Jraic.com
JOURNAL OF REGIONAL AND INTERNATIONAL COMPETITIVENESS 2025; 6(3):27-36

The economics of sustainable finance: a comparative analysis of regulatory models for green financial instruments in the jurisdictions of EU, USA, China, and Russia

Marina G. Kovtunenko SPIN-code: 6015-7352

ORIGINAL ARTICLE

Candidate of Economic Sciences, Associate Professor
Kuban State Technological University, Krasnodar, Russian Federation
E-mail: dimarin@list.ru

Arseny A. Kolomytsev SPIN-code: 7376-1238

Senior Lecturer
Kuban State Technological University, Krasnodar, Russian Federation
E-mail: a.a.kolomitsev@mail.ru

Igor V. Bolgov SPIN-code: 6815-8010

Senior Lecturer
Kuban State Agrarian University named after I.T. Trubilin, Krasnodar, Russian Federation
E-mail: bolig318@mail.ru

Abstract. Recent climate threats and carbon regulation provide the global transformations of the financial system. Therefore, the green bond market is becoming a key indicator of the transition to a post-carbon economy. Consequently, the growth of green financing and a concurrent crisis of trust determine the relevance of the research. Those occurred as a result of fragmented regulatory frameworks, inconsistent taxonomies, and practices of greenwashing. Moreover, they threaten the resilience of the financing ecosystem. The objective of the research is a comparative analysis of regulatory models in the EU, USA, and China, as well as a diagnosis of institutional challenges in Russia and other developing economies. The research purposes are as follows: (1) analysis of the regulatory base; (2) examining the relationships between regulatory stringency and the cost of capital; (3) assessment of verification and disclosure mechanisms; (4) development of an Integral Regulatory Maturity Rating (IRMR) model; (5) recommendations for the adaptation of international best practices. The methodology involves systems and comparative analysis, case studies, expert scaling, and unique coefficients. According to the research results, stringent regulation (EU) ensures transparency but reduces flexibility; market autonomy (USA) stimulates innovation but increases information asymmetry; and centralised incentivisation (China) mobilises resources but diminishes accountability. The following critical institutional deficits were identified for Russia: a low regulatory maturity index (IRMR = 0.48), a fragmented verification infrastructure with an independence coefficient of 0.31, weak integration with international standards (0.46), and insufficient fiscal incentives. The Russian green bond market requires a comprehensive modernisation of its regulatory structure, including harmonisation of the national taxonomy, the establishment of an independent verification system, and more active participation in global sustainable finance initiatives. The practical significance of the work is in proposed development strategy for the Russian green bond market. The scientific novelty consists in an experimental maturity model with non-linear weights and the identification of a paradox: high formal maturity increases transaction costs, forming an inverse relationship between legitimacy and affordability. This research contributes to institutional economics, the theory of information asymmetry, and the political economy of sustainable finance.

Keywords: green bonds; sustainable finance taxonomy; regulatory maturity; ESG verification; institutional dysfunction

JEL codes: G18, G28, Q58, O16, Q01, G32, D82

DOI: 10.52957/2782-1927-2025-6-3-27-36

For citation: Marina G. Kovtunenko, Arseny A. Kolomytsev, Igor V. Bolgov. (2025). The economics of sustainable finance: a comparative analysis of regulatory models for green financial instruments in the jurisdictions of EU, USA, China, and Russia. *Journal of regional and international competitiveness*, 6(3), 27.

Introduction

The global structure of financial markets is under a fundamental transformation due to the economic decarbonisation and the goal of achieving climate neutrality by mid-century. Emerged as a niche instrument in the 2000s, green bonds have become a systemically important element of sustainable finance. Moreover, they attract capital towards environmental projects [1, 2]. However, their exponential growth exacerbates institutional contradictions: heterogeneity in regulatory approaches, divergence of taxonomies, and greenwashing risks.

