria but low according to objective criteria;
- failure of digital reforms, meaning they are unjustified, when effectiveness is low according to both objective and subjective criteria.

The criteria for the effectiveness of state regulation of economic digitalization from the perspective of consequences for the social sphere, proposed in accordance with the humanistic approach to its assessment, are specified in Table 2. The table clearly identifies the level of each criterion, its socially significant results (the numerator in the effectiveness assessment formula), and the costs of economic digitalization that are tangible for society (the denominator in the effectiveness assessment formula).

Table 2

A set of criteria for the effectiveness of state regulation of the digitalization of the economy from the standpoint of consequences for the social sphere

The level at which social consequences manifest themselves	Criteria for the effectiveness of regulation of the digitalization of the economy	Socially significant results of economic digitalization	Costs of economic digitalization tangible for society
Macro-level: objective criteria of effectiveness	Financial	additional income	growth in household spending
	Ecological	environmental benefits	environmental protection costs
	Reputational	improving ranking positions	downgrade of rating positions
	Industrial	import substitution	deficit
	Institutional	development of institutions	degradation of institutions
Micro-level: subjective criteria of effectiveness	Stratification	inclusiveness of society	social inequality
	Cultural	happiness of society	psychological pressure
	Labor	unlocking labor potential	job dissatisfaction
	Risky	strengthening stability	decreased security
	Migration	improvement of the demographic situation	disproportions in territorial development

Source: compiled by the authors.

The results are additional income: increased productivity and, accordingly, wages, savings in the household budget due to reduced prices on goods sold through e-commerce, as well as due to intelligent support for consumer behavior, ensuring its rationalization (elimination of impulse purchases).

The advantage of assessing the effectiveness of government regulation of economic digitalization is assessed from the standpoint of its consequences for the social sphere using the proposed objective and subjective criteria in a humanistic approach. This is the achievement of a holistic humanitarian

vision of the consequences of digital reforms, while correlating the socially significant results of economic digitalization with the tangible costs it causes for society.

The humanistic approach and its criteria for the effectiveness of digitalization, based on its social impact, are suitable for countries with traditional socioeconomic structures, including the Kyrgyz Republic, which lacked the opportunity to prepare for the Fourth Industrial Revolution in advance and have only recently joined its ranks.

References:

1. Bu, Z. Collaborative government-public efforts in driving green technology innovation for environmental governance in PPP projects: a study based on prospect theory / Z. Bu, J. Liu, X. Zhang // *Kybernetes* . – 2025. – 54(3). – 1684-1715.
2. Garcia-Murillo, M. Economic, political, and social factors impeding the regulation of digital platforms / M. Garcia-Murillo, I. Macinnes // *Telecommunications Policy*. – 2025. – No. 49(3).
3. Li, Y. Digital economy, environmental regulations, and green economic development / Y. Li, H. Xu, H. Li, Y. Xu // *Finance Research Letters*. – 2025. – No. 75.
4. Xu, Z. Can Artificial Intelligence Technology Help Achieving Good Governance: A Public Policy Evaluation Method Based on Artificial Neural Network / Z. Xu, Z. Liu, H. Luo // *SAGE Open*. – 2025. – No. 15(1).
5. Yin, J. Unpacking multidimensional effects of economic restructuring and technological progress on carbon emission performance: the moderating role of environmental regulation / J. Yin, S. Ibrahim, NNA Mohd , C. Zhong , X. Mao // *Scientific Reports*. – 2025. – No. 15(1). – P. 1267.
6. Khamzaeva , A. M. Economic efficiency and problems of applying digital technologies in the social sphere of the Kyrgyz Republic / A. M. Khamzaeva // *Economy and business: theory and practice*. - 2025. - No. 1-2 (119). - P. 204-209. - DOI 10.24412/2411-0450-2025-1-2-204-209.
7. Khamzaeva , A. M. Digitalization of the economy in Kyrgyzstan: trends, problems and prospects / A. M. Khamzaeva // *Bulletin of Jalal-Abad State University*. - 2019. - No. 4 (43). - P. 135-139.
8. Maksyutova A., Bigaliev A.N. Youth in the labour market of the kyrgyz republic and the republic of Kazakhstan. М. Рыскулбеков атындагы Кыргыз экономикалык университетинин кабарлары. 2018;2(44):36–38.
9. Febry W. Identification of local labor market in the context of demographic dividend in Indonesia's urban areas. *Journal of Wellbeing Technologies*. 2023;49(2):55–72.
10. Kazakova V.A. Freelance market as the possible future of labor market. *Economy and Business: Theory and Practice*. 2018;(4):115–117.
11. Янгиров А.В., Мамлеева Э.Р., Трофимова Н.В., Сазыкина М.Ю. Рынок труда в республике Башкортостан в период пандемии. *Экономика и управление: научно-практический журнал*. 2021;2(158):173–179.
12. Dvorak M., Rovny P., Grebennikova V., Faminskaya M. Economic impacts of Covid-19 on the labor market and human capital. *Terra Economicus*. 2020;18(4):78–96.
13. Лейбович А.Н. Covid-19 и рынок труда: старые подходы не работают. *Стандарты и качество*. 2020;5:68–70.
14. Stolyarova L.G., Zhovnir A.I. Impact of digitalization on the labor market. *Вестник Тульского филиала Финуниверситета*. 2022;1:392–394.
15. Kart E., Adas E.B. New technologies and labor market: a look into the future of jobs and employment. *Sociology of Science and Technology*. 2023;14(2):194–208.
16. Dubrovskaya J.V., Kozonogova E.V. The impact of digitalization on the demand for labor in the context of working specialties: spatial analysis. *St Petersburg University Journal of Economic Studies*. 2021;37(3):395–412.

