

INNOVATION SCIENCE AND TECHNOLOGY

ISSUE 8, PART 1 / AUGUST 2026

 Acceptance of papers



**Acceptance of
papers**

Published monthly



Topics

economics,
technology, social
sciences





EDITOR-IN-CHIEF:

Mirzaliyev Sanjar Makhmatjon ugli

DEPUTY EDITOR-IN-CHIEF:

Makhmudov Nosir Makhmudovich
DSc., Prof., Academician

DEPUTY EDITOR-IN-CHIEF:

Ochilov Bobur Bakhtiyor ugli – Senior
lecturer at TSUI

THE SCIENTIFIC-POPULAR ELECTRONIC
JOURNAL **"INNOVATION SCIENCE AND
TECHNOLOGY"** HAS BEEN REGISTERED
UNDER THE NUMBER **C-5669633** BY THE
AGENCY FOR INFORMATION AND MASS
COMMUNICATIONS (AOKA) OF THE
REPUBLIC OF UZBEKISTAN, EFFECTIVE
FROM OCTOBER 9, 2024.

CONTACTS

Phone: **+998 50 737 87 88**

Website: <https://ist-journal.uz>

Email: innovationist2025@gmail.com

The scientific electronic journal "Innovation Science and Technology" has been included in the list of scientific publications recommended for the publication of main scientific results of dissertations for the award of PhD and DSc degrees in economics and technical sciences, in accordance with the Resolution No. 370 of the Presidium of the Higher Attestation Commission of the Republic of Uzbekistan, dated May 8, 2025.

Editorial board:



Sharipov Kongiratbay Avezimbetovich,
Doctor of Technical Sciences (DSc), Professor



Abdurakhmanova Gulnora Kalandarovna, Doctor of
Economic Sciences (DSc), Professor



Cham Tat Huei,
Doctor of Philosophy (PhD), Professor (Malaysia)



Muhammad Imran Sadiq
Doctor of Philosophy in Economics (PhD), Professor,
Malaysia



Ahmed Aziz Ismail
Doctor of Technical Sciences (DSc),
Professor (Egypt)



Lee Chin
Doctor of Philosophy in Economics (PhD), (Malaysia)



Asongu Simplice
Doctor of Philosophy in Economics (PhD), Cameroon



Rui Dang
Doctor of Chemistry (DSc), Professor, China



Zahoor Ahmed
Doctor of Philosophy in Economics (PhD), Turkey



Shujaat Abbas
Doctor of Philosophy in Economics (PhD), Russia



Tina A Coffelt
Doctor of Philosophy in Educational Sciences (PhD),
USA



Abdikarimova Dinara Rustamxanovna
Doctor of Economic Sciences (DSc), Professor

Kurbonbekova Mohichehra Turobjonovna
Doctor of Economic Sciences (DSc), Professor

Alimardonov Ilkhom Muzrabshokovich
Doctor of Economic Sciences (DSc), Professor



Razakova Barno Sayfieva
Doctor of Philosophy in Economics (PhD)



Khasanov Sarvar Ulugbek ugli
Doctor of Philosophy in Economics (PhD)



Kholikova Rukhsora Sanjarovna
Associate Professor (PhD)

CONTENTS

ANALYSIS OF FINANCIAL RESULTS ACCOUNTING AND AUDITING PRACTICES IN THE INFORMATION AND COMMUNICATION TECHNOLOGY SECTOR AND PRIORITIZATION OF KEY ISSUES	8
Bekchanov Fakhridin Atabekovich	
IMPROVING THE INVESTMENT BEHAVIOUR OF THE POPULATION OF UZBEKISTAN THROUGH ENHANCED FINANCIAL LITERACY.....	15
Karimova Nurjahon Olim qizi	
ACCURACY DEGRADATION OF MEASUREMENT CHANNELS IN GAS TRANSPORT SYSTEMS AND EARLY DETECTION OF METROLOGICAL FAULTS.....	25
Akxmedov Barat, Khayitov Shukhrat	
AN EMPIRICAL ANALYSIS OF THE FACTORS AFFECTING THE FINANCING OF INVESTMENT PROJECTS	32
Jumaniyazova Feruza Rajabovna	
CONCEPTUAL FOUNDATIONS OF INVESTMENT ACTIVITY IN A MODERN MARKET ECONOMY: ESSENCE, ROLE, AND DEVELOPMENT TRENDS.....	37
Matchanov Umirzak Seytjanovich	
IMPROVING INFORMATION LOGISTICS MANAGEMENT MECHANISMS IN UZBEKISTAN BASED ON ARTIFICIAL INTELLIGENCE AND BIG DATA TECHNOLOGIES	43
Islomjon Jamshedovich Jamshedov	
IMPROVING THE METHODOLOGICAL FOUNDATIONS OF ASSESSING THE EFFICIENCY OF LENDING PRACTICES IN COMMERCIAL BANKS.....	50
Turdiyev Eralijon Mukhtarovich	
INNOVATION PROCESSES IN AGRICULTURE IMPROVING DIGITALIZATION	58
Abduraimov Kamoliddin Khurram oglu	
EFFECT OF BENTONITE CONTENT ON THE PHYSICAL, MECHANICAL, AND WATERPROOFING PROPERTIES OF SAND-BENTONITE MIXTURES.....	67
Sirojiddinov Shavkat Najmiddinovich	
DIGITAL GOVERNANCE OF THE NATIONAL HIGHER EDUCATION RANKING: AN AI-BASED MONITORING ARCHITECTURE.....	73
Mamajonova Mukhlisakhon Muzaffar kizi	
ANALYSIS OF THE CURRENT STATE OF ACCOUNTING AND AUDIT OF INTANGIBLE ASSETS IN THE ICT SECTOR.....	83
Ishankulov Izzatilla Nurillaevich	
THE COMPETITIVENESS OF UZBEK HIGHER EDUCATION INSTITUTIONS FROM THE PERSPECTIVE OF AN INTERNATIONAL RANKING AGENCY AND THE NATIONAL REGULATOR: A CONVERGENCE OF TWO EXTERNAL ASSESSORS	88
Mukhlisa Khamidova	
ISSUES OF ENHANCING COMPETITIVENESS IN THE LIGHT INDUSTRY SECTOR THROUGH THE REDUCTION OF TAX ARREARS.....	95
Haydarova Shokhista Davronovna	
MODERN FINTECH SOLUTIONS AS A TOOL FOR EXPANDING FINANCIAL INCLUSION IN THE MICROFINANCE SECTOR OF THE REPUBLIC OF UZBEKISTAN.....	100
Alimova Aziza Sherzotovna	
THE ESSENCE AND ORGANIZATIONAL STRUCTURE OF ACADEMIC ACTIVITY MANAGEMENT IN HIGHER EDUCATION INSTITUTIONS	107
Ixtiyorov Bekzod Zulfiqor ugli	
ACCOUNTING AS A METHODOLOGICAL BASIS FOR FINANCIAL CRISIS MANAGEMENT IN ENTERPRISES OF THE REPUBLIC OF UZBEKISTAN	112
Rano Abrorovna Mannapova	