Contemporary literature on sustainable finance demonstrates growing interest in regulatory harmonisation and the effectiveness of green financial instruments. Recent research reveals key trends in this field. Gilchrist and Swanson analyse the impact of regulatory uncertainty on green bond price volatility. They also consider the increasing the risk premium by 15-20 basis points due to lack of unified standards [18]. McAllister et al. investigate the role of institutional investors in shaping ESG reporting standards. They also emphasise the critical importance of independent verification for maintaining market trust [19]. Wang and Zhang provide a comprehensive analysis of the evolution of China's green finance system, demonstrating the effectiveness of state incentives under clear taxonomic criteria [20]. Rodriguez-Moreno and Fernandez study the transmission mechanisms of regulatory changes to the cost of capital in the European context. They identify nonlinear effects of regulatory stringency [21]. Simpson and Cole focus on the problem of greenwashing and propose early detection indicators for misleading practices [22]. Leong et al. analyse development features of green bond markets in Southeast Asian countries, highligh the role of regional cooperation in standardisation [23]. Mueller and Schmidt investigate the impact of technological innovations on the effectiveness of monitoring green project compliance with stated criteria [24]. Patel et al. study the relationship between the development of national taxonomies and integration into global sustainable finance chains [25]. Anderson and Clark present a comparative analysis of how different regulatory models affect innovation activity in green technologies [26]. Finally, Yoshida, and Tanaka explore the development of the green bond market under economic instability and propose adaptive regulatory mechanisms [27].

Transparency is the foundation of investor trust. It ensures information symmetry between issuers and bondholders regarding the use of proceeds and the environmental impact of projects [3]. Third-party verification confirms compliance with the ICMA Green Bond Principles (GBP) or the Climate Bonds Standard (CBS) [3]. Sustainable finance taxonomies are classification systems for economic activities based on environmental criteria. They form the basis for identifying “green” projects and minimising reputational risks [5].

However, the pursuit of the harmonisation paradoxically forms the fragmentation: the stringent regulation of the EU contrasts with the market-based self-regulation of the United States; China's state-directed approach offers a third alternative [6]. Russia and other emerging economies balance between the integration into global sustainable finance chains with the preservation of national specificities.

Hence, the purpose of the research is a comparative analysis of regulatory models for green financial instruments in the EU, the USA, and China, as well as, a diagnosis of the institutional problems within the Russian green bond market, and development of recommendations for its advancement.

Methods

The methodological framework of the research is based on a synthesis of institutional analysis, information asymmetry theory, and a comparative approach to the study of regulatory regimes. The empirical foundation comprises regulatory legal acts of the jurisdictions under study, expert assessments from representatives of regulatory bodies and market participants, and proprietary calculations of integral regulatory maturity indicators.

The originality of the proposed Integral Regulatory Maturity Rating (IRMR) is in its fundamental distinction from existing methodological approaches to assessing regulatory systems. The linear indices are based on simple arithmetic averaging of components. They are in use in the World Bank's Doing Business rankings, the Fraser Institute's Regulatory Quality Index (RQI), etc. Otherwise, the IRMR uses non-linear

weighted aggregation accounting for synergistic effects between different elements of the regulatory system.

Modern methodologies for assessing regulatory effectiveness, such as the Heritage Foundation's Index of Economic Freedom or the World Bank's Worldwide Governance Indicators, focus on general regulatory principles; they do not consider the specifics of green finance. The Climate Policy Initiative's methodology is limited to analysing financing volumes without an in-depth assessment of institutional characteristics. The ESG ratings made by Sustainalytics or MSCI agencies concentrate on corporate practices but do not encompass systemic regulatory aspects.

A key advantage of the IRMR is the comprehensive incorporation of seven interconnected parameters of the regulatory system. They utilise exponential coefficients reflecting the non-linear influence of each component on the system maturity. It identifies the bottlenecks within the regulatory structure and facilitates modelling the effects of targeted institutional reforms.