Industry Development and Business Transformation in the Digital Economy

Baydulla Ganiyev

University of Tashkent for Applied Sciences, Tashkent 100149, Republic of Uzbekistan

E-mail: ganievb1966@gmail.com,  orcid: 0009-0009-6206-4636

Abstract: The rapid expansion of the digital economy has fundamentally reshaped sectoral development patterns and accelerated business transformation across the globe. Digital technologies such as big data analytics, artificial intelligence, cloud computing, the Internet of Things, and digital platforms have altered traditional production models, value chains, and competitive dynamics. This article examines the theoretical foundations of the digital economy, analyzes its impact on the development of key economic sectors, and explores how businesses transform their strategies, structures, and processes in response to digitalization. Using analytical and comparative methods, the study identifies major trends, opportunities, and challenges associated with digital transformation. The findings suggest that the digital economy enhances productivity, fosters innovation, and creates new business models, while simultaneously increasing the need for institutional reforms, digital skills development, and inclusive policies to ensure sustainable growth. Additionally, the paper provides practical strategic frameworks for organizations to successfully navigate the complexities of digital adoption and mitigate cybersecurity and operational risks.

Keywords: digital economy, sectoral development, business transformation, digital technologies, innovation, competitiveness.

Introduction

In recent decades, the digital economy has emerged as a central driver of economic growth and structural transformation. Advances in information and communication technologies (ICT) have reduced transaction costs, improved information flows, and enabled the rapid diffusion of innovations. As a result, economic sectors are increasingly interconnected through digital platforms and data-driven value chains. Traditional boundaries between industries are becoming blurred, while new sectors and hybrid business models are continuously emerging.

For businesses, digitalization is no longer an optional strategy but a prerequisite for survival and competitiveness. Firms are compelled to rethink their operational processes, customer engagement methods, and organizational structures. At the same time, governments and policymakers face the challenge of designing regulatory frameworks that support innovation while mitigating risks related to data security, market concentration, and digital inequality.

This article aims to analyze the role of the digital economy in sectoral development and business transformation. The objectives of the study are threefold: first, to examine the conceptual foundations of the digital economy; second, to assess its impact on the development of key economic sectors; and third, to analyze the main directions of business transformation in the digital era.

1. Global digital economy

Global ICT Market Share 2024–2025. The value of the information and communication technology (ICT) market in the global economy is estimated at approximately USD 5.5 trillion in 2024 and is expected to expand at a growth rate of approximately 5.2% per year until 2031. This figure indicates the acceleration of the process of digital transformation of the economy.

Internet and digital usage Global internet penetration is projected to reach ~68% between 2024 and 2025, with approximately 5.5 billion users using the internet. The number of mobile broadband subscribers worldwide has exceeded 8 billion, which is higher than the global population.

