

Mapping the Regulatory Quality in the nexus between Green Finance and Environmental Sustainability

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ABSTRACT

The green finance instruments are seen as essential tool for an environmental sustainability but its global application appears to be varied depending on institutional setup. This paper systematically reviewed the literature and used bibliometric analysis to examine the central moderating role of the quality of regulation in the green finance – environment sustainability linkage. By assessing 163 papers published from 2004 to 2026, this study explores an intellectual mapping, theory foundations and dynamics, and future development path of this growing research area. Our results find a rapid rise of academic interest from 2022 onwards on this field, which are related to modern ESG regulation development, but it also appears that current literature has suffered from a conceptual disorder of governance concepts and obvious geographic imbalance as empirical studies are concentrated in China and some advanced countries. The whole literature shows that good quality of regulation which implies policy consistency, strong anti-greenwashing controls and unified sustainability disclosure standards is a prerequisite to enable green financial instruments being translated into real environmental impact. Finally, this paper draws a future research agenda on theoretical convergence on governance indices and empirical explorations in developing economies.

Keywords: Green finance, regulatory quality, sustainability, Bibliometric Analysis, Biblioshiny.

INTRODUCTION

21st Century represents one of the most important challenges the world faces, it is the environmentally sustainable development. The effects of the climate change, depletion of resources, environmental degradation, biodiversity loss and carbon emissions have led to an increased need for reaching global sustainability development goals and transition to a low-carbon economy. There has been a great need for a strong inflow of money towards environmentally sustainable development paths, which has been supported through several international commitments like Paris Agreement on Climate Change and The United Nations Sustainable Development Goals (SDGs) (Zairis et al., 2024). The role of green finance has thus been identified as a crucial instrument for environmental challenges and sustainable development for a wide array of policymakers, governments, private and public financial institutions, international organizations etc. Green Finance refers to the provision of financial services, investments and financial instruments which finance environmentally sustainable development activities. Its goal is to promote and direct financial investments towards environmentally sustainable economy and the concept includes a range

of instruments including green bonds, green loans, climate finance, green investment funds, green banking, sustainability-linked financial instruments (Mudalige, 2023). With these instruments, green finance aims at redirecting funds towards development of renewable energy, clean technology, energy efficiency measures, sustainable infrastructure and environmentally conscious practices. Existing literature points that green finance leads to positive environmental sustainability via, for example, decrease in carbon emissions, an increase in the use of renewable energy sources, development of green innovations and improvement of environmental quality (Ojha, 2025; Zairis et al., 2024).

Although there is an increasing agreement of the positive influence of green finance, it has been observed that the implementation of green financial initiatives vary considerably across countries and region. Some countries have witnessed considerable environment benefits as a result of green financial practices whereas others have been seen with meager results from considerable financial investments. This have led scholars to probe into the institutional and governance mechanisms affecting the results from the implementation of green finance initiative (Atta & Sharifi, 2024). Among the mechanisms, regulatory quality has been cited as critical driver of sustainable development.

Regulatory quality refers to the ability of government and public institutions to formulate, implement and enforce good policies and regulations which support the private sector development whilst protect society and environment. Governance literatures suggest that good regulatory frameworks have the potential to reduce uncertainty and improve credibility and accountability mechanisms, as well as resource allocation (Atta & Sharifi, 2024). With respect to sustainable finance, regulatory quality effects environmental regulation formulation and implementation, sustainability disclosure provision, green taxonomies, environmental standards and sustainable investment structures. Regulatory quality may bolster investor confidence, enhance disclosure standards and curtail the occurrence of green washing, thus enhance the environmental impact of financial investments (Papafloratos & Pantazi, 2025).

In relation to the green finance-environmental sustainability relationship, the theoretical relevance of regulatory quality can be framed in terms of the following interlocking concepts. Institution Theory proposes that firms function within the context of institutional environment which will determine their organizational strategies and behaviors. Robust institutional framework or institutions will motivate firms and financial institutions to embrace environmentally sound behavior and invests in sustainable initiatives. Similarly, in the context of Ecological Modernization Theory, sustainable growth can be made feasible through technological progress, market mechanism and appropriate governance mechanisms. Governance theory advocates that availability of finance alone will not contribute significantly to policy outcomes, the quality of institutions administering these funds is critical (Atta & Sharifi, 2024). These concepts collectively suggest that green finance will more likely generate more significant environmental benefits in a country with strong institutional environment.

The role of regulatory quality is further enhanced in the context of recent trend in sustainable finance policy. Several sustainable finance policy developments have increasingly highlighted the importance of regulatory quality including mandated sustainability reporting standard, environmental disclosure obligations, ESG regulations, green finance taxonomy, and climate-related financial disclosure requirements. For example, the implementation of sustainable reporting regulation and ESG disclosure obligations represent a step towards regulatory revolution which is important to make the sustainable finance initiatives achieve their goals (Kim & Yang, 2026; Papafloratos & Pantazi, 2025). These trends reveal that regulatory quality is crucial to the green finance and environmental sustainability relationship.

While much has been written on green finance and environment sustainability in the last decade, the literature is fragmented in various disciplines, including finance, economics, environmental management, sustainability, public policy and so on. Existing reviews are predominantly on green financial instruments,

ESG performance, sustainable banking practices and climate finance initiatives (Mudalige, 2023; Ojha, 2025; Zairis et al., 2024). There is far less attention paid in terms of understanding in systematic way how regulatory quality affects, moderates or enhances the effect of green finance on environment sustainability outcomes.

In addition, governance related constructs were often conceptualized using other labels such as institution quality, regulation effectiveness, environment governance, government effectiveness, policy quality, rule of law and etc., which cause conceptual fragmentation (Atta & Sharifi, 2024). The fragmented understanding on regulatory quality on green finance-environment sustainability relationship consequently develops inadequately. The extant studies are informative yet, they are scattered across different conceptualization of green finance-environment sustainability relation, methodological orientations and context, which make it difficult to form a cohesive body of literature.

In the face of the rising salience of sustainable finance and the increased attention on governance instruments to promote environmental goals, an inclusive systematic literature review seems not only warranted but also needed. Drawing together the existing literature in a systematic manner-reviewing major research area, theories and methodological aspects-the present review intends to document the position of regulatory quality in the green finance-environmental sustainability relationship. Additionally, the review would explore new research avenues, thus laying down a future research agenda to move the theory, empirics and policy research forward.

Research Gap

While a large body of literature on green finance and environmental sustainability has been amassed, many gaps remain unaddressed, namely:

1. While a good amount of systematic reviews on green finance, sustainable finance, ESG, climate finance, and green banking has been conducted, the link between green finance and environmental sustainability in relation to the role of regulatory quality remains less researched (Mudalige, 2023; Zairis et al., 2024). Today, there has been no systematic synthesis and integrative mapping of regulatory quality research in green finance-environmental sustainability nexus.
2. In terms of governance aspects, previous studies focused on regulatory quality, regulatory effectiveness, institutional quality, environmental governance, government effectiveness and rule of law (Atta & Sharifi, 2024). However, the similar terms that overlapping in meanings between governance variables such as environmental governance, institutional quality, environmental effectiveness, etc. Cause a blurry and disperse range for theory and empirical results on environmental performance with respect to regulatory quality.
3. The geographical scope is still narrow: numerous studies have covered China and only few developed countries given the developed green finance systems and policies frameworks, while few works focused on developing countries, emerging markets, and cross-regional comparison, leading to narrowizability of the finding and less attention on the contextual role of regulatory quality.
4. Recent developments have resulted in changes to the sustainable finance governance, including mandating ESG disclosure, sustainable finance taxonomy, climate-related financial disclosure framework, and sustainability reporting (Kim & Yang, 2026; Papafloratos & Pantazi, 2025). To date, these changes have not yet been synthesized in relation to the impact of green finance on achieving environmental sustainability results.