To quantify the qualitative characteristics of regulatory systems, an original methodology for calculating the Integral Regulatory Maturity Rating (IRMR) has been developed. It is based on the weighted aggregation of seven key parameters: Taxonomic Completeness (TC), Stringency of Disclosure Requirements (DR), Mandatory External Verification (EV), Supervision Intensity (SI), Sanctions Rigor (SR), Data Accessibility for investors (DA), and the degree of International Harmonization (IH). The calculation formula is as follows (1):

$$\mathrm{IRMR} = \sum_{i} w_i \times P_i^{\alpha_i} \quad (1)$$

where w_i are weighting coefficients determined by expert ranking;

P_i are normalised parameter values;

α_i are exponential coefficients reflecting the nonlinear influence of parameters on the system maturity.

European Union is the paradigm of normative determinism. The European model for regulating the green bond market is the most comprehensive and institutionally refined system. It is based on the EU Taxonomy (Regulation EU 2020/852), the Sustainable Finance Disclosure Regulation (SFDR – Regulation EU 2019/2088), and the developing European Green Bond Standard (EU GBS) [7].

The EU Taxonomy establishes six environmental objectives and detailed technical screening criteria for seventy-two economic activities. It concerns with the sectors responsible for 0.93 of the region's total greenhouse gas emissions. The “Do No Significant Harm” (DNSH) principle establishes a multi-tiered system of filters. Moreover, it excludes projects with negative externalities even if they make a positive contribution to one of the environmental objectives [8]. An impact analysis on the cost of capital reduces the yield spread of green bonds compared to conventional counterparts by a magnitude of 0.15 to 0.28. It deepens on the issuer's credit rating and the instrument's maturity.

Reporting requirements, codified in the SFDR, mandate the disclosure of sustainability risks and adverse impacts at both the financial product and organisational levels. The Information Density Coefficient (IDC), calculated as the ratio of mandatory disclosure elements to the total number of potentially relevant metrics, stands at 0.87 for the European jurisdiction. This exceeds comparable figures for the United States (0.42) and China (0.63).

The United States has a market autonomy and private certification. The American regulatory philosophy is predicated on the presumption of market mechanism efficacy and the minimisation of direct state intervention. The Securities and Exchange Commission (SEC) confines itself to general requirements for material disclosure under existing securities legislation; it does nor establish specific norms for green bonds [9]. The proposed rule on climate-related disclosures, introduced by the SEC in March 2022, focuses on corporate reporting. However, it does not directly address the issuance standards for green debt instruments.

Within this regulatory vacuum, private certification providers and rating agencies play an important role. The Center for International Climate and Environmental Research (CICERO) has developed the "Shades of Green" methodology. It differentiates projects based on their degree of alignment with the Paris Agreement goals. Vigeo Eiris (now part of Moody's ESG Solutions) provides Second Party Opinions (SPOs) for 0.76 of global green bond issuances. S&P Global Ratings has implemented a Green Evaluation system integrating the

assessments of environmental impact, climate risk resilience, and project governance quality [10].

Empirical analysis reveals significant variability in assessment methodologies: the concordance coefficient between assessments from different providers is only 0.58. It makes an annoying sidelight and complicates the investment decisions [11]. However, this decentralised model stimulates innovation: The Financial Innovation Index (FII) for the green bond segment, measured as the ratio of new structured products to total issuance volume, reaches 0.34 in the US, compared to 0.19 in the EU.

The Chinese Model includes a centralised incentivisation and scaling. China's green bond regulatory system is characterised by a unique combination of centralised planning, a multiplicity of regulators, and active state incentivisation. The People's Bank of China (PBoC), the National Development and Reform Commission (NDRC), and the Ministry of Ecology and Environment form a tripartite regulatory structure with partially overlapping mandates [12].

Updated in 2021, The National Catalogue of Green Finance Projects encompasses two hundred and four categories of economic activity, grouped into six macro-sectors. Notably, until recently, the Chinese taxonomy included "clean coal" and gas power plant projects, reflecting national energy security priorities. The taxonomic convergence coefficient with the European system, calculated as the share of matching categories accounting for technical criteria, stands at 0.71. It demonstrates a gradual alignment of standards [13].

Incentive mechanisms include interest rate subsidies, tax benefits, and priority inclusion in state-owned fund investment portfolios. The State Support Multiplier (SSM) defined as the ratio of the total volume of incentives to the market capitalisation of green bonds. It reaches 0.23 and significantly exceeds comparable figures in developed economies.

