Analysis of the Quality of the Green Bonds for Climate Action

by

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ABSTRACT

This research aims to quantify and evaluate the quality of green bonds in terms of transparency and additionality at the issuance level. The study reveals the differences between different countries and industry groupings in their green bond quality assessment and aims to provide a snapshot of the status of the market.

For the purpose of this study, 241 green bonds were analyzed. The sample represents 31% of the 774 green bonds disclosed by the International Capital Markets Association (ICMA) as aligned with ICMA Green Bond Principles which covers 2016 – 2022 period as updated on 25 November 2022. For each green bond issuance, the same metrics were collected through an extensive review of the publicly available green bond frameworks and their impact reporting practices.

Using the data extracted and coded by the author, each issuance is scored in terms of transparency and additionality. In this study, the disclosure practices concerning the use of proceeds of an issuance feed the transparency score. On the other hand, additionality is assessed based on the presence of refinancing and if any, the share of refinancing in the total use of proceeds. Hence, an issuance may receive a high transparency score with a low additionality score in the final scoring table. Each selected metric, such as disclosure of the excluded activities from financing, affects only transparency or additionality assessment. At the same time there are some interdependencies between

metrics. For instance, the share of refinancing in total financing is a determinant of additionality. However, to be able to assess this, there should be a disclosure of the refinancing share which feeds the transparency score.

There is a growing literature focusing on the greenwashing risk in the financial markets. This research fills a significant gap in the literature in two aspects. First, it creates a green bond database focusing on detailed disclosures. To the best knowledge of the author, there is no similar database publicly available. Secondly, the analysis provides an evidence-based analysis of the quality of issuances. The results of this study indicate that there is significant room for improvement in the transparency practices of the green bonds even if they are aligned with the ICMA Green Bond Principles. Further policy development is needed to enhance the reporting practices of the issuers to limit the risk of greenwashing.

Green bonds are not designed as tools to finance greenfield projects only. Any green bond can be fully or partially dedicated to refinancing. The results show that the majority of the issuances are dedicated fully or partially to refinancing. This resulted in lower additionality scores. The additionality scoring helps to distinguish financial capital dedicated to address climate change from green bond issuances structured as “nice to have” labels. In the absence of clear intentions and transparent communication of impact, no kind of label can help us in the middle of a global climate catastrophe. This

research aims to provide evidence of the urgent improvements required in climate finance market by specifically focusing on its shining star green bonds.

FOREWORD

I joined the MES program after working in the financial markets for five years in Türkiye. My main focus was financing green energy transition projects. This hands-on experience provided me with an opportunity to observe the gaps between tools and intentions. I decided to get my MES degree at York University to learn sustainability issues using critical lenses and lead action. I know I was at the right place on day one.

My MES plan of study's main area of focus is climate finance. My aim was to grasp a coherent and comprehensive view of the system's change and real-world applications by making the connection between the required amid insufficient financial capital to build a just and sustainable future. This research is a core part of my focus area. It is positioned as providing evidence-based research outcomes yet still useful for practitioners.

I have also completed the requirements of the Business and Environment Diploma from Schulich Business School. Being involved in both EUC and Schulich gave me the opportunity to observe not only differences between learning outcomes but also differences between views of two different cohorts.

This research is a product of my dedication to being a part of change mindfully. We need urgent yet high-quality action. I see my research and MES degree as the most

realistic yet impactful efforts I can put in individually to be a part of a solution to a global problem.

DEDICATION

The first and foremost dedication is to Gücüm, the best partner in life I can imagine. Your calm presence and inner power have supported me every single day.
To Soleil, our sunshine, you do not know how much you helped us to feel at home. To Burcu and Ali for being the best moving day experts no matter where, in Kilyos or Toronto. And to my mother, I am glad to be much more alike you than I thought.

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1 Introduction

A picture of forestland burnt and demolished to grow palm oil. A landfill full of fast fashion waste. An unprecedented wildfire season in Canada. Floods in Pakistan. Drought in Türkiye. If we open a news website, we will likely see similarly depressing headlines. Right next to these, we can read an announcement of a financing package approval for a new oil pipeline or a land-use change proposal to build luxury homes.