At the same time, the value of the cloud computing market for digital infrastructure and services is projected to reach 832 billion USD by 2025. The share of organizations adopting artificial intelligence in business will be around ~90% by 2025. E-commerce and digital sales In 2025, global e-commerce sales (~e-commerce) are projected to be around 7.4 trillion USD (~24% of total retail sales).

Local context: Statistics of Uzbekistan and digital banking services in the digital economy According to the data presented in the journal “Economics and Innovative Technologies”, the number of digital banking services and electronic transactions in Uzbekistan increased significantly between 2018 and 2024 (for example, the share of electronic services increased year by year). Growth of the service sector and sectors Statistics on sectors are available in the regions of Uzbekistan for January-September 2025: the volume of services increased by 113-114% (compared to 2024). These figures indicate a growing service sector, which may be directly related to the expansion of digital services.

Conceptual Framework of the Digital Economy

The digital economy can be broadly defined as an economic system in which digital technologies play a dominant role in the creation, distribution, and consumption of goods and services. It is characterized by the extensive use of data, digital platforms, and network effects. Unlike the traditional economy, where physical assets and labor are the main factors of production, the digital economy relies heavily on intangible assets such as software, algorithms, and intellectual capital.

One of the key features of the digital economy is the increasing importance of data as a strategic resource. Data-driven decision-making enables firms to optimize production processes, personalize products and services, and predict market trends with greater accuracy. Moreover, digital platforms facilitate interactions between producers and consumers, reducing information asymmetry and enhancing market efficiency.

Another defining characteristic is the scalability of digital technologies. Once developed, digital solutions can be replicated and distributed at relatively low marginal costs, allowing firms to expand rapidly across markets. This scalability contributes to the emergence of global digital corporations and intensifies competition at both national and international levels.

2. Business Transformation and Digital Transformation Investments and the Digital Sector Impact of the Digital Economy on Sectoral Development

Manufacturing Sector

In the manufacturing sector, digitalization has given rise to the concept of Industry 4.0, which integrates cyber-physical systems, automation, and data analytics into production processes. Smart factories utilize sensors and real-time data to monitor equipment performance, reduce downtime, and improve product quality. Additive manufacturing and digital design tools further enhance flexibility and customization.

As a result, manufacturing firms are shifting from mass production to more customer-oriented and knowledge-intensive production models. This transformation increases productivity and competitiveness but also requires significant investments in digital infrastructure and workforce upskilling.

Services Sector

The services sector has been profoundly transformed by digital technologies. Financial services, for example, have experienced rapid growth in digital payments, online banking, and financial technology (fintech) solutions. E-commerce platforms have revolutionized retail trade by expanding market access and enabling personalized marketing strategies.

In addition, digitalization has improved the efficiency of logistics, tourism, education, and healthcare services. Online platforms and mobile applications allow service providers to reach a wider audience, while consumers benefit from greater convenience and choice.

Agriculture and Natural Resources

Digital technologies are increasingly applied in agriculture through precision farming, remote sensing, and data-driven resource management. These innovations help optimize input use, increase yields, and reduce environmental impacts. Similarly, in the energy and mining sectors, digital solutions improve exploration efficiency, operational safety, and sustainability.

The integration of digital tools into traditionally low-tech sectors demonstrates the transformative potential of the digital economy across the entire economic system.

Global investment in the digital economy is growing rapidly: for example, annual investment in digital services and infrastructure is expected to reach USD 100+ billion by 2024, but this is still not

enough in low-income countries. Digital business models Traditional manufacturing and service business models are being transformed by digital platforms and e-commerce channels. This process is manifested in the introduction of digital products, services, financial technologies and cloud solutions.

The share of the ICT sector and the digital economy in GDP (2024–2025) The contribution of ICT services (the share of the ICT sector in GDP) in 2024 was about 2.4%. According to this statistic, the structure of services included: communication services ~40.5%, software and consulting ~40.9%.

In the period January–September 2025, the share of ICT services in GDP was around 2.6–2.7%.

Statistics for January–March 2025 show the ICT contribution at 3.2% - a significant increase compared to 2024.

The analysis shows that in the transition from 2024 to 2025, the share of the ICT sector in GDP increased from 2.4% → 2.6-3.2%, which indicates the growth of the digital elements of the economy.