5. To date, no systematic review has simultaneously considered theory, methodology, research theme development, geographical distribution and future research direction in the specific context of the regulatory quality of the green finance-environmental sustainability nexus, and a systematic literature review on these topics is urgently required in order to synthesize scattered information and pinpoint future research topics.

Research Objectives

1. To systematically review and integrate the literature on the quality of regulatory in the nexus of green finance-environmental sustainability.
2. To classify the major theories, theme issues, and research methods of the studies on the quality of regulatory, green finance and environmental sustainability.
3. To appraise the impacts of the quality of regulatory on the efficiency of green finance in attaining environmental sustainability outcomes in different institutional contexts.
4. To establish a future research agenda through exploring new research issues and prospects.

Research Questions

1. In what ways has the literature developed in the field of regulation quality, green finance & environmentally sustainable growth?
2. What is the overall Theoretical Foundation, thematic groupings, and methods of the literature concerned with regulatory quality, green finance and environmental sustainability?
3. What is the strength and nature of the moderating effect of institutional setting on the relationship between green finance and environmental sustainability?
4. What research gaps, trends, or areas for further research have been identified from the literature?

LITERATURE REVIEW

Theoretical Foundations of the Green Finance-Environmental Sustainability Nexus

The practical connection lies between green finance and environment sustainable encompassing Institution Theory, Stakeholder Theory, Ecological Modernization Theory, Governance Theory, and Sustainable Development Theory. According to these theories, it is argued that for environmental sustainability to emerge green finance must be accompanied by the commitment and decisions of the institutional arrangements in the form of government policies on, institutionalization, stakeholder participation, sustainable life styles, technology transfer, etc.

Institutional Theory, institutions are defined as external rules made by general consensus on which organizations depend, institutional issues and contingent factors affect the strategic choices and sustainable behaviors of organizations. Institutional environment, brings the most powerful forces drives the economic behavior of firms and financial institutions to be environmentally friendly depending on the factors such as regulatory power, policy inducements and mechanisms of enforcing obligations (Atta & Sharifi, 2024). The regulatory institutions specify rules, provide the framework within which technical instruments work in the green finance.

As the Ecological Modernization Theory, the solution to environmental problems has to be accompanied by technological advancement, market mechanism and good governance. Green finance is a market instrument that channels debt and equity funds to environmentally beneficial activities in order to further ecological modernization and economic resettling (Ahmed & Raza, 2024). The Stakeholder Theory also shared that these institutions are playing more attention to environmental expectation of investors, regulators, customers and society that are encouraging the green finance practices (Zairis et al., 2024).

In more recent years, Governance Theory has been gaining prominence in the context of sustainable finance literature. Governance scholars postulate that the success of sustainability outcomes in the environmental dimension is highly contingent on the quality of the institutions that formulate, implement and enforce actions and policies related to sustainability (Barra & Falcone, 2025). As a result, institutional regulator quality has emerged as an important institutional factor that can potentially facilitate or hinder green finance.

Evolution and Conceptualization of Green Finance

Green finance has transformed from a specialized concept to a critical component of international sustainability agenda. In its early stage, green finance was inclined to be confined to environmental lending and renewable energy financing, but now extended to include green bonds, green loans, sustainability linked bonds, green credit, climate finance, ESG investment, green banking and transition finance (Flottmann et al., 2025).

As stated by Mudalige (2023), green finance is intended to introduce the financial mechanisms for green projects, utilizing a series of financial instruments, through a financial system in order to promote environment protection, environmental conservation and green development. Recent reviews show that the development of green financial products has resulted in a significant flow of capital into green projects and increased corporate environmental performance. (Ojha, 2025)

The fast expansion of green debt markets has accelerated the build-up of sustainable finance ecosystems. Flottmann et al. (2025) found that green bonds and related financial products such as sustainability-linked financial instruments are among the most prominent tools used to fund climate investments globally. Likewise, Mamun and Lszl (2025) noted the integration of environmental goals into existing finance systems and decision-making frameworks worldwide.

Nevertheless, academic researchers have highlighted the issues of greenwashing, unstandardized reporting approaches, opacity, and fragmentation of regulations as well. The existence of 'environmental' led investment funds, which are certified as sustainable in questionable ways, has further increased the demand for regulatory reforms and governance improvements (Papafloratos & Pantazi, 2025). Regulatory quality appears to be necessary in order to make green finance work in practice.

Green Finance and Environmental Sustainability

Environmental sustainability is the sustainability of natural resources, ecosystems, and the environment that essentially distributes the benefits over the long-term future on an equitable basis among various generations (Narayan, 2005). Green finance research, rests on (the) assumption that financial systems could play a critical role to contribute toward sustainability of environment by channeling the flows of finance into environmentally sustainable activities (Chakravorty et.al 2007; 80)].

An increasing amount of empirical research confirms the positive impact of green finance on the environment. For instance, empirical results suggest that green finance tools (e.g. Green financial loans,

green insurance) can favor the development of renewable energy, the diffusion of cleaner production technologies, and decrease the emission of greenhouse gases (Dai et al., 2025). The various positive effects of green credit loans on the environment for highly-pollutant firms have been also proven.

Likewise, the effect studies performed by Ojha (2025) and Zairis et al. (2024) affirm that green banking activities have an impact on sustainable development by means of environmentally sensitive lending, financing renewable energy projects, and including environmental considerations in credit decision processes. These mechanisms serve as enablers in the transition toward low-carbon economies and the achievement of better environmental performance.

However, the coherency of green finance in terms of environmental sustainability remains not universal. Other researchers have found heterogeneous results among different countries and regions, indicating the contextual effects of green financial mechanisms (Ahmed & Raza, 2024). This inconsistency made scholars focus on the institutional and governance variables as other explanations.

Regulatory Quality as an Institutional Determinant

Regulatory quality, one of the six Worldwide Governance Indicators (2007), shows the ability of government to formulate and implement sound policies and regulations. It is a key institutional indicator in contemporary economic and social development. With regard to sustainability research, regulatory quality is identified as an essential institutional factor affecting environmental governance and sustainable financial performance.

Good regulatory quality comprises policy consistency, implementation of policy, transparency and accountability, legal enforcement, and regulatory capacity. These features foster conducive environments for sustainable investments by stabilizing the market through consistency, providing assurance to the investors and establishing the market credibility (Atta & Sharifi, 2024).

Recent studies indicate that a robust regulation mechanisms contribute to environmental sustainability through three channels: First, the generation of firm environmental norms and disclosure requisites through regulatory systems promotes the enhancement of environmental performance; secondly, the quality of regulation asserts the reliability of green financial products by discouraging green-wash and information cheating; thirdly, the governance structures formed by quality regulations strengthen the efficiency of financial resources transferred into environmentally-friendly projects (Rivo-Lpez et al., 2025).