THE IMPORTANCE OF FINANCING IN THE DEVELOPMENT OF TOURISM IN REGIONS	118
Karimova Dilafruz Sadirdin qizi	
INVESTIGATION OF THE MAXWELL RHEOLOGICAL MODEL USING MIKUSINSKI OPERATIONAL ALGEBRA	124
Akmal Ahadovich Mirzoev, Sabohat Islom qizi Isomova, Abdulfatto Raximjon o'g'li Ibrokhimov, Ilhom Aktam o'g'li Ahmadov	
CONCEPTUAL FOUNDATIONS FOR PREPARING ELEMENTARY SCHOOL STUDENTS FOR CREATIVE PROJECT-BASED ACTIVITIES IN THE TECHNOLOGY EDUCATION PROCESS.....	131
Rustamova Manzura Mirkamalovna	
EVALUATION OF THE EFFECTIVENESS OF HEALTHCARE PROFESSIONALS' PROFESSIONAL DEVELOPMENT BASED ON ROI AND DIGITAL KPIS	139
Nazarov Baxrom Mustafayevich	
ASSESSING THE EFFECTIVENESS OF INTRODUCING UNIFIED DIGITAL DATA EXCHANGE STANDARDS IN THE HEALTHCARE SYSTEM	145
Turayeva Nafisa Odiljonovna	
IMPROVING MECHANISMS FOR ENHANCING THE COMPETITIVENESS OF SERVICE INDUSTRIES THROUGH INNOVATION MANAGEMENT IN THE CONTEXT OF DIGITAL TRANSFORMATION	150
Almanov Ilhom Sultonovich	
THEORETICAL AND METHODOLOGICAL APPROACHES TO THE STUDY OF THE EXPORT POTENTIAL OF SMALL ENTREPRENEURSHIP	157
Khamidova Kamilla Ulugbekovna	
THE IMPACT OF DEVELOPING TELEMEDICINE SERVICES ON THE ECONOMIC EFFICIENCY OF MEDICAL SERVICE ENTERPRISES	164
Urokov Firdavs Ortiquiyoz ugli	
THE IMPACT OF DATA-DRIVEN MANAGEMENT ON TRADE PERFORMANCE IN DIGITAL TRADE PLATFORMS	170
Sobirjonov Sanjar, Jumaboyev Javoxir	
BANK ASSET AND LIABILITY MANAGEMENT IN THE CONTEXT OF FINANCIAL SECTOR TRANSFORMATION	179
Shodiev Odiljon Salim ugli	
DIRECTIONS FOR IMPROVING THE THEORY OF ENSURING NATIONAL CURRENCY STABILITY	183
G'afurov Olimjon G'olib o'g'li	
WAYS TO IMPROVE THE USE OF TARIFF-RATE QUOTAS IN UZBEKISTAN	190
Sarmanov Orifjon Adiljonovich	
INDEX ASSESSMENT OF THE IMPACT OF TAX BURDEN ON THE INNOVATION ACTIVITY OF TOURISM ENTERPRISES.....	197
Ruzibaeva Nargiza Khakimovna	
IMPLEMENTATION OF INNOVATIVE TECHNOLOGIES AND INCREASING LABOR PRODUCTIVITY IN SMALL BUSINESS.....	203
Musaev Ozodjon Shavkat Ogli	
DEVELOPING TOURISM BASED ON NATIONAL DRESS: INTERNATIONAL EXPERIENCE AND CONDITIONS FOR ITS TRANSFER	209
Yusupova Mokhinur Farkhod qizi	
IMPROVING DIGITAL AND PERSONALISED INSTRUMENTS FOR THE PROMOTION OF EDUCATIONAL SERVICES.....	219
Umarov Shuhrat Bahodir o'g'li	
AN ECONOMETRIC MODEL OF THE MARKETING FACTORS SHAPING DEMAND FOR HIGHER EDUCATION SERVICES	231
Egamov Sevinchbek	
MULTILEVEL ADAPTIVE METHODOLOGY FOR THE STRATEGIC ALIGNMENT OF DEMAND AND PRODUCTION OF CONSTRUCTION MATERIALS	236
Turdiyev Abdullo Sagdullaevich	

COMPARATIVE ANALYSIS OF SMALL BUSINESS DEVELOPMENT IN NAMANGAN, ANDIJAN AND FERGANA REGIONS.....	241
Mavkulov Ravshan Nematjonovich	
METHODOLOGY FOR TARGETING REGIONAL INVESTMENTS BASED ON THE MULTIDIMENSIONAL POVERTY INDEX AND INVESTMENT FORECASTS.....	246
Nabiyev Olimjon Abdisalomovich	
AN IMPROVED CLASSIFICATION OF HOTEL INDUSTRY EFFICIENCY INDICATORS	253
Rakhimov Hasan Abdusaitovich	
IMPROVING REINSURANCE ACTIVITIES IN UZBEKISTAN: THE CASE OF “UZBEKINVEST” EISK JSC....	257
Mirzoyev Sayfullo Fayzulloyevich	
MODERN MECHANISMS FOR ENSURING COMPETITIVENESS IN THE SERVICES MARKET	263
Allamuratova Gulchekhra Makhsetbaevna	
EXISTING PROBLEMS OF THE SUSTAINABLE FINANCING SYSTEM IN UZBEKISTAN: A DIAGNOSTIC ANALYSIS	270
Akhmedova Shokhistakhon	

EXISTING PROBLEMS OF THE SUSTAINABLE FINANCING SYSTEM IN UZBEKISTAN: A DIAGNOSTIC ANALYSIS

Akhmedova Shokhistakhon

Project assistant, Asian Development Bank Uzbekistan Resident Mission

ORCID ID: <https://orcid.org/0009-0008-6930-2847>

Abstract. This article examines the main constraints on sustainable financing in Uzbekistan using a six-block conceptual framework and problem-tree analysis. The diagnostic findings indicate limited domestic sustainable-bond issuance, potential regulatory and coordination gaps, underdeveloped verification services, a narrow institutional investor base, and relatively high financing costs. A levelised-cost-of-electricity simulation shows that increasing the discount rate from 6 to 14 percent raises solar and wind generation costs by approximately 72 and 69 percent, respectively, demonstrating their sensitivity to financing conditions. The priority assessment distinguishes short-term measures, including regulatory clarification, improved reporting and project preparation, from structural reforms requiring sustained capital-market development. The article proposes a structured diagnostic framework for sequencing reforms and emphasizes the need for further empirical and multi-expert validation.