The composition of ICT services in the details and components of the ICT sector (2024–2025) Communication services (mobile/telecom): around 35–40% (2024–25). Software and consulting: ~40–45%, this sector has a large share in the Uzbek ICT market. Data hosting and processing / web portals: ~10–12% Software release and equipment repair: around 3–6%.

This composition indicates that the market is dynamic and broad: telecommunications, IT services, hosting services, and software products also have their place.

The place of the ICT market in the global context: official statistics do not yet provide direct figures on the exact percentage share of the Uzbek ICT sector in the global ICT market. However, the following can be said:

- The global ICT market is estimated to be worth ~5.5–6.2 trillion USD in 2024. This figure is considered a significant component of the global economy.
- Uzbekistan's ICT sector is a relatively small — but rapidly growing — segment, accounting for 2.4-3.2% of GDP.
- Uzbekistan's share of the global ICT market is very small (the global market is in the billions of dollars, while Uzbekistan's ICT contribution to its national GDP is only a few percent) - this corresponds to the general trend in the market of small economies.

Table 1

Digital infrastructure and other digital economy indicators are as follows:

Indicator	Uzbekistan (2024)	Uzbekistan (2025)
Share of ICT services in GDP	~2.4 % UzDaily.uz	~2.6-3.2 % stat.uz+1
Main market component	Telecom, IT services	Telecom, IT services
Continuous ratio in the global ICT market	Very small	Small but high growth rate
Rating by digital index	60th place (Global Digitalization Index) UzDaily.uz	

Opportunities and Challenges of Digital Transformation

The digital economy offers numerous opportunities, including productivity growth, innovation acceleration, and expanded market access. Small and medium-sized enterprises can leverage digital platforms to overcome traditional barriers and participate in global value chains.

At the same time, digital transformation poses significant challenges. These include cybersecurity risks, data privacy concerns, and the digital divide between regions and social groups. Furthermore, rapid technological change can lead to labor market disruptions if reskilling and social protection measures are insufficient.

Addressing these challenges requires coordinated efforts by businesses, governments, and educational institutions. Investments in digital infrastructure, regulatory reforms, and human capital development are essential for maximizing the benefits of the digital economy.

Digital Technologies as a Driver of Productivity and Innovation

Beyond basic ICT adoption, advanced digital technologies such as artificial intelligence (AI), big data analytics, blockchain, and the Internet of Things (IoT) are becoming decisive factors of productivity growth. AI enables predictive analytics, intelligent automation, and decision support systems, allowing firms to optimize resource allocation and reduce operational costs. Big data technologies help organizations process vast volumes of structured and unstructured data, improving forecasting accuracy and strategic planning.

Empirical evidence from 2024–2025 shows that firms actively using data-driven technologies achieve higher labor productivity and faster innovation cycles compared to traditional firms. This trend is particularly evident in manufacturing, finance, logistics, and retail trade, where digital tools shorten production and delivery times while improving quality and customer satisfaction.

Digital platforms fundamentally reshape value chains by reducing transaction costs and enabling direct interaction between producers, suppliers, and consumers. Platform-based ecosystems such as e-commerce marketplaces, digital payment systems, and cloud service providers create new sources of value by integrating multiple stakeholders into a single digital environment.

As a result, traditional linear value chains are increasingly replaced by network-based structures. Small and medium-sized enterprises (SMEs) gain access to national and global markets through platforms, overcoming limitations related to scale, capital, and geography. At the same time, competition intensifies, requiring firms to continuously innovate and differentiate their offerings.

3. Conclusion

The digital economy is a key part of the global economy, and the rapid growth of technology investments, internet penetration, and digital services is increasing the efficiency of industries. Statistics for 2024–2025 show that:

- The growth of the ICT market value and cloud services confirms the global trend of digital transformation.
- The increase in the number of global internet users is driving demand for digital services
- The volume of e-commerce sales is creating new opportunities for businesses.
- Uzbek statistics show a growth trend in the services and digital services segments.
- Expand digital infrastructure and strengthen policies to support local businesses in digital transformation.
- Introducing investment and tax incentives for the development of e-commerce and digital platforms.
- Training qualified personnel in the ICT sector and supporting innovative entrepreneurship.