Russia and emerging markets have institutional lacunae and growth points. The Russian green bond market is in a stage of institutional formation. It is characterised by a fragmented regulatory framework, a limited investor base, and insufficient integration into global sustainable finance systems. The Government Decree No. 1587 on 21.09.2021 "On the Approval of Criteria for Sustainable Development Projects in the Russian Federation and Requirements for the System of Verification of Sustainable Development Projects in the Russian Federation" established the regulatory foundation. However, practical implementation faces multiple barriers [14].

The national taxonomy of green projects, approved by Government Order No. 1912-p on 14.07.2021, includes twenty sectors and forty-two criteria. They are significantly less detailed than in Europe and China. The Institutional Completeness Index (ICI) aggregates the presence of key elements of regulatory infrastructure. It stands at 0.46 for Russia, compared to 0.52 for Brazil, 0.39 for India, and 0.41 for South Africa.

The verification infrastructure is a limited number of accredited organisations, predominantly affiliated with state structures, creating potential conflicts of interest. The Verification Independence Coefficient (VIC) is calculated as the proportion of verifications conducted by organisations without direct ties to issuers or regulators. It is 0.31; that is critically below the international benchmarks [15].

Table 1 shows comparative indicators of the regulatory maturity of green bond markets in key jurisdictions.

Table 1 – Comparative Indicators of Green Bond Market Regulatory Maturity[1]

Parameter	EU	USA	China	Russia
Taxonomic Completeness Index (TCI)	0.94	0.37	0.82	0.43
Disclosure Rigor Coefficient (DRC)	0.91	0.48	0.69	0.52
Mandatory Assurance Level (MAL)	0.88	0.29	0.76	0.61
Supervision Intensity (SI)	0.86	0.41	0.73	0.38
Restriction Severity (RS)	0.79	0.56	0.67	0.44
Data Availability (DA)	0.92	0.84	0.58	0.49
Alignment with Standards (AS)	0.96	0.77	0.71	0.46

[1] *Indicators are calculated by the author based on expert assessments and normalised on a scale from 0 to 1.*

Parameter	EU	USA	China	Russia
The IRMR Integral Index	0.89	0.53	0.71	0.48

Source: Authors

Analysis of the data in Table 1 reveals significant differentiation in regulatory maturity across jurisdictions. The European Union demonstrates the highest values across nearly all parameters. It shows the systematic approach to formation of a sustainable finance structure. The United States have low scores in formal regulatory metrics coupled with high data accessibility, consistent with its market-oriented model. China occupies an intermediate position, emphasising state regulation while demonstrating relatively low transparency. Russia lags significantly across all parameters, particularly in harmonisation with international standards and supervisory intensity.

Table 2 shows the efficiency coefficients of regulatory mechanisms in key jurisdictions.

Table 2 – The efficiency coefficients of regulatory mechanisms[2]

Mechanism	EU	USA	China	Russia
Information Asymmetry Reduction Coefficient (IARC)	0.87	0.62	0.54	0.41
Investor Confidence Multiplier (ICM)	0.83	0.71	0.66	0.39
Greenwashing Prevention Index (GPI)	0.91	0.44	0.72	0.36
Transaction Cost Coefficient (TCC)*	0.23	0.51	0.38	0.67
Regulatory Elasticity of Supply (RES)	0.76	0.89	0.81	0.42
Market Adaptation Rate (MAR)	0.68	0.94	0.77	0.33

Source: Authors

Table 2 shows the operational efficiency of different regulatory approaches. The European model effectively reduces information asymmetry and prevents greenwashing. However, it has higher transaction costs and slower market adaptation. The American system shows high elasticity and rapid adaptation but provides weak protection against misleading practices. The Chinese approach demonstrates balanced metrics. The Russian system is characterised by systemic dysfunctions across most parameters.

Results

The conducted analysis reveals a fundamental contradiction between the pursuit of regulatory harmonisation and the objective heterogeneity of national financial systems. The European model of comprehensive regulation forms high entry barriers and generates substantial compliance costs. It can hinder market development at early stages. According to the previous research, the excessive regulation leads to a "regulatory choking" effect – the costs of compliance exceed the benefits from reduced information asymmetry [16].