Keywords: sustainable financing; problem tree; green taxonomy; levelised cost of electricity; institutional infrastructure; priority matrix; closed loop; Uzbekistan

Annotatsiya. Ushbu maqolada O'zbekistonda barqaror moliyalashtirishning asosiy cheklavlari olti blokli konseptual asos va muammolar daraxti tahlili yordamida o'rganilgan. Natijalarda ichki barqaror obligatsiyalar emissiyasining cheklanganligi, tartibga solish va muvofiqlashtirishdagi bo'shliqlar, verifikatsiya xizmatlarining yetarli darajada rivojlanmaganligi, institutsional investorlar bazasining torligi va moliyalashtirish xarajatlarining yuqoriligi aniqlangan. Elektr energiyasining me'yorlashtirilgan qiymati bo'yicha simulyatsiya diskont stavkasining 6 foizdan 14 foizgacha oshirilishi quyosh va shamol energiyasi ishlab chiqarish xarajatlarini mos ravishda taxminan 72 va 69 foizga oshirishini ko'rsatadi, bu esa ularning moliyalashtirish sharoitlariga sezgiriligini namoyon etadi. Ustuvorlikni baholash tartibga solishni aniqlashtirish, hisobot yuritishni yaxshilash va loyihalarni tayyorlash kabi qisqa muddatli choralarni kapital bozorini izchil rivojlantirishni talab qiladigan tarkibiy islohotlardan ajratadi. Maqolada islohotlarni ketma-ket amalga oshirish uchun tuzilmaviy diagnostik asos taklif etilib, qo'shimcha empirik va ko'p ekspertli tasdiqlash zarurligi ta'kidlanadi.

Kalit so'zlar: barqaror moliyalashtirish; muammolar daraxti; yashil taksonomiya; elektr energiyasining me'yorlashtirilgan qiymati; institutsional infratuzilma; ustuvorlik matritsasi; yopiq sikl; O'zbekiston

Аннотация. В статье исследуются основные ограничения устойчивого финансирования в Узбекистане с использованием шестиблочной концептуальной основы и анализа дерева проблем. В результате выявлены ограниченный объем выпуска внутренних устойчивых облигаций, пробелы в регулировании и координации, недостаточная развитость услуг верификации, узкая база институциональных инвесторов и высокая стоимость финансирования. Моделирование приведенной стоимости электроэнергии показывает, что увеличение ставки дисконтирования с 6 до 14 процентов повышает стоимость производства солнечной и ветровой энергии примерно на 72 и 69 процентов соответственно, что демонстрирует их чувствительность к условиям финансирования. Оценка приоритетов позволяет отделить краткосрочные меры, включая уточнение регулирования, улучшение отчетности и подготовку проектов, от структурных реформ, требующих последовательного развития рынка капитала. В статье предлагается структурированная диагностическая основа для последовательного осуществления реформ и подчеркивается необходимость дальнейшей эмпирической и многоэкспертной валидации.

Ключевые слова: устойчивое финансирование; дерево проблем; зелёная таксономия; приведенная стоимость электроэнергии; институциональная инфраструктура; матрица приоритетов; замкнутый цикл; Узбекистан

INTRODUCTION

Uzbekistan's engagement with sustainable financing has produced a visible international track record: a sovereign SDG bond in 2021, a sovereign green Eurobond in 2023, and a series of subsequent sovereign and bank issuances brought cumulative sustainable-bond placements by national issuers to approximately USD 2.9 billion between 2021 and 2025 [3]. Over the same period, the share of renewable sources in electricity generation reached 19.4 percent in 2025, and a national green taxonomy was adopted on a pilot basis in 2023. Yet this external track record has not translated into a functioning domestic sustainable financial instruments

market: the first and, to date, largest domestic green bond issuance - UZS 50 billion (approximately USD 4 million) placed by the Mortgage Refinancing Company in September 2024 – amounts to only about 0.1 percent of the volume national issuers have placed internationally [2]. This asymmetry between external achievements and the limited development of the domestic market may reflect a set of interconnected structural constraints that this article seeks to identify, classify, and rank.

Diagnosing these problems systematically matters for a specific policy reason: without a clear map of which problems are root causes and which are consequences, which mechanism blocks are affected, and which problems can realistically be addressed in the short term versus which require sustained structural reform, a national strategy risks addressing symptoms - for example, encouraging a further large sovereign issuance - while leaving the underlying causes of the domestic market's absence untouched. The purpose of this article is therefore to provide a rigorous, replicable diagnostic of the problems constraining Uzbekistan's sustainable financing system: to classify them according to the mechanism block in which they originate, to trace their causal relationship to a single central problem using the "problem tree" method, to quantify the economic cost of one specific problem - the elevated domestic cost of capital - through a levelised-cost-of-electricity simulation, and to rank the identified problems by impact and short-term solvability so that reform efforts can be sequenced rather than dispersed.

LITERATURE REVIEW

The literature on barriers to sustainable-finance market development in emerging economies converges on several recurring frictions that this article's diagnostic draws upon. First, on the economic rationale for market intervention, Pigou's welfare-economics account of externalities [25] and its climate-economics extensions by Stern [26] and Nordhaus [27] establish why environmental and social costs are systematically under-priced by markets left to themselves - the theoretical starting point for asking why a country's financial system might under-supply green investment even when real-sector transformation (Uzbekistan's renewable-generation growth) is proceeding. Second, on the instrument-level economics of sustainable debt, Zerbib's evidence of a modest "greenium" [29] and Flammer's finding that certification and independent verification, rather than the green label alone, drive the positive market reaction to green bond issuance [30] together imply that a market lacking verification infrastructure - precisely Uzbekistan's condition, as this article documents - cannot capture the pricing benefit that would otherwise reward sustainable issuance and thereby catalyze further supply.