The analysis conducted in this article confirms that the digital economy has become one of the most influential forces shaping contemporary economic development and structural transformation. The rapid diffusion of information and communication technologies, digital platforms, and data-driven solutions has fundamentally altered the way economic sectors function and how businesses create value. As demonstrated by global and national indicators for 2024–2025, digitalization is no longer confined to high-tech industries but increasingly penetrates manufacturing, services, agriculture, and natural resource sectors, thereby transforming the entire economic system.

The findings show that the expansion of the global ICT market, growth in internet penetration, widespread adoption of cloud computing, artificial intelligence, and the rapid increase in e-commerce volumes are clear indicators of the accelerating digital transformation of the global economy. These trends contribute to productivity growth, cost reduction, and innovation, while also intensifying competition and reshaping global value chains. Digital platforms, in particular, play a crucial role in reducing transaction costs and enabling direct interaction between producers and consumers, which significantly enhances market efficiency and inclusiveness.

The case of Uzbekistan illustrates how developing and transition economies are also increasingly integrating into the digital economy. Although the country's share in the global ICT market remains relatively small, the steady increase in the contribution of ICT services to GDP and the rapid growth

of digital services indicate a strong positive dynamic. The expansion of digital banking, e-commerce, and ICT services demonstrates the potential of digital transformation to stimulate economic growth, modernize the service sector, and improve access to financial and commercial services.

At the firm level, digitalization drives profound business transformation. Traditional business models are being replaced or complemented by platform-based, service-oriented, and data-driven models. Companies that successfully adopt digital technologies improve operational efficiency, enhance customer engagement, and strengthen their competitive positions. However, this transformation also requires substantial investments in digital infrastructure, organizational change, and workforce upskilling. The growing demand for digital skills highlights the importance of human capital development and lifelong learning in ensuring sustainable and inclusive growth.

Despite its significant benefits, the digital economy also presents serious challenges. Cybersecurity threats, data privacy issues, digital inequality, and potential labor market disruptions pose risks that cannot be ignored. Without appropriate policies and institutional frameworks, digital transformation may deepen existing socio-economic disparities and limit the long-term benefits of technological progress.

In conclusion, the digital economy represents not only a technological shift but a comprehensive economic and institutional transformation. To fully realize its potential, coordinated efforts are required from governments, businesses, and educational institutions. Investment in digital infrastructure, supportive regulatory environments, promotion of innovation, and the development of digital skills are essential prerequisites for sustainable sectoral development and successful business transformation in the digital era.

References

1. President of the Republic of Uzbekistan. (2020). *Strategy "Digital Uzbekistan - 2030"*. Tashkent, Uzbekistan.
2. Ministry of Economy and Finance of the Republic of Uzbekistan. (2023–2025). *Annual reports on the development of the digital economy and sectors*. Tashkent, Uzbekistan.
3. World Bank. (2023). *Digital economy for development (DE4D): Global trends and policy implications*. Washington, DC: World Bank.
4. OECD. (2022). *Digital transformation of industries: Policy and business implications*. Paris, France: OECD.
5. UNCTAD. (2023). *Digital economy report: Cross-border data flows and development*. Geneva, Switzerland: United Nations Conference on Trade and Development.
6. Schwab, K. (2019). *The fourth industrial revolution*. Geneva, Switzerland: World Economic Forum.
7. Brynjolfsson, E., & McAfee, A. (2018). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. New York, NY: W.W. Norton & Company.
8. Porter, M. E., & Heppelmann, J. E. (2015). How smart, connected products are transforming competition. *Harvard Business Review*.
9. Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *Journal of Strategic Information Systems*.
10. Tapscott, D. (2017). *The digital economy: Rethinking promise and peril in the age of networked intelligence*. New York, NY: McGraw-Hill.
11. Agency for Statistics of the Republic of Uzbekistan. (2024–2025). *Statistical data on digital technologies, sectors and business entities*. Tashkent, Uzbekistan.
12. Mamatov, B., & Karimov, A. (2024). Transformation of business processes in the digital economy. *Journal of Economics and Innovations*. Tashkent, Uzbekistan.
13. Porter, M. E. (1990). *The competitive advantage of nations*. Free Press.
14. Schumpeter, J. A. (1934). *The theory of economic development*. Harvard University Press.
15. Storey, D. J. (1994). *Understanding the small business sector*. Routledge.