Furthermore, quality of regulation has grown in significance in the age of ESG disclosure, sustainable finance taxonomies, and climate disclosure frameworks. With growing country-level stringency of sustainability reporting, green finance effectiveness relies more and more on the strength of the regulatory institutions to oversee and ensure compliance (Kim & Yang, 2026).

Regulatory Quality and Green Finance

In addition to the green finance definition, a significant part of recent academic papers put a great deal of stress of the quality of regulations as determinants for a successful green financial system. Markets for sustainable finance need sound regulations, transparent disclosure policies, investor protection framework, enforcement.

Well-structured regulatory framework promotes green finance by creating the investor confidence, lowering of transaction costs, and providing policy certainty. On the other hand, weak regulatory framework

discourages green investments because of policy uncertainty, lack of enforcement, and greater information asymmetries (Mamun & Lszl, 2025).

The proliferation of sustainable finance taxonomies, ESG regulation and climate-related disclosure mandates is evidence of the increasing importance of regulation to channel financial flows in support of environmental goals. Regulation can help grow green finance markets and enhance the environmental characteristics of sustainable financial products.

The recent evidence from the markets shows how the looming green regulations uncertainty can have adverse impacts on green finance markets, such as the shrinking investor confidence caused by the rollback of existing regulations and uncertainty over the future regulations has been intertwined with the stagnation of the green bond markets and the shrinking of sustainable investment.

Regulatory Quality and Environmental Sustainability

The link of regulations quality and the sustainability of environment has been drawing the future research extensively. Good regulatory institutions shape standards and controls, such as regulations and laws, thereby induce the government enforcement, transparency and environmental innovations.

Institutional effectiveness and rule of law are found, by Atta & Sharifi, 2024, to have significant positive impacts on environmental performance irrespective of national contexts. Likewise, the body of evidence on environmental governance supports that of stronger institutional factors enabling better environment achievement, lower emissions index and more effective sustainability policies.

Regulatory quality can also promote indirectly environment sustainability due to innovation and technology adoption. Regulatory quality enhances the incentives for firms to utilize cleaner, more resource-efficient modes of production. Thus, it acts as a driver (or a determinant) of environmental sustainability both directly and indirectly.

Regulatory Quality in the Green Finance–Environmental Sustainability Nexus

While the literature in the green finance and regulatory quality has been heavily explored separately, the interaction effect between green finance and regulatory quality has not been sufficiently investigated. Preliminary results imply that the interaction effect could be sizable.

A most important find in this field is from the most recent cross-country study indicating that institutional quality enhances the beneficial effects of green finance on sustainability issues (Shahbaz et al., 2025). Green finance is more environmentally beneficial in countries with strong institutional quality relative to those countries with poor institutional qualities.

In the same way, research on the role of policy uncertainty reveals that unstable political regimes and a deficient regulatory framework impair the environmental efficiency of financial sustainability efforts (Sun et al., 2025). It can be said that regulatory uncertainty elevates the risks associated with investments, hindering long-term green investments and diminishing the ability of the financial markets to sustain the environment.

Hence, the literature emerging points to the regulatory quality as a key enabling condition enabling green finance to achieve significant environmental results. Not yet, the empirical evidence remains disconnected across region, methodology, and theoretical framework. In addition, the existing studies use different

measures of governance quality, institutions functioning, and regulatory enforcement, leading to conceptual inconsistencies.

Synthesis of Literature and Identification of Knowledge Gaps

The literature examined in this paper provides convincing evidence that green finance has made a breakthrough in realizing environmental sustainability through the channel of adding to the resource allocation to promote the environmentally friendly investments. The result also suggests that the quality of regulatory environment has been a critical factor for sustainable finance and environmental performance improvement.

Nevertheless, the research gaps that are still present are several: first, prior studies narrowly focus on green finance and regulatory quality separately instead of focusing on their nexus; second, governance dimensions are still not coherently conceptualized, as complementary terms, e.g., regulatory quality, institutional quality, governance effectiveness, environmental governance, and rule of law, are used synonymously; third, the empirical inquiries against coverage are very concentrated on China and some few advanced economies, generating profound geographical distortions; fourth, the implications of emerging environmental, social and governance (ESG) regulations, sustainability disclosure requirements, and sustainable finance taxonomies are not yet comprehensively integrated.

These shortcomings point to the need of a dedicated systematic literature review that is solely dedicated to the topic of mapping the regulatory quality in relation to green finance–environmental sustainability link. This would address 19's call for a comprehensive review of the theoretical and empirical literature (including methodologies, findings, and future knowledge gaps) of the recently emerging green finance and environmental sustainability realm.

DATA ANALYSIS AND INTERPRETATION

Introduction

In this section, the empirical findings based on the systematic bibliometric analysis of literature (green finance, regulatory quality, and environmental sustainability) are presented. Data visualization and descriptive analytics constitute the evidence to characterize the intellectual structure and development pathways of the investigation on limited indication of the content knowledge of the fields. Performance (including publication and citation analysis) and science mapping (such as geographic analysis and learning and thematic cluster analysis) are used from after the content source tracking; to the evolving research dimension; up to the heterogeneous author collaboration network analysis. The endeavor serves as the primary evidence to fill the knowledge gaps; identify current research trend and answer the key research questions of governance on sustainable finance.

Main information of Data

This table offers a macro view of the bibliometric on the time period 2004-2026. 124 documents culled from 129 sources form a sample of 163 documents. Clearly, there is an extremely high annual growth rate (16.72%) of literature in the field. On average, there are 439 authors who have published these papers and each has published, on average, of 13.52 references per document. A comparison of high number of authors as compared to single-author documents (47) and a high international co-authorship rate (30.67%) imply a very collaborative, possibly trans-national research activity.

Table 01. Main information of data

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2004:2026
Sources (Journals, Books, etc.)	129
Documents	163
Annual Growth Rate %	16.72
Document Average Age	2.23
Average citations per doc	13.52
References	4860
DOCUMENT CONTENTS	
Keywords Plus (ID)	206
Author's Keywords (DE)	466
AUTHORS	
Authors	439
Authors of single-authored docs	44
AUTHORS COLLABORATION	
Single-authored docs	47
Co-Authors per Doc	2.77
International co-authorships %	30.67
DOCUMENT TYPES	
article	163

Annual Scientific Production

The figure 01 shows the volume of science paper publications over time from 2004, 2022 to 2026. From the graph, the publication was almost relatively unchanged for more than ten years. Then a sharp, breathtaking rise, especially after 2022 continuously to its peak near 2025. It echoes the rapid development of green finance and ESG regulations (standards and regulations) at present as new topical subjects worldwide.