There is no question mark on the link between the catastrophic events we observe and human greediness. In its 6th Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) made its urgent call for climate action. Accordingly, "Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020. Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and among individuals." (IPCC, 2022, p. 4).

In the same report, the IPCC pointed out there is a significant financing gap to reach emission reduction projections to keep global warming below 2°C across all sectors and countries. (IPCC, 2022, p. 6). The annual target volume of provided and mobilized

climate finance by developed countries is USD 100 billion (OECD, 2022a), representing the commitment made in COP15 in 2009 to provide necessary financial capital to developing nations. In 2020, the annual climate finance market reached its highest level at USD 83.3 billion, consisting of USD 31.4 billion bilateral public, USD 36.9 multilateral public, USD 1.9 billion export credits and USD 13.1 billion mobilized private financing.

Green bonds are not part of this USD 100 billion target. They are a capital market instrument associated with providing necessary financial capital to projects with positive environmental impact. Hence, in general volume and trend analysis of green bonds is conducted compared to similar instruments, not the overall climate finance market. Although the popularity of green bonds has resulted in a significant increase in the issuance volume and investor appetite, the capability of these instruments to reach the claimed impact is unclear. In 2021, green, social, sustainability and sustainability-linked bonds (grouped as GSS+) reached an annual issuance volume of USD 1 trillion which was 5% of total capital market issuances (CBI, 2022). Green bonds accounted for more than half of the total GSS+ pool. In 2022, annual issuance of GSS+ was lower at USD 855.5 billion while the share of green bonds was 57% (CBI, 2023).

Impact is defined as “a powerful effect that something, especially something new, has on a situation or person” (Cambridge University Press, n.d.). Impact can be positive or negative, intentional or unintentional, expected or unexpected (Impact Frontiers, n.d.). In this research, the examination is focused on positive, intentional and expected impact of

green bonds as a financial instrument for creating a contribution to environment. The green bond market can be instrumental for positive impact as much as the issuances are designed with intentionality. If the positive impact is desired but perceived as a side-product of utilizing investor demand for a specific financial instrument, we cannot think of intentionality.

For the purpose of this study, the green bond frameworks and green bond impact reports of 241 green bond issuances from different countries and industries are reviewed and coded. This accounts for 31% of the total ICMA green bond issuance list based on the ICMA's green bond list updated on 25 November 2022. The capability of a green bond from an impact perspective is analyzed and empirical evidence is provided under two dimensions: transparency and additionality.

Transparency is evaluated in terms of providing the necessary level of detail for a clear and understandable use of proceeds to the public. Additionality is defined as the direct contribution of a green bond to a positive and additional environmental impact which would not be present if the green bond was not issued. To be able to assess the additionality of a green bond, there should be sufficient public data available. Hence, being transparent is a prerequisite of additionality from this perspective. However, not each green bond with a high transparency has a high impact additionality.

2 Research Context

2.1 Research Objectives

This research aims to quantify and evaluate the quality of green bonds in terms of transparency and additionality at the product level. The study reveals the differences between different countries and industry groupings in their green bond quality assessment and aims to provide a snapshot of the status of the market.

Objective 1: Identify issuing companies' disclosure preferences and practices, with a close eye to any greenwashing.

This study provides evidence for issuing companies' disclosure preferences and practices. The effectiveness of green bonds for creating positive environmental impact diminishes if the link between impact and green bonds is vague. This evidence-based approach contributes to the literature focusing on strategies to identify and eliminate greenwashing.

Objective 2: Analyze the quality of green bonds, based on the coding of their impact reports and green bond frameworks.

Most previous research focused on the pricing of green bonds compared to mainstream corporate bonds without an environmental, social or sustainability label (Hachenberg & Schiereck, 2018; Harrison et al., 2020). These analyses mostly focused on additional transaction costs associated with green bond issuances (such as external verification)

and interest rate/spread differences, which is named ‘greenium’ (Gianfrate & Peri, 2019; Agliardi & Agliardi, 2021). My research sheds light on the quality of green bonds independent of their pricing. Hence, it fills a significant gap in the literature by focusing on the relationship between actual positive impact and green bonds.

Objective 3: Assess the impact creation ability of existing green bond issuances.