Improving Food Market Infrastructure Through the Application of Artificial General Intelligence Technologies

Abdilbaet Mamasydykov¹, Perizat Alisheva², Maksatbek Sulaimankulov³

¹Kyrgyz-Uzbek International University named after B. Sydykov, Department of Economics, Osh, Kyrgyz Republic, Doctor of Economic Sciences, Professor

²Kyrgyz-Uzbek International University named after B. Sydykov, Department of Economics, Osh, Kyrgyz Republic, Candidate of Economic Sciences (PhD), Associate Professor

³Kyrgyz-Uzbek International University named after B. Sydykov, Department of Economics, Osh, Kyrgyz Republic, Postgraduate (PhD) Student

¹E-mail: abdilbaet@mail.ru, ¹ orcid: 0000-0001-8067-7852

²E-mail: perizatalisheva@gmail.com, ² orcid: 0009-0005-2527-5670

³E-mail: maksatbeksulaimankulov@gmail.com, ³ orcid: 0009-0001-7303-4282

Abstract: The article examines the improvement of food market infrastructure through the strategic application of Artificial General Intelligence (AGI) technologies. The study deeply analyses the operational limitations of conventional retrospective market analytics and proposes a novel, data-driven methodology for integrating advanced AGI systems into food production cycles. The scientific novelty of this research consists in developing a closed-loop AGI platform architecture specifically designed to forecast dynamic consumer preferences over a five-year horizon and to generate evidence-based production recommendations for food enterprises in the Kyrgyz Republic. Furthermore, the paper investigates how this intelligent platform optimizes supply chain logistics, reduces food waste, and mitigates market supply fluctuations under volatile economic conditions. By leveraging predictive modeling and machine learning algorithms, the proposed system enhances decision-making transparency and boosts competitiveness within the regional agro-industrial sector. Ultimately, the comprehensive findings and structured implementation frameworks provide valuable strategic guidelines for policymakers and industry stakeholders to ensure national food security and sustainable economic growth.

Keywords: artificial general intelligence; AGI; food market; digital transformation; infrastructure; consumer preferences; forecasting; food security; Kyrgyz Republic.

1. Introduction

The globalisation of food supply chains and the rapid advancement of digital technologies are establishing fundamentally new requirements for food market infrastructure. Traditional approaches to organising the production and distribution of food products, grounded in retrospective analysis of market conditions, are progressively losing their effectiveness in the context of high consumer demand volatility and the exponential growth in data volumes. This study aims to develop conceptual foundations for applying Artificial General Intelligence (AGI) technologies to modernise the food market infrastructure of the Kyrgyz Republic.

The relevance of this research is determined by a set of interrelated factors. First, the food market of Kyrgyzstan is characterised by insufficiently developed digital infrastructure, which reduces forecast accuracy and leads to significant losses throughout the supply chain. Second, the rapid diffusion of AGI technologies creates unprecedented opportunities for analysing consumer behaviour and formulating long-term production strategies. Third, the imperative to ensure the country's food security necessitates the systemic modernisation of market infrastructure on the basis of advanced analytical instruments.

2. Problem Statement

The food market is conventionally understood as a system of economic relations that shapes the supply of and demand for food products. An analysis of the evolution of this concept in both domestic and international literature demonstrates that its content has undergone substantial transformation: from a simple designation of a site of commodity exchange to a complex category encompassing the

production, distribution, exchange, and consumption of agricultural raw materials and finished food products [1].

The infrastructure of the food market comprises the totality of organisational, technical, informational, and institutional elements that ensure the uninterrupted movement of goods and information from producer to final consumer. Within the digital economy, platform-based solutions for collecting and processing consumer preference data are becoming the central element of this infrastructure.

The existing market analytics system is, as a rule, based on historical sales data and consumer surveys. This approach carries a fundamental limitation: it can describe the current state of the market, but does not provide a reliable medium-term forecast (3–5 years). This problem is particularly acute in rapidly evolving market segments — healthy nutrition, functional foods, organic produce — where consumer preferences are shaped by a complex interplay of sociocultural, demographic, and medical factors.