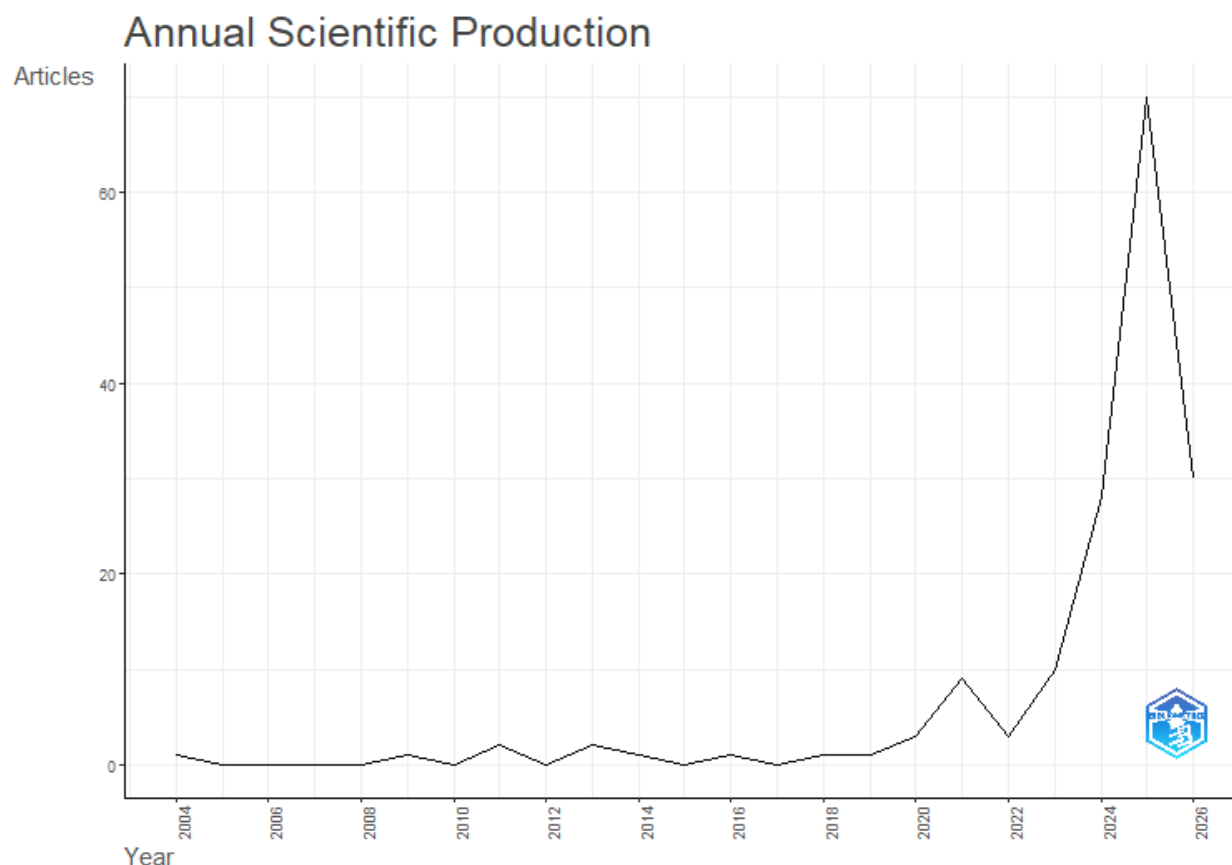


Fig. 01: Annual Scientific Production

Average Citations Per Year

Figure 02 depicts the total number of citations received annually by the retrieved documents. This time, citation impact and not publication number was considered, and the impact has experienced one spectacular spike just around 2020, indicating that the established 2020 papers gained a huge academic impact at once, probably as the original, high-impact papers that triggered the proliferation of publication volume seen in the last 1–2 years.

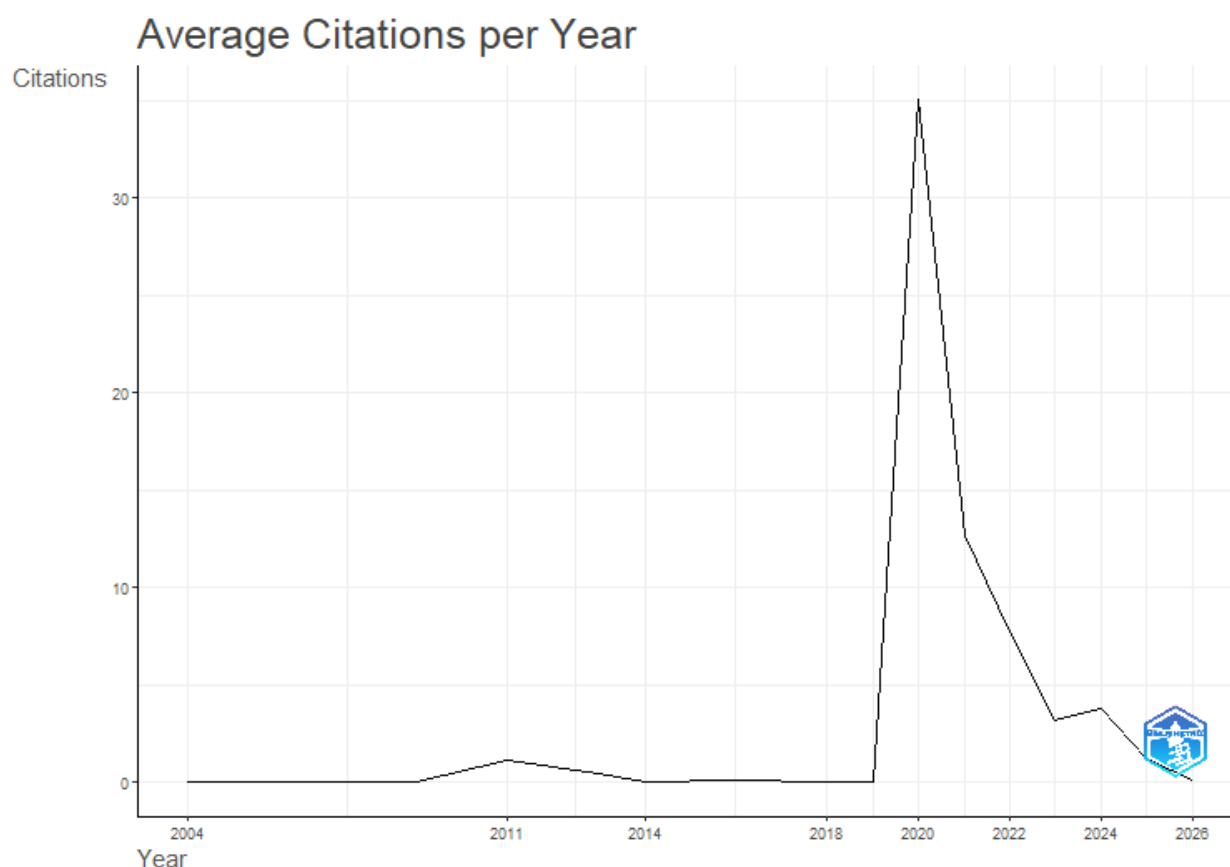


Fig. 02: Average citations per Year

Three Fields Plot

Figure 03 illustrates a Sankey diagram representing links among referenced sources on the left, authors situated in the center and merged keywords displayed on the right. This network flow indicates the major research directions (top research segments) that specific core authors serve as a link from literature to keywords. As can be seen, keywords such as "sustainability", "economics" and "sustainable development" had the high number of references from diverse authors, implying that the related field is multidisciplinary.