Third, on financial-stability and prudential dimensions, Carney's account of the "tragedy of the horizon" [31] and the Bank for International Settlements' "green swan" analysis [32] frame climate risk as a source of systemic risk requiring central bank and prudential attention - a framing subsequently formalized in the Basel Committee's 2022 principles for managing climate-related financial risk [11], against which this article's finding of an absent prudential regime in Uzbekistan can be benchmarked. Fourth, Fatemi and Fooladi's account of sustainable finance as an emerging paradigm [28], together with Schoenmaker and Schramade [33] and Migliorelli [34], provide integrated frameworks for what a functioning sustainable-finance system requires - taxonomy, disclosure, verification, and incentive layers operating together - which this article's six-block mechanism model operationalizes for the specific case of problem diagnosis rather than market design. Fifth, on emerging-market-specific frictions, Friede, Busch and Bassen's aggregation of more than 2,000 empirical studies on the ESG-financial-performance relationship [35] and Bolton and Kacperczyk's finding that carbon risk is priced through required returns [36] together suggest that where disclosure and verification are absent - as this article finds for Uzbekistan - investors cannot price sustainability-related risk and return at all, removing a channel through which market discipline might otherwise operate.

On developing-country experience specifically, the literature remains comparatively thin, and prior treatments of Uzbekistan's own financial-market development have generally examined green-economy financing questions in isolation – taxonomy design, or a single bond issuance - rather than as a systemically interconnected mechanism whose regulatory, institutional, instrument, subject, method and information-related problems reinforce one another. This article's contribution is precisely that systemic, causally structured diagnosis, using the problem-tree method to make explicit the causal chain from six mechanism-block-level root causes to a single, quantifiable central problem, and a replicable priority-scoring exercise to convert the diagnosis into an actionable sequencing logic.

RESEARCH METHODOLOGY

The analysis proceeds in four steps, using the six-block conceptual model of the sustainable financing mechanism - regulatory foundation, institutional infrastructure, financial instruments, subjects, methods, and objects/information – developed in the author's broader dissertation research [21] as its organizing framework.

First, problems are classified by the mechanism block in which they originate, drawing on primary sources including Uzbekistan's securities-market legislation, the national green taxonomy documentation, Central Bank policy-rate releases, and international benchmarking data (OECD, IRENA, ICMA, ADB). Second, the "problem tree" method is applied to distinguish a single central problem from its root causes (organized by mechanism block) and its economic consequences, following standard development-policy diagnostic practice. Third, a levelised cost of electricity (LCOE) model quantifies the economic cost of one root cause – an elevated domestic cost of capital - by simulating the effect of discount-rate changes (6, 10, 14 and 18 percent) on the levelised cost of a representative 100 MW solar photovoltaic plant and a representative onshore wind plant, using IRENA's global average benchmark capital costs (USD 758/kW for solar, USD 1,160/kW for wind), capacity factors (22 and 35 percent respectively), annual operating costs (1.5 and 2.0 percent of capital cost respectively) and a 25-year operating life [6], following the standard formula:

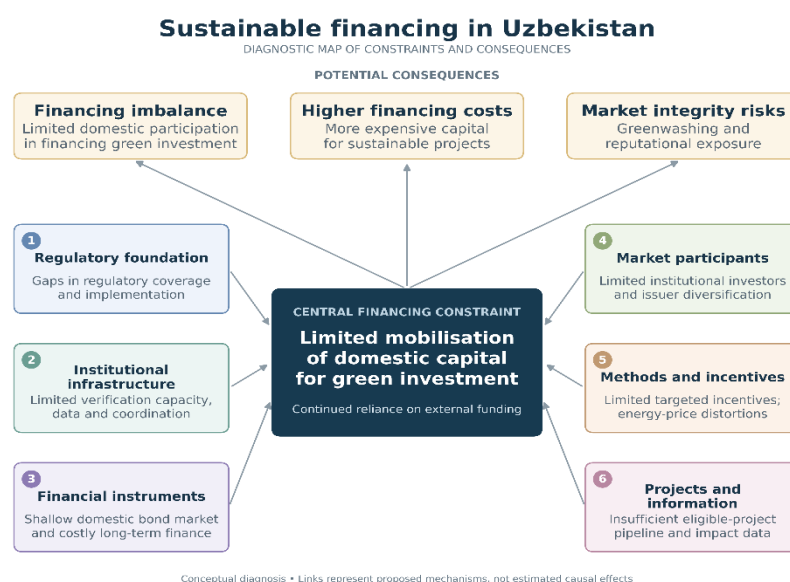
$$\text{LCOE} = (I \times \text{CRF} + O) / E, \text{ where } \text{CRF} = r(1+r)^n / ((1+r)^n - 1).$$

Fourth, the ten identified problems are assessed using two analytical scoring criteria – impact on the sustainable financing system and short-term solvability – each measured on a 1–5 scale - impact on the sustainable financing system, and short-term solvability - each on a 1-5 scale, drawing on the comparative international evidence, existing legal and institutional conditions, and the budgetary and time resources realistically required to address each problem, and plotted on a two-dimensional priority matrix to identify quick-win, strategic-priority, medium-priority and lower-priority problem clusters.

ANALYSIS AND RESULTS

The central problem and its causal structure

Applying the problem-tree method to Uzbekistan's sustainable financing system identifies a single central problem: the national financial system does not yet fully meet the country's domestic green-investment financing needs from internal resources, and sustainable-project financing therefore remains substantially reliant on foreign investors and international financial institutions. This central problem is not a statement about the absence of green investment activity – the share of renewable sources in electricity generation reached 19.4 percent in 2025, reflecting substantial real-sector transformation – but about the source of the capital financing that transformation, which remains overwhelmingly external and foreign-currency-denominated rather than domestic and sum-denominated.



Source: author's construction, based on the diagnostic analysis developed in the author's dissertation research [21].
Figure 1. Problem tree: causal structure of Uzbekistan's sustainable financing system problems

As Figure 1 shows, the central problem is fed by six categories of root cause, one per mechanism block, and in turn produces three principal economic consequences: an external–internal mismatch between the country's international issuance record and its negligible domestic market; an elevated cost of capital that specifically penalizes capital-intensive green projects; and a growing exposure to "greenwashing" and reputational risk as the market expands without commensurate verification and disclosure safeguards. Each root cause is

examined in turn below.