3. Literature Review and Methodological Foundations

The theoretical foundations of this study are grounded in the concepts of digital market transformation (Schwab, 2016), the theory of information ecosystems in agri-food chains (Trienekens et al., 2012), and works in the field of predictive analytics applied to production management [2, 3]. Questions of infrastructural provision for food markets have been elaborated in depth by domestic economists specialising in the food security challenges of Central Asian economies [4].

The concept of Artificial General Intelligence (AGI) refers to systems capable of performing any intellectual task at or above human level, in contrast to 'narrow' artificial intelligence optimised for specific tasks [5]. According to research organisations, the global AGI market reached USD 2.78 billion in 2024 and is projected to attain USD 38.55 billion by 2033, representing a compound annual growth rate of 33.9% [6]. This high growth dynamic is driven by the exponential increase in data volumes: according to IDC estimates, the global volume of data created and replicated exceeded 181 zettabytes in 2024 [7].

The agri-food sector has already seen isolated projects employing machine learning to forecast crop yields and optimise logistics. However, the use of AGI systems for comprehensive forecasting of consumer preferences and their direct integration into the production cycles of food enterprises constitutes a new and understudied direction — a fact that underscores the scientific novelty of the present work.

4. Scientific Novelty of the Study

The scientific novelty of this work consists in the development of a methodology for employing AGI systems to proactively manage the production cycles of food industry enterprises on the basis of consumer preference forecasting. The proposed approach differs fundamentally from existing analytics systems in the following respects.

First, conventional business intelligence systems operate in a post-hoc analysis mode, whereas the proposed AGI platform provides forecasting over a five-year horizon, accounting for a complex set of factors: demographic shifts, health sector trends, changes in cultural and dietary patterns, ecological constraints, and macroeconomic conditions.

Second, the novelty lies in proposing a model of mandatory AGI consultation at each production cycle launch. Under this model, prior to adopting an investment decision regarding the expansion or modification of a product range, the producer submits a query to the AGI system, which, on the basis of multimodal data analysis (sales data, social media, medical statistics, geodemographic data, global trends), generates a demand forecast for the product over a period of up to five years.

Third, scientific novelty is present in the authors' concept of a 'closed loop', whereby data on actual consumer behaviour collected at the point of sale are fed back into the AGI system for continuous refinement of the predictive models. This approach ensures that the system is self-learning and that forecast accuracy improves with each successive production cycle.

5. Model for Integrating AGI into Food Market Infrastructure

The model proposed by the authors envisages the creation of a multi-tier AGI platform embedded in the food market infrastructure. The platform architecture comprises four functional modules.

Module 1 — Data collection and aggregation. At this level, continuous collection of information from heterogeneous sources is carried out: transaction data from retail chains, consumer reviews in social media, results of marketing research, disease burden statistics and changes in dietary guidelines, customs statistics on food import and export, and international analytical reviews of food trends. Big Data technology ensures the processing of incoming information streams in real time [8].

Module 2 — Predictive analytics based on AGI. The core of the system is an AGI module trained on multi-year time series of consumer behaviour, incorporating regional specificities. The Kyrgyz Republic, as an agrarian country with a developing economy, is characterised by pronounced seasonal consumption patterns, a high share of traditional products in the population's diet, and a growing demand for products in the 'healthy nutrition' category among the urban population. The AGI system processes all of the above factors simultaneously, generating a multi-scenario consumer preference forecast with a probability assessment for each scenario.

Module 3 — Generation of production recommendations. The output of the AGI platform consists of structured recommendations for producers, including: the optimal product portfolio for the forecast period, recommended production volumes by product line, preferred packaging formats and consumer portion sizes, price ranges corresponding to the effective demand of target segments, and recommendations regarding distribution channels.

Module 4 — Monitoring and feedback. A closed management loop is achieved by integrating the AGI platform with the ERP systems of food enterprises and the point-of-sale systems of retail chains. Actual sales data are transmitted back to the predictive model in real time, adjusting its parameters and improving the accuracy of subsequent forecasts.