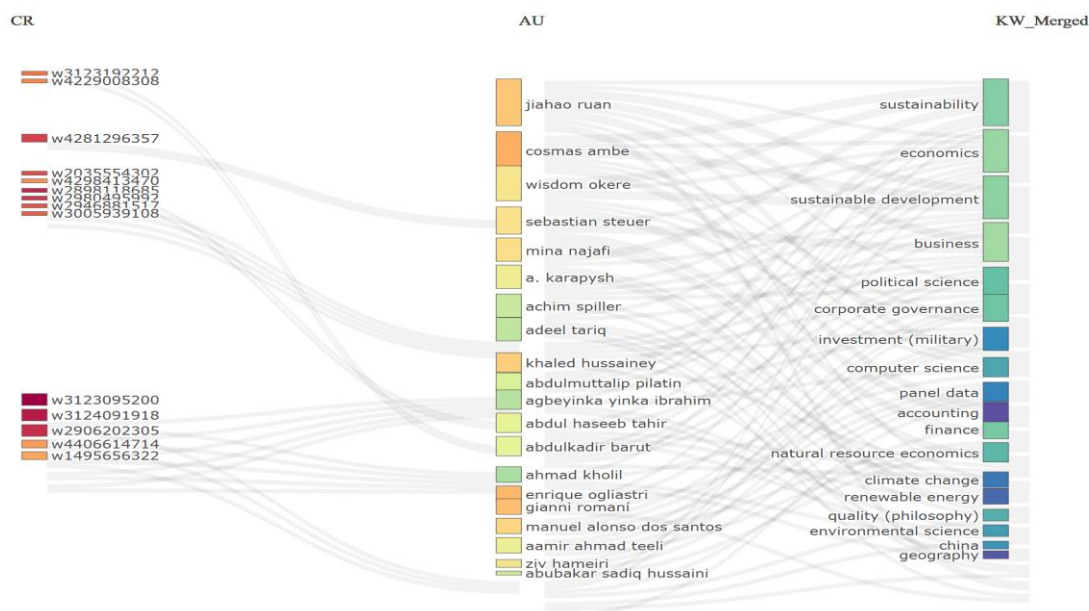


Fig. 03: Three Field Plot

Most Relevant Sources

Figure 04 shows the leading publication sources that can be found. The journal "Sustainability" has published the most, with 8. Fourth led by "Environment Journal-Special issue is the journal "Frontiers in environmental science" (5 published). The next is "The journal "Sustainable development" with 5 published articles. The Most of the searches point out the most probable journals that the authors publish.



Fig. 04: Most Relevant Sources

Barford Law

Figure 05 adapts Bradford's Law to visualize the spread of scientific literature across journals. Distribution of sources has been grouped around in the "Core Sources" region, where maximum number of publications come out. Journals such as "Sustainability", "Frontiers in Environmental Science" and "Sustainable Development" fits into the high-yield core zone. This affirms the domain being multidisciplinary, the core group of journals in the problem domain has a significantly higher number of publications.

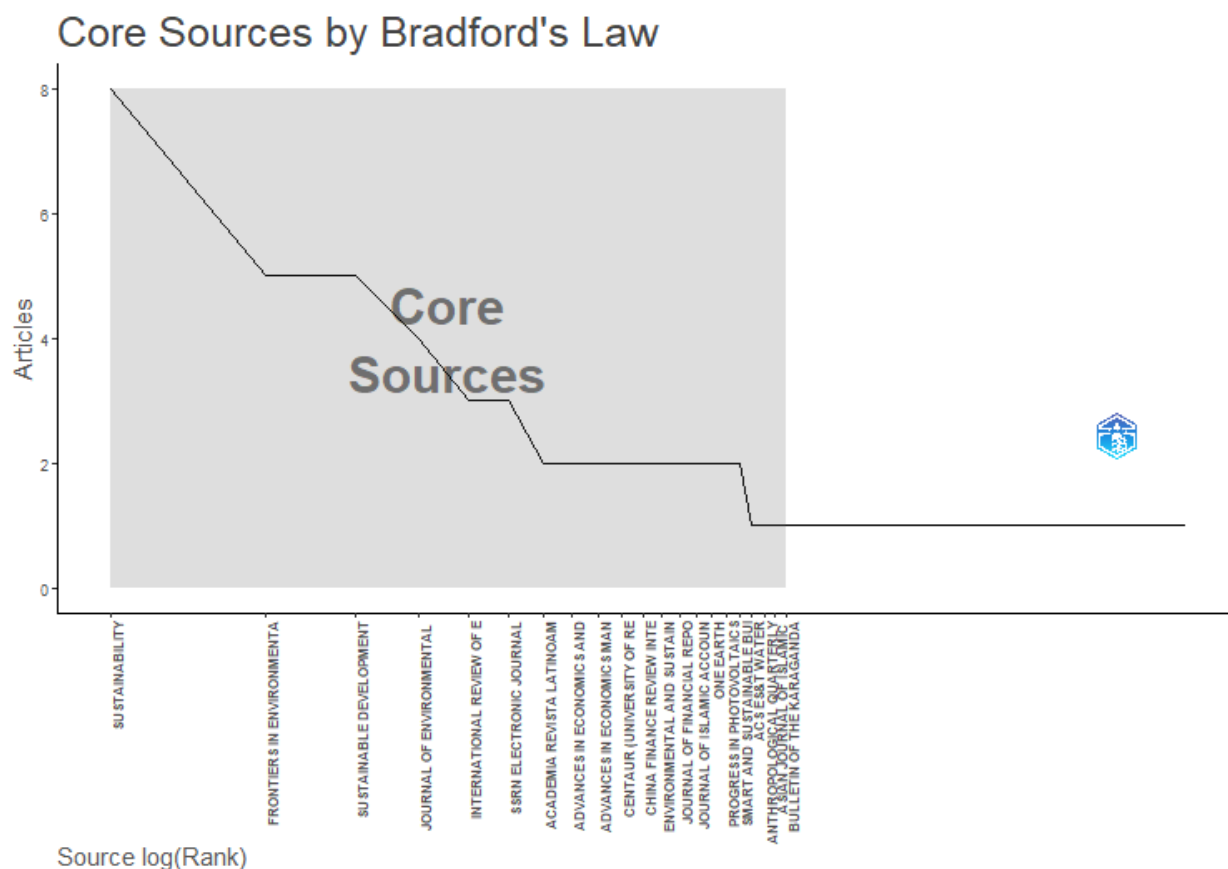


Fig. 05: Barford Law

Most Relevant Authors

Figure 06 shows the most prolific authors in the corpus by number of documents; as can be seen, the authorship is very fragmented, with Cosmas Ambe, Enrique Ogliastri, and Gianni Romani tied at two documents each. There is no single author with an enormous publication record, indicating that no dominant researcher is conducting research on the regulatory quality of green finance (something that is still emerging).