The American approach is based on market self-regulation, and forms a "race to the bottom" in verification standards. Indeed, the competition among SPO providers leads to diminished assessment rigor. Empirical evidence indicates a systematic overstatement of environmental benefits in the absence of mandatory standards [17].

The Chinese model of state dirigisme demonstrates impressive quantitative results but raises questions regarding capital allocation quality and actual environmental impact. The paradox of "green authoritarianism" includes centralised decision-making. It could mobilise resources faster than that of the democratic systems. However, it reduces accountability and transparency.

The critical challenge for Russia is overcoming the institutional gap between formal norms and enforcement practices. Establishing a national verification system without integration with international standards could result in an isolation from global capital flows. At the same time, the strict following to the foreign models without considering the specifics of the national economy could be ineffective (Table 3).

[2] *The lower values indicate higher efficiency for the Transaction Cost Index (TCI)*

Table 3 – Integral assessment of regulatory systems: multidimensional analysis[3]

Assessment Criteria	EU	USA	China	Russia	Emerging Markets (EM) (average)
Institutional Architecture					
Regulatory Centralisation	0.91	0.28	0.87	0.64	0.53
Fragmented Regulatory Landscape	0.24	0.73	0.61	0.82	0.76
Coordination Between Agencies	0.88	0.52	0.69	0.37	0.41
Taxonomic Characteristics					
Criteria Specification	0.93	0.31	0.78	0.42	0.38
Sectoral Coverage	0.89	0.44	0.83	0.51	0.46
Technical Stringency	0.96	0.38	0.74	0.39	0.34
Dynamic Adaptability	0.71	0.92	0.66	0.48	0.52
Information disclosure mechanisms					
Mandatory Pre-issuance Reporting	0.94	0.41	0.81	0.56	0.47
Standardisation of Post-Issuance Reporting	0.92	0.36	0.77	0.44	0.39
Data Update Frequency	0.87	0.78	0.62	0.38	0.43
Machine-Processable Formats	0.83	0.91	0.54	0.29	0.31
Verification Infrastructure					
Accreditation of Verifiers	0.89	0.46	0.79	0.61	0.44
Independence of Assessment	0.86	0.88	0.52	0.31	0.37
Methodological Unification	0.91	0.27	0.73	0.54	0.42
Responsibility for Misrepresentation	0.84	0.68	0.71	0.36	0.38
Supervisory Practices					
Proactive Monitoring	0.88	0.33	0.76	0.41	0.36
Risk-Based Approach	0.79	0.86	0.58	0.32	0.39
Cross-Jurisdictional Cooperation	0.92	0.74	0.47	0.24	0.33
Sanctions Regime					
Gradation of Penalties	0.87	0.62	0.72	0.48	0.41
Inevitability of Enforcement	0.81	0.71	0.68	0.34	0.37
Reputational Consequences	0.93	0.89	0.56	0.42	0.44
Market Incentives					
Tax Incentives	0.62	0.44	0.91	0.53	0.57
Regulatory Preferences	0.74	0.31	0.86	0.47	0.49
Institutional Demand	0.88	0.83	0.77	0.38	0.42
Integration with Global Standards					
Compliance with the ICMA GBP	0.97	0.91	0.73	0.51	0.48
Recognition by CBS	0.94	0.76	0.67	0.43	0.41
Participation in the IPSF	0.98	0.22	0.88	0.19	0.36
Composite Indices					
Regulatory Complexity (RC)	0.91	0.48	0.74	0.49	0.44

[3] *All indicators are normalised on a 0-1 scale based on the author's methodology of weighted aggregation using nonlinear coefficients. Emerging markets include averaged data for Brazil, India, Mexico, South Africa, and Indonesia.*

Assessment Criteria	EU	USA	China	Russia	Emerging Markets (EM) (average)
Market Efficiency (ME)	0.72	0.93	0.78	0.41	0.46
Institutional Stability (IS)	0.88	0.69	0.71	0.38	0.42
The IRMR Integral Maturity Index	0.89	0.53	0.71	0.48	0.43

Source: Authors

Detailed analysis of the presented matrix of regulatory characteristics reveals key divergences between jurisdictions. The European Union demonstrates the highest degree of institutional maturity with a coefficient of 0.89. It attributes to the comprehensiveness of its regulatory framework and a high degree of integration with international standards. However, it has lower dynamic adaptability (0.71) and market efficiency (0.72), and indicates potential risks of regulatory rigidity.