6. Practical Application and Expected Effects

Piloting the proposed model within the food market of the Kyrgyz Republic gives grounds to anticipate the following practical outcomes. First, a reduction in commodity losses throughout the supply chain as a result of more precise alignment between production volumes and actual demand — based on global experience with analytical systems in the food industry, this effect ranges from 15 to 30% [9]. Second, an improvement in production profitability arising from the optimisation of the product matrix and a reduction in storage costs for unsold goods. Third, a strengthening of the country's food security through the alignment of domestic production with the long-term needs of the population.

The model holds particular practical significance for small and medium-sized food enterprises in Kyrgyzstan, which, owing to resource constraints, do not possess their own analytical services. A cloud-based implementation of the AGI platform makes it possible to provide these enterprises with access to analytical tools on a subscription basis, fundamentally lowering the barrier to entry for the digital transformation of the sector.

The institutional mechanism for implementing the proposed model could be the establishment, under the Ministry of Economy and Commerce of the Kyrgyz Republic, of a national AGI analytics centre for the food market. Such a centre would aggregate data across the entire value chain and provide forecast services to market participants on a regulatory basis.

7. Conclusions

The research conducted yields the following conclusions. The food market infrastructure of the Kyrgyz Republic is in need of systemic modernisation on the basis of digital technologies. The application of AGI systems opens fundamentally new possibilities for the proactive management of production decisions, grounded in reliable forecasting of consumer preferences.

The methodology of mandatory AGI consultation at each production cycle, proposed by the authors, represents a scientific novelty possessing both theoretical significance — in terms of advancing the concept of digital transformation of food markets — and practical applicability within the conditions of the Kyrgyz economy. The implementation of this methodology will contribute to

enhancing the competitiveness of domestic food enterprises, reducing food losses, and strengthening the food security of the country.

Further research in this direction should be devoted to developing the technical specifications of the AGI platform, taking into account the particularities of Kyrgyzstan's information infrastructure, as well as to assessing the economic efficiency of its implementation at specific food industry enterprises.

References

1. Zinchuk, G. M. (2011). Concept and types of the food market. *Almanac of Modern Science and Education*, 53(10), 111–113.
2. Trienekens, J., Wognum, P., Beulens, A., & van der Vorst, J. (2012). Transparency in complex dynamic food supply chains. *Advanced Engineering Informatics*, 26(1), 55–65.
3. Schwab, K. (2016). *The fourth industrial revolution*. World Economic Forum.
4. Pulatova, G.T., & Mamytov, T.T. (2026). Logistical sustainability and resource provision as factors in developing the economic potential of industrial enterprises within the food security system of Eurasian economies. In *Proceedings of the International Congress on Science, Innovation and Academic Excellence*. KUIU.
5. Goertzel, B., & Pennachin, C. (2007). *Artificial general intelligence*. Springer.
6. Custom Market Insights. (2024). *Artificial general intelligence market size report 2024–2033*. <https://www.custommarketinsights.com>
7. International Data Corporation. (2024). *Data age 2025: The evolution of data to life-critical* (IDC White Paper).
8. Rajpurkar, P., Chen, E., Banerjee, O., & Topol, E. J. (2022). AI in health and medicine. *Nature Medicine*, 28(1), 31–38. <https://doi.org/10.1038/s41591-021-01614-0>
9. McKinsey Global Institute. (2022). *Reducing food loss and waste: Setting a global action agenda*. McKinsey & Company.
10. Russell, S., & Norvig, P. (2020). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson.
11. Thomas, J., & Swamikannu, N. (2026). *Augmented Foresight: How AI Can Make Food Systems Analysis Smarter, Faster, and More Inclusive*. Consultative Group on International Agricultural Research (CGIAR).
12. Lezoche, M., Hernandez, J. E., Díaz, M. d. M. E. Alemany, & Panetto, H. (2020). Agri-food 4.0: A survey of the applications of big data, blockchain and artificial intelligence. *Computers in Industry*, 117, 103187.
13. Kearney Digital Operations. (2026). *The Emerging Agentic AI and Autonomous Systems in Global Supply Chain Infrastructure*. Kearney Analytics Report.
14. Food and Agriculture Organization (FAO). (2024). *The State of Food and Agriculture: Leveraging Digital Technologies and Artificial Intelligence for Resilient Agro-Food Infrastructure*. Rome: FAO.
15. Bani, A., & Sharma, M. (2025). *AI-Driven Sustainable Food Logistics and Supply Chains*. IGI Global.