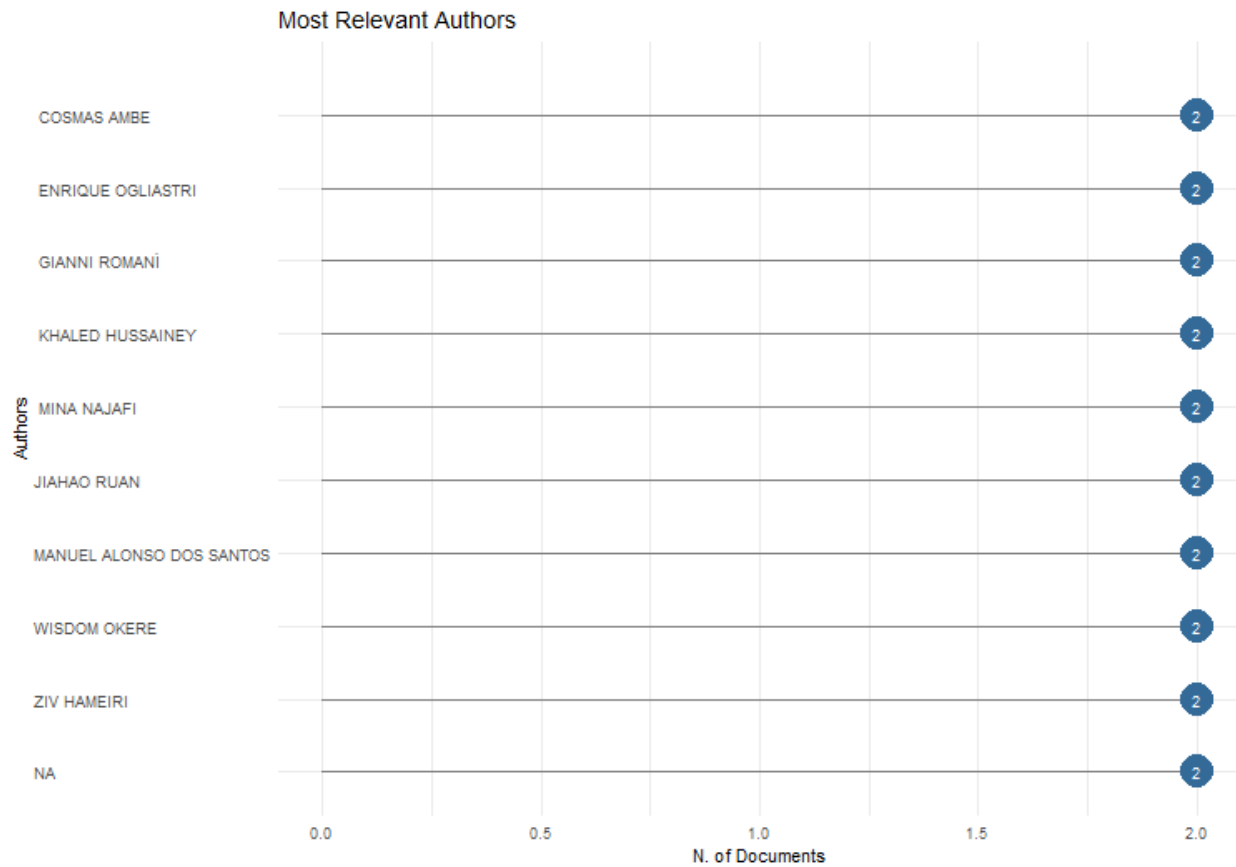


Fig. 06: Most Relevant Authors

Lotka's Law

The authorship within this dataset. Again, the drastically downward trend of the log-linear line resembles a typical inverse-square function. The study's authors found that predominantly one author contributed to only one document while almost no authors only authored two. This "flat" peak suggests a lack of continuous authorship: most authors have only published once.

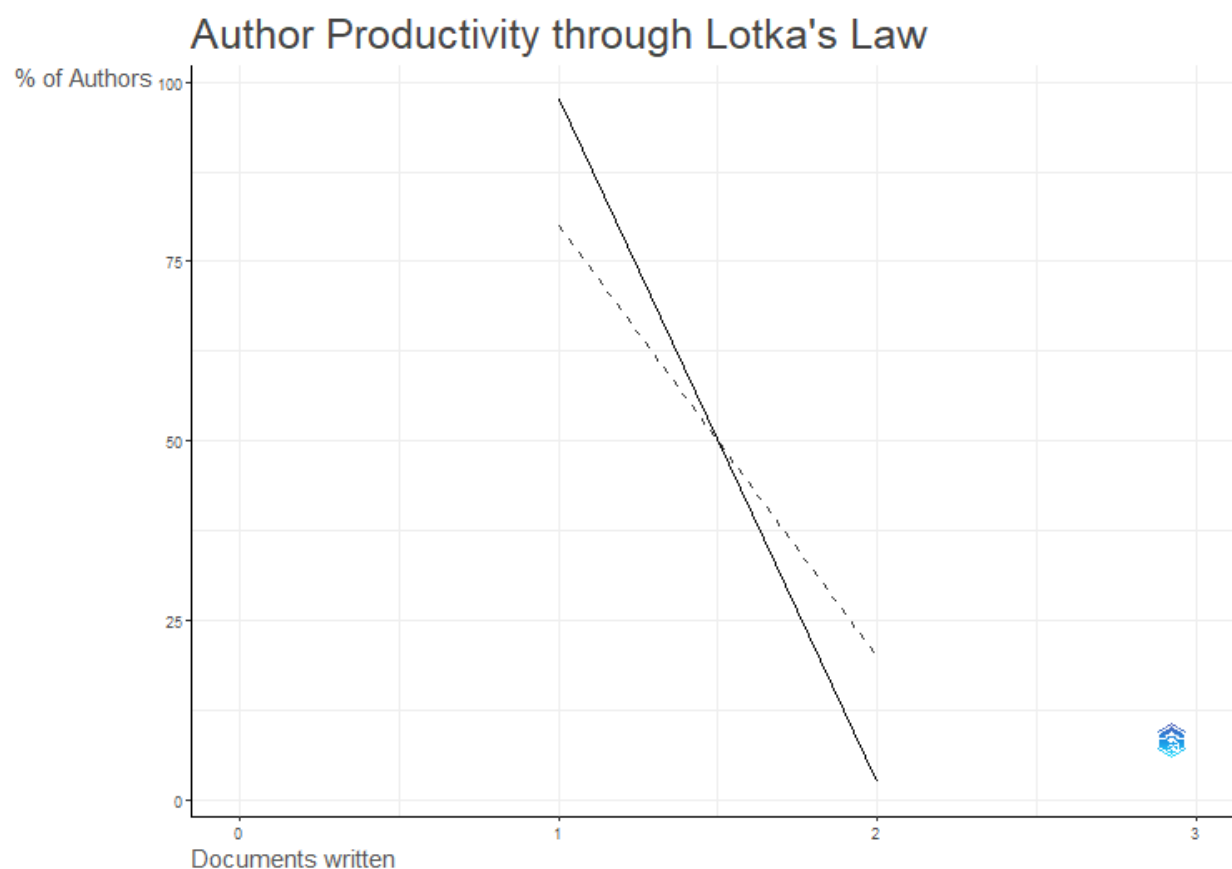


Fig. 07: Lotka's Law

Corresponding Author's Countries

The distribution of the special fields relating to national output in Figure 8 is dominated by China, with the majority of its output being single country work and a significant presence of (albeit dominated) MCP work; the former gains the most significant share of overall output, but MCP ratios are high within the UK.