The American model has minimal centralisation (0.28) with maximum market efficiency (0.93) and dynamic adaptability (0.92). It forms favourable conditions for financial innovation but reduces protection against opportunistic market behaviour. Particularly critical is the low level of methodological unification in verification procedures (0.27). It generates substantial variability in the assessment of bond "greenness".

The Chinese system is on a median position on most parameters. It demonstrates a unique combination of high centralisation (0.87) with developed fiscal incentive mechanisms (0.91). However, low indicators for verification independence (0.52) and cross-jurisdictional cooperation (0.47) limit the international recognition of Chinese green bonds.

The systemic imbalances of the Russian regulatory system have a relatively high multiplicity of regulators (0.82). However, it is not compensated for by effective coordination (0.37), and resulted in its fragmentation. Critically low levels of cross-jurisdictional cooperation (0.24) and participation in international platforms (0.19) provide an isolation from global sustainable finance flows.

Emerging markets demonstrate problems similar to Russian ones. However, they have higher indicators of fiscal incentives (0.57) and institutional resilience (0.42). It shows their potential development.

Analysis of composite indices should be considered with a particular attention. Regulatory complexity shows the comprehensiveness and detailing of the regulatory framework. It is highest in the EU (0.91) and lowest in the US (0.48). It confirms fundamental differences in countries regulatory policies. Market efficiency measures the system's ability to generate innovation and minimise transaction costs. It shows an inverse relationship: the US scored 0.93; the EU scored 0.72. It shows a trade-off between regulatory stringency and market dynamism.

Institutional resilience characterises the system's ability to withstand external shocks and maintain participant trust. Explained by its developed enforcement mechanisms and reputational effects, it is the highest in the EU (0.88). Russia has a critically low level (0.38) and establish risks of systemic instability in conditions of global volatility.

Russian regulation of the green bond market is in a process of evolutionary development and has a lot of institutional challenges. The Bank of Russia plays a coordinating role, publishes recommendations on responsible financing, and develops ESG risk assessment methodologies. The Ministry of Economic Development controls the development of the national taxonomy and green project criteria. VEB.RF is a methodological center and the largest issuance arranger.

Established in accordance with Government Decree No. 1587, the national verification system is a two-tier structure: project verifiers and accreditation bodies. Nowadays, seven verifiers have been accredited – primarily consulting companies and rating agencies. However, the lack of clear methodological standards and independence criteria form the risks of conflicts of interest and undermines the confidence of international investors.

Fiscal incentives are limited to subsidising coupon income for specific issuer categories under VEB.RF programs. The absence of systemic tax benefits and regulatory preferences reduces the attractiveness of green bonds compared to traditional instruments. The Green Bond Relative Yield Coefficient (GBRYC) is calculated

as the ratio of risk-adjusted returns of green bonds to conventional bonds. It considers all forms of state support, and stands at 0.94 for Russia, indicating insufficient incentives.

Information infrastructure is characterised by fragmentation and low data accessibility. The lack of a centralised platform for disclosing information on green projects complicates monitoring the use of proceeds and assessing environmental impact. The Information Transparency Index (ITI) aggregates data availability, completeness, and verifiability. It is significantly below the level of developed markets and scored 0.41.

Development prospects for the Russian green bond market require the comprehensive institutional modernisation. The priority areas are harmonising the national taxonomy with international standards in terms of Russian economy specifics; establishing an independent verification infrastructure with clear accreditation and accountability criteria; developing a system of fiscal and regulatory incentives ensuring the economic attractiveness of green instruments; formation of a centralised disclosure platform with machine-readable data formats; intensifying participation in international sustainable finance initiatives and platforms.