Regulatory foundation problems. Although Uzbekistan has adopted a strategic and programmatic foundation for sustainable financing - the 2019 strategy for transition to a green economy, the 2023 “Uzbekistan-2030” strategy, the 2022 resolution on accelerating green-economy reforms, and a national green taxonomy [22][23][24] - most of these documents are programmatic instruments that set goals and tasks rather than binding legal norms. Securities-market legislation does not define the legal status of green, social, sustainable and sustainability-linked bonds as these instruments are defined under ICMA's Principles [12][13][14][15], the conditions for their issuance, the requirements for a framework document and external review, or issuer liability for misuse of proceeds. Under the current regulatory framework, where certain requirements for sustainable financial instruments are not yet comprehensively defined, issuers may need to develop individual approaches with the support of international advisors, potentially increasing issuance costs and reducing instrument comparability for investors.

The national green taxonomy, introduced on a pilot basis in 2023, is not linked to the financial system or the banking sector. Where the European Union's taxonomy [17] serves as a single foundation for corporate reporting, fund classification, banks' “green asset ratio,” and bond standards, in Uzbekistan the taxonomy's application is not connected to any mandatory reporting or incentive mechanism for financial institutions. As a result, in the absence of mandatory links to reporting and incentive mechanisms, the taxonomy currently appears to perform primarily an advisory function within the financial system. Regulatory barriers also constrain the potential issuer base: under the Budget Code, local government authorities are prohibited from issuing debt securities, even though regional budgets account for 56 percent of total government expenditure and a large share of green infrastructure projects - water supply, waste management, public transport – are implemented precisely at the regional level; representatives of the Tashkent city administration have themselves noted the absence of a mechanism for obtaining Ministry of Finance guarantees for municipal bond issuance and the need for further legal change [1]. By comparison, Kazakhstan's Budget Code has since 2016 granted fourteen regional administrations the right to issue bonds under the strict oversight of the Ministry of Finance [1]. In addition, the absence of a legal basis for Islamic finance instruments restricts the use of green sukuk [16] and the mobilization of funds from Islamic finance institutions in the Gulf and Southeast Asia. Finally, a legal gap in disclosure requirements compounds these problems: Uzbekistan has no single corporate sustainability-reporting standard comparable to the European Union's Corporate Sustainability Reporting Directive [18] and no mandatory ESG disclosure requirement for listed companies and banks, unlike India, where BRSR reporting has been mandatory for the largest 1,000 companies since the 2022–2023 financial year [8], or China, Japan and the Republic of Korea [20], which are phasing in national requirements aligned with ISSB standards [19].

Institutional infrastructure problems. The necessary infrastructural elements of a sustainable-financing market - external verifiers, ESG rating agencies, sustainable-finance databases and specialized advisory firms - have not developed in Uzbekistan. Among the 48 external reviewers registered under ICMA's guidance, none is an Uzbekistani institution [7]. When the Mortgage Refinancing Company placed the country's first domestic green bond (UZS 50 billion) on the “Tashkent” Republic Stock Exchange in September 2024, external review was carried out by the Green Finance Centre at Kazakhstan's Astana International Financial Centre rather than by any domestic provider [2], indicating that national issuers currently rely to a considerable extent on foreign institutions for external verification services. Institutional coordination is similarly fragmented: authority over sustainable financing is distributed across the Ministry of Economy and Finance (public debt, sovereign bonds, capital markets), the Central Bank (the banking system, monetary policy), the Ministry of Ecology, Environmental Protection and Climate Change (environmental policy, the MRV system), the Ministry of Energy (renewable energy) and other agencies, with no single inter-agency coordinating mechanism, shared data platform, or monitoring-indicator system, so that reporting on sovereign bonds, green-lending statistics, and emissions monitoring is conducted independently and without cross-referencing.

Financial instruments and market problems. The limited depth of the national capital market represents one of the major constraints on the development of sustainable financial instruments. According to the OECD, the corporate bond market represents less than 0.2 percent of GDP, and the absence of a long-term government-securities yield curve complicates the pricing of corporate bonds [3]. Domestic sustainable-bond issuance is correspondingly minimal: the UZS 50 billion (approximately USD 4 million) first domestic green bond issuance in 2024 amounted to only about 0.1 percent of the roughly USD 2.9 billion in GSS bonds national issuers had placed on international markets. The Asian Development Bank's 2025 placement of a UZS 312 billion domestic social bond supporting women's entrepreneurship does, however, demonstrate that international institutions are prepared to help establish a domestic pricing benchmark [4].

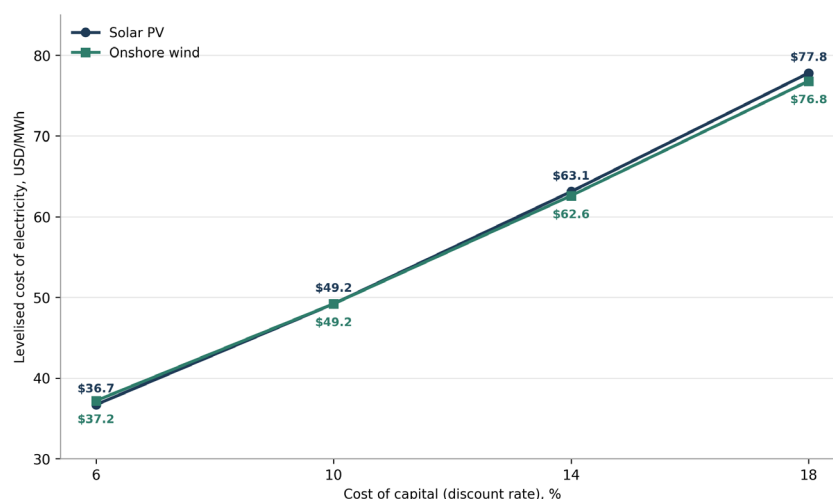
At the center of the instrument-related problems lies the elevated cost of capital. The Central Bank's policy rate stood at 14 percent as of July 2026, against annual inflation of 6.4 percent in June 2026 [5], while sum-denominated tranches of sovereign international bonds carried yields of 14.0-16.25 percent over 2020-

2025. Under such conditions, the relatively high cost of long-term domestic-currency financing may reduce the economic attractiveness and financial viability of capital-intensive sustainable projects.