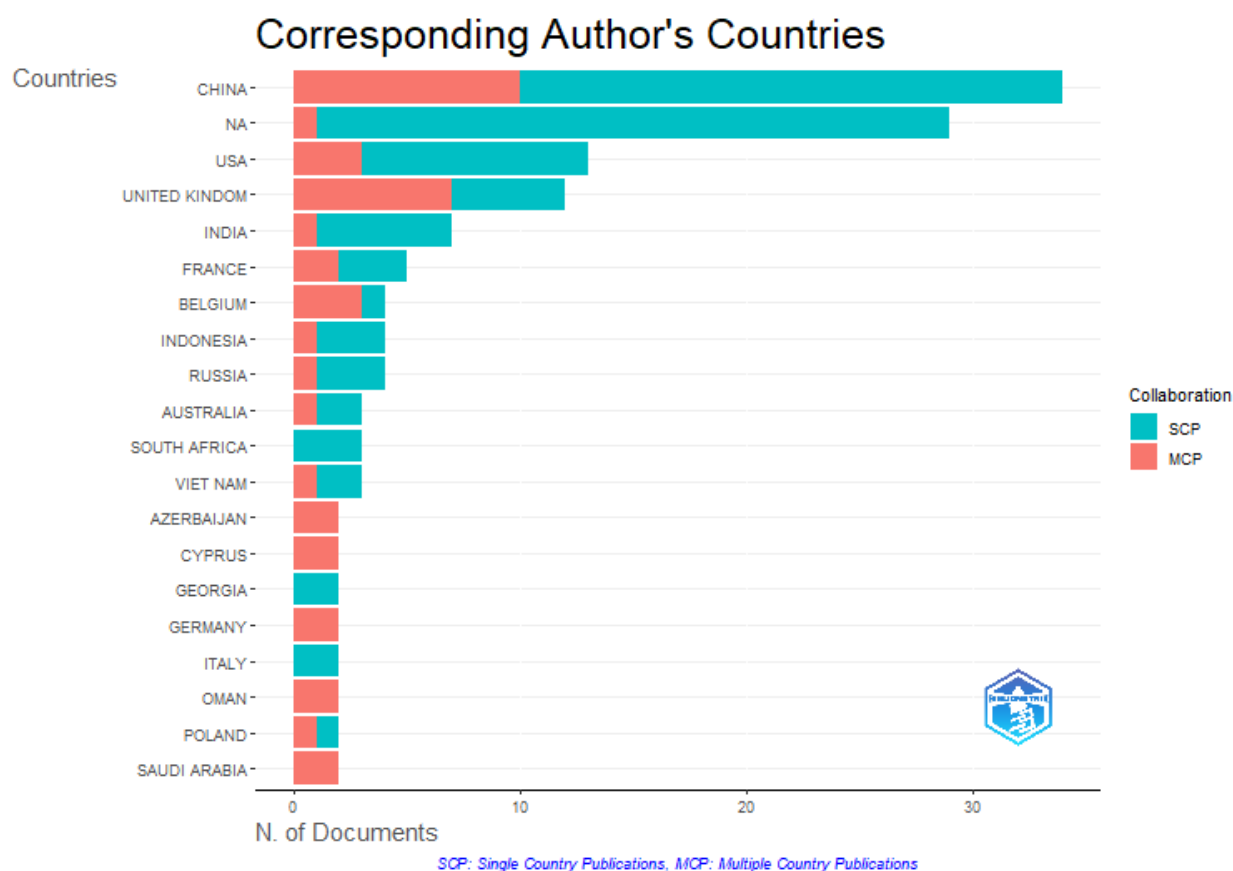


Fig. 08: Corresponding Author's Countries

Country Scientific Production

The density of blue shading states the Chinese is at the center of world production on this theme. In addition, there are other centers in North America, in Europe, and in some Countries of Asia-Pacific. Our map visually makes evident the global South concentration.

Country Scientific Production

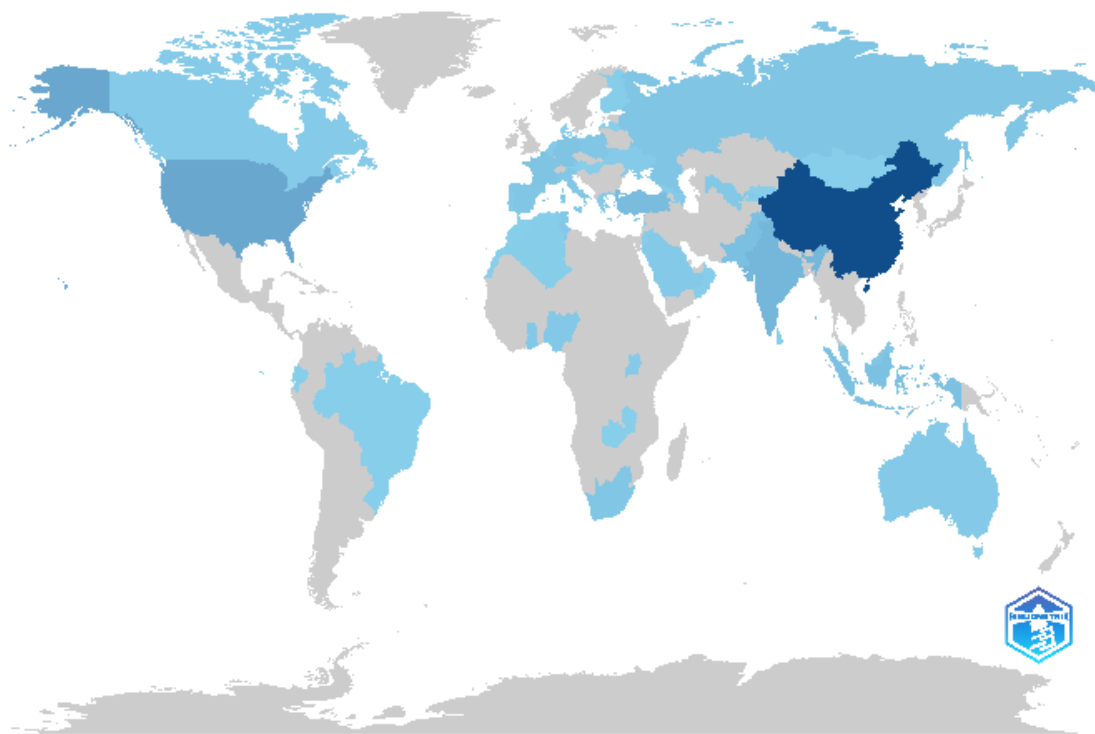


Fig. 09: Country Scientific Production

Most Occurred Words

The most cited words in the body of existing author articles are listed in table 02. Not surprisingly the most overused words are the most economic and strategic "business" (96 hits), followed by "economics" (71 hits), "sustainable development" (61 hits), and "sustainability" (51). This high occurrence of systemic wordings such as "finance", "corporate governance", and "political science" display that scholars are conceptualizing green finance well beyond being a niche environmental-topic, but mores as a structural, corporate, and regulatory matter.

Table 02: Most Occurred words

Words	Occurrences
business	96
economics	71
sustainable development	61
sustainability	51
finance	45
corporate governance	37
political science	37
natural resource economics	30

quality (philosophy)	22
computer science	21
environmental science	20
china	19
investment (military)	19
panel data	19
climate change	18
environmental economics	18
renewable energy	17
ecology	15
geography	15

Word Cloud

Figure 10 reflects the frequency data of Table 02 into a visual Word Cloud. From a visual perspective, "business," "economics," "sustainable development," and "finance" were the central and most legible words among the list of words. The less manageable and less obvious words, like "climate change," "natural resource economics," "corporate governance," etc. Are the niche sub-discipline that is responsible for the overarching fields.



Fig. 10: Word Cloud

Collaboration Network

In Figure 11, the co-authors network reveals the overall picture of collaboration between authors. The co-author network shows defined separate groups of authors connected together, i.e. Research co-authors occurred in several disjointed unconnected islands of the network, instead of in one large, global co-author

network. For example, the central group of co-authors (Gianni Romani and Enrique Orgiastic) is totally segregated from the surrounding research groups of Cosmas Ambe and Wisdom Okere.