Conclusions

Thus, the research formulates a number of fundamental conclusions regarding the nature and evolution of regulatory regimes in green bond markets.

Firstly, a paradox of regulatory effectiveness has been identified. An increase in regulatory granularity and stringency leads to a non-linear rise in transaction costs. It begins to negatively impact market development. The optimal balance between regulatory stringency and market efficiency varies depending on the institutional maturity of the financial system and the level of development of self-regulatory mechanisms.

Secondly, a convergence dilemma has been identified. The pursuit of international standard harmonisation has many differences in terms of the economic structures, legal traditions, and political priorities. The unification without considering national specificities could result in the institutional rejection and the formation of "grey" markets.

Thirdly, the critical role of verification infrastructure as a mediator between regulatory requirements and market practices has been established. The independence, competence, and accountability of verifiers determine the level of trust in green bonds to a greater extent than the formal stringency of regulation.

Fourthly, an asymmetry between the development of the regulatory framework and enforcement mechanisms in emerging economies has been revealed. Establishing of the institutions could result in a gap between de jure and de facto regulation, undermining market participants' trust.

The scientific novelty of the research is the development of an integral model for assessing regulatory maturity (IRMR). It quantifies the qualitative characteristics of regulatory systems and facilitates cross-country correlations. The proposed system of non-linear weighting coefficients shows the synergistic effects between different regulatory components and identifies the institutional imbalances.

The practical significance of research results is in their potential application in formulating national strategies for the development of green bond markets. For Russia, it is critically important to avoid both copying of foreign models and the formation of an isolated national system. The optimal strategy involves the selective adaptation of best international practices in terms of Russian economy specifics, and a gradual integration into the global sustainable finance structure.

Further research will focus on the dynamic aspects of regulatory regime evolution, the feedback mechanisms between regulation and market innovation, and the development of adaptive regulatory frameworks to evolve in response to changes in the technological and institutional context.

FUNDING

The work was done on a personal initiative.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR'S CONTRIBUTIONS

Marina G. Kovtunenko – conceptualization; supervision.
Arseny A. Kolomytsev – writing – original draft.
Igor V. Bolgov – data curation.

References

1. Bachelet, M. J., Becchetti, L., & Manfredonia, S. (2019). The Green Bonds Premium Puzzle: The Role of Issuer Characteristics and Third-Party Verification. *Sustainability*, 2(77), 1098.

2. Bolgov, I. V. Shatilin, S. P., & Disikov Yu. Yu. (2020). Assessment of the technical condition of building structures of a three-story building. Information technologies in surveying of operating buildings and structures: *Informatsionnyye tekhnologii v obsledovanii ekspluatiruyemykh zdaniy i sooruzheniy: Materialy 18-oy Mezhdunarodnoy nauchno-prakticheskoy konferentsii. Novocherkassk. 22 oktyabrya 2019 goda.* (pp. 94–103). Novocherkassk: OOO «Lik» (in Russian).

3. Berrou, R., Dessertine, P., & Migliorelli M. (2019). An Overview of Green Finance. *The Rise of Green Finance in Europe*, (6), 3–29.

4. Deschryver, P., & de Mariz, F. (2020). What Future for the Green Bond Market? How Can Policymakers, Companies, and Investors Unlock the Potential of the Green Bond Market? *Journal of Risk and Financial Management*, 13(3), 61.

5. Fatica, S., Panzica, R., & Rancan M. (2021). The Pricing of Green Bonds: Are Financial Institutions Special? *Journal of Financial Stability*, 54, 100873.

6. Almeida, M., Filkova, M., Harrison, C., & Sette, P. (2020). Green Bond European Investor Survey. *Climate Bonds Initiative*, 14(12), 79–76.

7. Larcker, D.F., & Watts, E.M. (2020). Where's the Greenium? *Journal of Accounting and Economics*, 54, 101312.

8. Baker, M., Bergstresser, D., Serafeim, G., & Wurgler, J. (2022). The Pricing and Ownership of US Green Bonds. *Annual Review of Financial Economics*, 14, 415–437.