Table 1. Effect of the cost of capital on the levelised cost of electricity of renewable-energy projects, USD/MWh

Cost of capital (r), %	Solar PV	Change vs. 6%, %	Onshore wind	Change vs. 6%, %
6	36.7	–	37.2	–
10	49.2	+34.1	49.2	+32.3
14	63.1	+71.9	62.6	+68.3
18	77.8	+112.0	76.8	+106.5

Source: author's calculation based on IRENA (2024) benchmark cost data [6].



Source: based on Table 1.

Figure 2. Sensitivity of the levelised cost of electricity to the cost of capital, solar PV and onshore wind

Table 1 and Figure 2 show that, holding all other conditions constant, raising the cost of capital from 6 to 14 percent increases the levelised cost of electricity of a solar plant from USD 36.7 to USD 63.1 per MWh - a 72 percent increase - and of a wind plant by 68 percent; at 18 percent, the cost of electricity more than doubles. These simulation results indicate that financing conditions can be a major determinant of renewable-energy project costs, particularly when other technological and operating parameters are held constant. The record-low tariffs achieved by Uzbekistan's largest solar plants - the 100 MW Nur Navoi solar plant, for example, at 2.679 US cents/kWh - were supported by favourable long-term financing conditions involving international financial institutions and sovereign support, which is consistent with the importance of financing conditions identified in the simulation. It follows that financing green projects on competitive terms from domestic resources, under prevailing domestic-currency interest rates, requires dedicated cost-of-capital-reducing mechanisms - guarantees, subsidies, concessional refinancing, and a "green premium".

Problems related to the subjects of the mechanism. On the demand side, the principal problem is the limited presence of long-term institutional investors. Insurance companies' liabilities average only twelve months in duration, while accumulated pension-system assets are invested predominantly in government securities and bank deposits rather than in longer-dated instruments; as a result, 92 percent of the sovereign SDG bond issued in 2021 was purchased by foreign asset-management companies. On the supply side, although state-owned enterprises account for roughly half of economic activity and 80 percent of state investment in renewable energy, energy efficiency and water-management sectors critical to the green economy, the international bonds they have issued (by "UzAuto Motors" and "Uzbekneftegaz") have been directed toward purposes unrelated to green transformation - suggesting that the sustainable-financing potential of state-owned enterprises has not yet been fully realised. On the issuer side more broadly, the pool of issuers remains confined to the state, state-owned banks and state-owned enterprises, with private companies - and small and medium-sized enterprises in particular - making almost no use of sustainable financing instruments.

A related problem at the level of the banking sector itself is insufficient internal capacity for green financing. While large state banks have developed sustainable-financing framework documents for international issuances, environmental and social risk-assessment systems, specialized green-lending units, and relevant professional

capacity appear to be less developed among some medium and small banks. Furthermore, because the Central Bank has not established prudential requirements for banks to manage climate-related risk, the systematic incorporation of climate-related physical and transition risks into bank credit-risk assessment remains at an early stage of development.

Problems related to methods and incentives. Every country examined in comparative international research on these subjects employs direct state instruments to encourage sustainable financing - tax credits (United States), subsidized issuance costs (Japan), interest subsidies (Republic of Korea), concessional refinancing (China) [9], and a green-deposit regime (India) [10]. In Uzbekistan, by contrast, no special tax incentives for green bonds and loans, no interest or verification-cost subsidies, and no central bank targeted refinancing instrument have yet been introduced. At the same time, subsidies provided to energy resources – equivalent, by OECD estimates, to 19.3 percent of GDP in 2021 – lengthen the payback period of energy-efficiency projects and reduce their commercial attractiveness, which may reduce the commercial attractiveness of energy-efficiency projects and create additional challenges for sustainable-finance market development.

Problems related to objects and information. An inadequate pipeline of technically and economically justified projects verified against taxonomy criteria constitutes an important further problem. As of December 2023, only 76.5 percent of sovereign green bond proceeds had been allocated, against a two-year allocation window, suggesting that further strengthening of the pipeline of eligible projects could help improve the alignment between project preparation and capital mobilisation. In addition, impact reports do not quantify final outcome indicators such as avoided greenhouse-gas emissions, making it difficult for investors to assess the genuine environmental effectiveness of the funds deployed. A further constraint on the system's development is a shortage of human capital: developing green bond framework documents, assessing projects' taxonomy alignment, modelling climate risk, and calculating impact indicators all require specialists who combine financial, environmental and engineering expertise, and the further development of specialized sustainable-finance training programmes and internationally certified professional capacity could reduce the need for external advisory support and strengthen domestic expertise; certification programs in sustainable bonds and ESG investing offered by organizations such as ICMA and the CFA Institute could be an effective means of addressing this gap.

Even though the market remains small at present, early attention to “greenwashing” risk is important. International experience shows that a single serious controversy involving an issuance that obtained “green” status on the basis of unclear criteria can undermine investor confidence in an entire national market: in a 2022 European Union survey, 84 percent of 168 companies, investors and rating agencies assessed the ESG market as prone to greenwashing risk, and more than 80 percent stated that government regulation of the area was needed [ICMA training materials, 7]. As Uzbekistan's sustainable-finance market gradually develops, strengthening legal norms, independent verification, and reporting requirements could help limit potential exposure to greenwashing risk.