Fig. 11: Collaboration Network

CONCLUSION AND FUTURE RESEARCH AGENDA

Conclusion

Several of the world's escalating challenges concerning climate change, the loss of biodiversity, deteriorating environmental health and resource scarcity have unequivocally placed environmental sustainability as one of the era's most urgent priorities. Therefore, the world's nations, rallying behind the likes of the Paris Climate Agreement, the United Nations Sustainable Development Goals and other frameworks are increasingly turning to green finance to leverage the immense capital flux needed for the transition to a low-carbon future. As evidenced by this bibliometric-based systematic review, the green finance tools; green bonds, green loans, sustainable funds and climate finance in whether as standalone or as application-specific instruments (sustainable tourist, environmental, corporate and agricultural finance) are all important to putting the world's money to work into renewable energy and green technology but the mere existence of green finance or the green finance tools is not enough to guarantee environmental performance; but rather the thesis in this paper is that the ability of green finance to achieve the desired outcome depends inherently on the quality of regulations surrounding these financial mechanisms.

However, an extensive analysis of the literature provided above reveals that in our view the link between green finance and environmental sustainability is mainly based on a number of economic and management theories such as: Institution Theory, Ecological Modernization Theory, Stakeholder Theory and Governance Theory. In our opinion, they all advocate that powerful regulatory institutions will: (i) foster environmentally sound corporate behavior and investments; (ii) relax information asymmetry among firms and investors and, (iii) be the bases of the fundamental governance structure of market-based ecology

modernization. Quality regulation can be defined as a regulatory framework with a certain cohesion among its policies, effective enforcement and transparency and life of the compliance of the rules committed to monitoring and punishing deviations. This issue is of paramount importance in hedging the high exposure of investments to the greenwashing risks and conserving the incentive of green investments¹³.

The empirical and bibliometric analyses of 163 documents from 2004 to 2026 reveal tremendous insights into the faster booming academic field with the remarkable lack of otherwise in the literature in the form of annual growth rate of 16.72%. The scholarly arc is a decade of comparative dormant publication levels until a perfect exponential growth up-blow commencing around 2022 corresponds one-to-one onto the current world dramatically needs-on ESG regulation and sustainable finance taxonomy movements. Also, the enormous citation impacts around the year 2020 infer this golden couple of original and influential papers planting late publications actually accelerated the subsequent writings boomed in the literature. The literature is largely situated in the heart of academic journals, the journal of Sustainability, the pioneer sustainably is followed at the fortress, by the journal of Frontiers in Environmental Science and Sustainable Development.

Despite the rapid pace of this literature development, the bibliometric map exposes important fragmentation as well as geographical inhomogeneities. First, the network of co-authors is characterized by a large number of co-authors working in a split research environment with disjointed institutional enclaves rather than a globally integrated research consortium. Second, empirical research on emerging markets and developing countries is lacking, due to the fact that the larger share of the empirical work is concentrated in China, followed by the US and the UK. Third, there is considerable conceptual ambiguity as existing body of literature interprets the same construct by referring to institutional quality, environmental governance, government efficiency and rule of law.

Policy Recommendations

The outcomes of this systematic review produced several insightful, practical suggestions for the governments, financial regulators, and international policymakers to use green finance as a driving force for environmental sustainability.

Harmonization of sustainability disclosure frameworks: The lack of harmonization in sustainability disclosure frameworks is an urgent problem that policymakers need to tackle. Governments should cooperate internationally to establish mandatory standardized sustainability disclosure regulations and comprehensive ESG disclosure rules, and establish common green taxonomies to mitigate information asymmetries and enhance market transparency, so that investors will have the objective standards with which to measure the real greenness of sustainable investment products.

Establishment of Strict Anti-Greenwashing Measures: To maintain investor confidence and channel investments into genuinely sustainable projects, regulating authorities need to intensify their anti-greenwashing activities through the implementation of strict regulatory measures. This involves not only adopting voluntary standards but also incorporating comprehensive audit procedures and adopting tough sanctions on financial service providers and companies engaged in false marketing of financial instruments.

Improved stability and long-term certainty of policies: Academic research suggests that uncertainty on policy, as well as rollbacks of regulation, heavily deteriorates investors' confidence, ultimately dragging down the green bonds issued. Regulators must coordinate to establish policy consistency and ensure the long-term legal stability of the environmental policies. Governments establishing predictable investment environment will motivate corporate and financial sector behavior to commit to the long-term capital funding the key for the realization of major technological and clean energy revolution.

The importance of capacity development for developing and emerging economies Many of the hand-on evidence and practical achievements of green finance that exist are located in China and only a handful of developed Western countries; thus, it will be crucial for global organizations to focus on capacity development for developing economies.

Hence, most international bodies should offer technical and financial assistance to support developing economies in the formulation and enforcement of effective green policies, as the abundant high-standard regulatory environments are essential condition for attracting global green capital flows.

Inclusion of Environment Dimensions in Financial Policies and Central Banks: Financial institutions and central banks should incorporate environmental governance and quality of regulation measures into their overall financial risk decision making framework. Connecting the financial system of the nation directly with environment objectives may ease the transition to a low carbon economy.

Implications

The systematic mapping of regulatory quality in green finance-environmental sustainability nexus leads to vast implications in theoretical, practical and further research prospects.

Theoretical Implications: This review revealed an immediate call for the theoretical adoption of governance concepts in sustainability research. The indiscriminate application of one of the myriads, often synonyms-including regulatory quality, institutional quality, and rule of law has critically stifled the progression of cumulative knowledge. Next generation research is expected to identify standard operational definitions and econometric indicators for "regulatory quality" to appropriately assess the dimensions of it is a moderator to sustainable development relationships.

Practical & Managerial Consequences: Is this impending change truly addressed to the financial institutions as well as the corporate targets? The answer is yes. The voluntary period is ending before our eyes, as more and more governments demonstrate their intention to make the compliance with sustainability standards mandatory and implement strict ESG taxonomies. In light of the advancements in the existing high-quality regulatory environment, the need for the business managers and portfolio managers to build the environmental risk- and regulation-compliance components into their decision-making processes has never been more urgent.

Additional External Effects: The results are conclusive that the quality of regulation is both a direct and an indirect driver for the environmental sustainability. Directly regulation creates the essential regulatory baseline and compliance requirement to limit intensive polluting undertaking. Indirectly, a solid institutional setting offers incentives for higher adoption rates of cleaner production practices and green technology by securing the economy to carry out long-term sustainable investments. Accordingly, the international climate change mitigation is just not a financial issue, but ultimately an institutionally governed challenge.

The implications for future research: Existing research deficiencies outlined above provide a clear direction for future academic development. Emphasizing the investigation for empirical evidence beyond China and advanced Western economies, scholars should intensify cross-regional comparison study involving developing countries to better exhibit the influence of context and culture on the quality of regulation on green finance. More importantly, we need to assess the effectiveness of implemented contemporary regulatory restructuring, e.g. Newly instituted climate-related financial disclosure regulations in the real-world context of subsequent implementation, with systematic policy evaluation to identify whether such step can indeed bring positive environmental contribution to green finance.

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