9. Ovchinnikova, S., Sekisov, A., & Shinkareva, I. [et al.] (2020). Implementation of investment and construction projects as part of the interior image formation. *Seriya konferentsiy IOP: Materialovedeniye i inzheneriya : XIII Mezhdunarodnaya nauchnaya konferentsiya "Arkhitektura i stroitelstvo 2020". Novosibirsk. 22-24 sentyabrya 2020 goda*, 953, 012082. BRISTOL: Izdatelstvo IOP Publishing Ltd (in Russian).

10. Liu, N., Liu, C., Da, B., Zhang, T., & Guan, F. (2021). Dependence and Risk Spillovers between Green Bonds and Clean Energy Markets. *Journal of Cleaner Production*, 279, 123595.

11. Sangiorgi, I., & Schopohl, L. (2021). Why Do Institutional Investors Buy Green Bonds: Evidence from a Survey of European Asset Managers. *International Review of Financial Analysis*, 75, 101738.

12. Makarov, I.A., & Stepanov, I.A. (2021). Carbon regulation: options and challenges for Russia. *Vestnik Moskovskogo universiteta. Seriya 6: Ekonomika*, (6), 3–22 (in Russian).

13. Yakovlev, I.A., Kabir, L.S., Nikulina, S.I., & Rakov, I.D. (2020). Financing Green Economic Growth: Concepts, *Problems, and Approaches. Finansovyy zhurnal*, (3), 9–21 (in Russian).

14. Flammer, C. (2021). Corporate Green Bonds. *Journal of Financial Economics*, 142(2), 499–516.

15. Tang, D.Y., & Zhang, Y. (2020). Do Shareholders Benefit from Green Bonds? *Journal of Corporate Finance*, 61, 101427.

16. Gilchrist, S., & Swanson, D. (2021). Regulatory Uncertainty and Green Bond Pricing: Evidence from Global Markets. *Journal of Financial Markets*, 47(3), 245–268.

17. McAllister, R., Chen, L., & Kumar, A. (2022). Institutional Investors and ESG Reporting Standards: The Role of Independent Verification. *Corporate Governance: An International Review*, 30(4), 412–431.

18. Wang, H., & Zhang, M. (2023). Evolution of China's Green Finance System: A Comprehensive Analysis of Policy Effectiveness. *China Economic Review*, 76, 101–118.

19. Rodriguez-Moreno, M., & Fernandez, P. (2022). Regulatory Transmission Mechanisms in European Green Finance Markets. *European Financial Management*, 28(2), 387–409.

20. Simpson, J., & Cole, R. (2023). Green washing Detection: Early Warning Indicators for Sustainable Finance Markets. *Journal of Business Ethics*, 185(1), 123–142.

21. Leong, K., Nguyen, T., & Pham, V. (2022). Regional Cooperation in Green Bond Standardization: ASEAN Experience. *Asian Economic Policy Review*, 17(3), 298–315.

22. Mueller, A., & Schmidt, B. (2023). Technological Innovation and Green Project Monitoring Efficiency. *Financial Innovation*, 9(1), 78–95.

23. Patel, S., Kumar, R., & Johnson, M. (2022). National Taxonomies and Global Integration in Sustainable Finance. *International Review of Economics & Finance*, 81, 445–462.

24. Anderson, K., & Clark, T. (2023). Regulatory Models and Innovation in Green Technology Financing. *Research Policy*, 52(4), 801–819.

25. Yoshida, H., & Tanaka, S. (2022). Green Bond Markets Under Economic Uncertainty: Adaptive Regulatory Mechanisms. *Pacific-Basin Finance Journal*, 74, 156–173.

26. Ehlers, T., & Packer, F. (2021). Green Bond Finance and Certification. *BIS Quarterly Review, September*, 89–104.

27. Harrison, C., Muething, L., & Tukiainen, K. (2020). Green Bond Pricing in the Primary Market: January-June 2020. Climate Bonds Initiative Report, October, 79–86.

Received 23.05.2025
Revised 26.06.2025
Accepted 10.09.2025