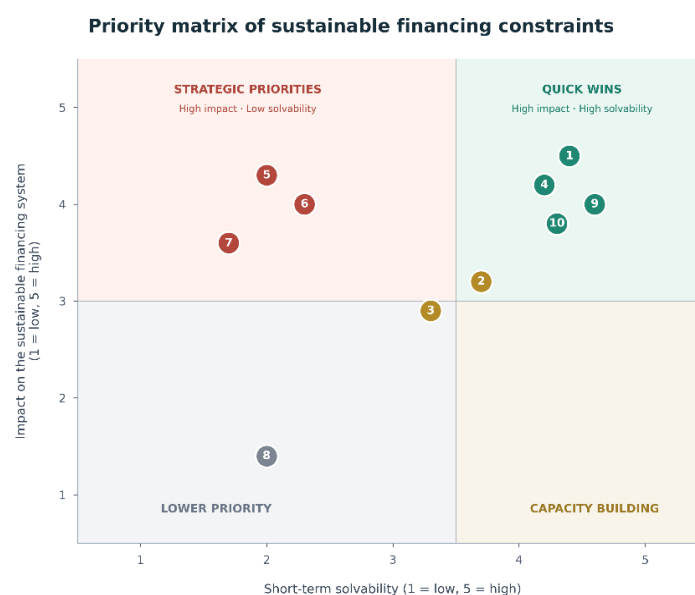
Table 2. Classification of the main problems of Uzbekistan's sustainable financing system

No.	Mechanism block	Manifestation of the problem	Economic consequence
1	Regulatory foundation	Absence of binding norms directly regulating GSS bonds and green loans; taxonomy not linked to the financial system	Higher issuance costs, lower comparability of instruments, greenwashing risk
2	Regulatory foundation	Absence of mandatory sustainability-disclosure requirements	Information barrier for international ESG investors; rating and assessment difficulties
3	Institutional infrastructure	Absence of national verifiers, ESG rating agencies and a data platform	Dependence on foreign services; high fixed costs for small issuances
4	Institutional infrastructure	Fragmented authority; insufficient inter-agency coordination	Inconsistent policy; disconnected data
5	Financial instruments	Narrow domestic bond market; no long-term yield curve	Sustainable bonds directed almost entirely to international markets; currency risk
6	Financial instruments	Elevated domestic-currency cost of capital (policy rate 14%)	Levelised cost of electricity in green projects rises 70% or more
7	Subjects	Limited long-term institutional investors	Low domestic demand; difficulty placing long-term instruments

8	Subjects	Limited private-sector and SME participation; insufficient bank ESG capacity	Sustainable financing remains confined to the state sector
9	Methods	Absence of incentive instruments; persistence of energy subsidies	Reduced commercial attractiveness of green projects
10	Objects and information	Inadequate eligible-project pipeline; outcome indicators not quantified	Delayed fund allocation; declining investor confidence

Source: author's construction, based on the diagnostic classification developed in the author's dissertation research [21].

Priority assessment of identified problems. Given resource constraints, measures to address the identified problems must be prioritized. An expert-scoring exercise assessed each of the ten problems in Table 2 along two dimensions – its impact on the sustainable financing system, and its short-term solvability - each on a 1-to-5 scale, drawing on the international comparative evidence, existing legal and institutional conditions, and the budgetary and time resources realistically required for resolution.



Source: author's analytical scoring assessment. Numbers correspond to the problem numbering in Table 2.

Figure 3. Priority matrix of Uzbekistan's sustainable financing system problems, by impact and short-term solvability

The matrix in Figure 3 groups the ten problems into four clusters. The first cluster - "quick wins" (high impact, high short-term solvability) – comprises the absence of GSS bond regulation (1), institutional fragmentation (4), the absence of incentive instruments (9), and the inadequate project pipeline and impact-reporting problems (10); these can realistically be addressed within one to two years through the adoption of regulatory instruments and better use of existing institutions. The second cluster - "strategic priorities" (high impact, low short-term solvability) – comprises the narrowness of the domestic bond market (5), the elevated cost of capital (6), and the limited presence of institutional investors (7); these problems are tied to macroeconomic conditions and structural financial-system reform and require a sustained, multi-year policy effort. The third cluster comprises medium-impact, medium-solvability problems - disclosure requirements (2) and national verification infrastructure (3). The fourth cluster comprises problems related to private-sector and bank capacity (8), which are expected to resolve progressively as the other problems are addressed.

Analysis of the interdependence among these problems shows that they form a self-reinforcing "closed loop": because domestic demand for sustainable bonds is low, issuers turn to international markets; because mainly large state issuers can participate in international markets, the private sector and smaller issuers remain excluded from the market; because the number of issuances is small, national verification and rating infrastructure cannot become economically viable; and the absence of that infrastructure raises the cost of domestic issuance, further reducing the number of issuances. Addressing this self-reinforcing cycle may require a more active coordinating and market-supporting role for the state and the Central Bank during the market's formative stage – that is, including, where appropriate, serving as an "anchor" issuer or supporting investor to

facilitate market formation during its initial stage, together with the introduction of incentive instruments. This conclusion forms the methodological foundation for the market-development strategy proposed in the author's companion research [21].

CONCLUSION AND SUGGESTIONS

This article provides a systematic diagnostic of the main constraints on Uzbekistan's sustainable financing system using a six-block mechanism model, problem-tree analysis, an LCOE simulation, and expert priority scoring.

The findings suggest that, under current conditions, domestic financial resources do not yet fully meet the financing requirements associated with green investment, despite substantial progress in renewable-energy development and international sustainable-bond issuance. The main constraints are concentrated in the regulatory and financial-instrument blocks, including the absence of binding GSS bond rules, limited domestic capital-market depth, high financing costs, and institutional infrastructure that requires further development.

The LCOE simulation indicates that increasing the cost of capital from 6 to 14 percent raises solar and wind generation costs by 72 and 68 percent, respectively, highlighting the strong sensitivity of renewable-energy projects to financing conditions. The identified problems also form a self-reinforcing closed loop involving low domestic demand, a narrow issuer base, limited issuance, and underdeveloped verification infrastructure.

The priority assessment identifies regulatory clarification, institutional coordination, incentive instruments, and project preparation as relatively short-term measures, while capital-market development, reduction of financing costs, and expansion of the institutional investor base require sustained structural reform. The state and Central Bank may therefore play an important anchor role during the market's formative stage.

Future research should validate the priority ranking through multi-expert assessment and extend the quantitative analysis to additional renewable-energy and energy-efficiency projects.

REFERENCES

1. OECD. Financing Uzbekistan's Green Transition: Capital Market Development and Opportunities for Green Bond Issuance. - Paris: OECD Publishing, 2023.
2. With support from AIFC Green Finance Centre the first green bonds were issued on the Tashkent Stock Exchange // Astana International Financial Centre. - 17.09.2024.
3. Asian Development Bank. ADB Issues Inaugural Uzbekistan Sum-Denominated Bond and Third Mongolian Togrog Bond in 2025. - 2025.
4. Asian Development Bank. ADB Issues Inaugural Uzbekistan Sum-Denominated Bond and Third Mongolian Togrog Bond in 2025 [women's-entrepreneurship social bond tranche]. - 2025.
5. The Central Bank of the Republic of Uzbekistan. At the meeting on 29th of July, the Board of the Central Bank decided to keep the policy rate unchanged at 14 percent per annum. - 29.07.2026.
6. IRENA. Renewable Power Generation Costs in 2023. - Abu Dhabi: International Renewable Energy Agency, 2024.
7. ICMA. Introduction to Sustainable Bonds. Training materials. - London: ICMA, December 2025.
8. Securities and Exchange Board of India. BRSR Core - Framework for assurance and ESG disclosures for value chain. Circular SEBI/HO/CFD/CFD-SEC-2/P/CIR/2023/122. - Mumbai: SEBI, 12.07.2023.
9. People's Bank of China. PBOC launches carbon emission reduction facility. - Beijing: PBOC, 08.11.2021.
10. Reserve Bank of India. Framework for acceptance of Green Deposits. -Mumbai: RBI, 11.04.2023.
11. Basel Committee on Banking Supervision. Principles for the effective management and supervision of climate-related financial risks. - Basel: BIS, June 2022.
12. International Capital Market Association (ICMA). Green Bond Principles: Voluntary Process Guidelines for Issuing Green Bonds. - Paris: ICMA, June 2025.
13. International Capital Market Association (ICMA). Social Bond Principles: Voluntary Process Guidelines for Issuing Social Bonds. - Paris: ICMA, June 2025.
14. International Capital Market Association (ICMA). Sustainability-Linked Bond Principles: Voluntary Process Guidelines. - Paris: ICMA, June 2023.
15. International Capital Market Association (ICMA). Sustainability Bond Guidelines. - Paris: ICMA, June 2021.
16. ICMA, IsDB, LSEG. Guidance on Green, Social and Sustainability Sukuk. - April 2024.
17. Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment // Official Journal of the European Union. - L 198. - 22.06.2020.
18. Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 as regards corporate sustainability reporting // Official Journal of the European Union. - L 322. - 16.12.2022.
19. IFRS Foundation. IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information; IFRS S2 Climate-related Disclosures. - London: ISSB, June 2023.
20. Ministry of Environment of the Republic of Korea. K-Taxonomy (Korean Green Taxonomy) Guidelines. - Sejong, December 2021.
21. Akhmedova Sh. Improving Mechanisms of Sustainable Financing in Uzbekistan. PhD dissertation. - Tashkent: Tashkent State University of Economics, 2026 (forthcoming).

22. Resolution of the President of the Republic of Uzbekistan No. PQ-4477 of 4 October 2019 // National Database of Legislation, 5 October 2019.
23. Decree of the President of the Republic of Uzbekistan No. PF-158 of 11 September 2023 // National Database of Legislation, 12 September 2023.
24. Resolution of the President of the Republic of Uzbekistan No. PQ-436 of 2 December 2022 // National Database of Legislation, 3 December 2022.
25. Pigou A.C. The Economics of Welfare. - London: Macmillan, 1920.
26. Stern N. The Economics of Climate Change: The Stern Review. - Cambridge: Cambridge University Press, 2007.
27. Nordhaus W. Climate Change: The Ultimate Challenge for Economics // American Economic Review. - 2019. - Vol. 109, No. 6.
28. Fatemi A.M., Fooladi I.J. Sustainable finance: A new paradigm // Global Finance Journal. - 2013. - Vol. 24, No. 2.
29. Zerbib O.D. The effect of pro-environmental preferences on bond prices: Evidence from green bonds // Journal of Banking & Finance. - 2019. - Vol. 98.
30. Flammer C. Corporate green bonds // Journal of Financial Economics. - 2021. - Vol. 142, No. 2.
31. Carney M. Breaking the Tragedy of the Horizon - Climate Change and Financial Stability. Speech at Lloyd's of London. - London, 29 September 2015.
32. Bolton P., Despres M., Pereira da Silva L.A., Samama F., Svartzman R. The Green Swan: Central Banking and Financial Stability in the Age of Climate Change. - Basel: Bank for International Settlements, 2020.
33. Schoemaker D., Schramade W. Principles of Sustainable Finance. - Oxford: Oxford University Press, 2019.
34. Migliorelli M. What Do We Mean by Sustainable Finance? Assessing Existing Frameworks and Policy Risks // Sustainability. - 2021. - Vol. 13, No. 2.
35. Friede G., Busch T., Bassen A. ESG and financial performance: aggregated evidence from more than 2000 empirical studies // Journal of Sustainable Finance & Investment. - 2015. - Vol. 5, No. 4.
36. Bolton P., Kacperczyk M. Do investors care about carbon risk? // Journal of Financial Economics. - 2021. - Vol. 142, No. 2.

Proofreader: Zokir ALIBEKOV

Layout and Designer: Oloviddin Sobir ugli

2026. № 8

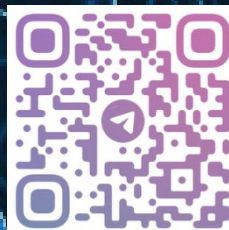
© When materials are reproduced, the INNOVATION SCIENCE AND TECHNOLOGY journal must be cited as the source. Authors are responsible for the accuracy of the information in materials and advertisements published in the journal. Editorial opinions may not always align with those of the authors. Submitted materials will not be returned to the editorial office.

To publish articles in this journal, you may submit articles, advertisements, stories, and other creative materials through the following links. Materials and advertisements are published on a paid basis.

You may subscribe to the journal at any time using the following details. Once subscribed, please send a screenshot or photo of your payment confirmation to our Telegram page @iqtisodiyot_77. Based on this, we will send the latest issue of the journal to your address each month.

“The journal “INNOVATION SCIENCE AND TECHNOLOGY” has been registered by the Agency for Information and Mass Communications under the Administration of the President of the Republic of Uzbekistan from 09.10.2024 under the registration number №390637. License number: C-5669633. PNFL: 30407832680027

Our address: Tashkent city, Yunusobod district, 19th block,
House 17.



Acceptance of articles

Published every
monthly



Directions

Social, economic, political,
technological, scientific



Scopus || Scientific electronic journal specializing in Scopus

CERTIFICATE NUMBER: №390637

**ORDER NUMBER ACCORDING TO
THE LICENSE REGISTER: C-5669633**

CONTACT:



Contact us
+998 50 737 87 88



Telegram channel
t.me/scopus_IST2100



Journal official website
<https://ist-journal.uz/index.php/IST>