The aim is also to provide a reality check for the participants of the green bond market. The current green bond issuers, companies planning to issue green bonds, investors, companies providing verification and assurance reports, and the public who put its faith in the financing of green projects to create positive environmental impact and mitigate global warming are among the targeted audience of this paper. Using evidence, we can learn and correct our actions.

Objective 4: Provide an open-source green bond database for future research.

Finally, the data collected from the green bond frameworks and impact reports will be available to the public under a Creative Commons License subject to using appropriate citation. Considering that the current information rights of similar databases are available only to a group of investors or paid subscribers, this study aims to provide a database which can be used, updated and enlarged by other researchers.

2.2 ***Scope of the Study***

Different industry groups have formed different green bond frameworks which aim to define the scope of the projects, desired impacts and rules of reporting and verification (ICMA, 2022a; CBI, 2021; European Commission, n.d.). The most prevalent green bond standard is the Green Bond Principles (GBP) created by the International Capital Markets Association (ICMA). The other most widely used and known green bond standard is Climate Bonds Initiative's (CBI) Climate Bond Standards (CBS), which has stricter rules compared to GBP. Due to the flexibility provided by ICMA compared to CBI, GBP has been accepted as the most dominant market standard and the majority of the base framework of green bonds in the market consists of ICMA bonds (Spinachi, 2022).

Recently, the European Union (EU) has announced the EU Green Bond Standards (EUGBS), targeting 100% compliance with EU taxonomy in its draft form (European Commission, n.d.). The market participants' concerns related to EUGBS have been vocalized by ICMA regarding the unintentional potential of EUGBS to jeopardize the green bond market with unachievable standards for the issuers (ICMA, 2022a).

For the purpose of this study and due to their dominant position in the market, only the green bonds issued under ICMA's Green Bond Principles are used for the selection of the green bond sample. As of January 2023, ICMA provided a list of 774 green bond

issuances in its database updated latest on 25 November 2022 (ICMA, 2022b). Among these, 241 green bond issuances were selected so as to make sure there was a coverage of the original country and industry breakdown. Under each country and industry, selection was completed randomly.

For each green bond issued under ICMA, there is a green bond framework published by the issuer pre-issuance to present to potential investors its alignment to the ICMA Green Bond Principles. In this document, issuers provide details about the use of proceeds, selection of the projects, management of the proceed and reporting. The “use of proceeds” section details which type of green projects, such as renewable energy and energy efficiency, will be financed using that specific issuance. There is no obligation to provide a detailed list of projects, but rather only the overall theme information is necessary. The reporting section details the commitment of the issuers to provide information about allocation and impact of the green bonds post-issuance. The issuers also disclose their reporting frequency, such as providing an annual impact report. The impact reports cover the allocation of use of proceeds between different sub-sectors and in some cases provide key impact metrics to quantify positive environmental impact associated with the relevant green projects.

2.3 ***Limitations of the Study***

There are three main limitations of this study. First, the sample consists of only ICMA aligned green bond issuances. It may be possible to reach a different conclusion about

market practices if other green bond frameworks were used. A future research opportunity is to generate a similar database using another green bond framework and compare the differences and similarities to assess effectiveness of different voluntary or mandatory requirements.

Second, the climate finance market is growing, and the related taxonomy is still developing. The changing definitions and regulations in the climate finance market will shape the future of the green bond as an instrument for climate action. Hence, this study only captures the current features of the issuances which may deteriorate or improve in terms of impact intentionality in the future.

And third, additionality of a product is different than additionality of the investor. This study examines only the additionality of the issuance by looking into characteristics of its use of proceeds. Hence, investor contribution is not a part of the scope and not part of the transparency or additionality evaluation of the issuances.

3 Literature Review

3.1 Climate investments and historical responsibility

Climate finance is defined as *"local, national, or transnational financing - drawn from public, private and alternative sources of financing - that seeks to support mitigation and adaptation actions that will address climate change"* by the United Nations Framework

Convention on Climate Change (UNFCCC, n.d.-a). The necessary financial capital can be sourced from different channels, but the investments must be dedicated to climate change mitigation and adaptation efforts.

There is a different minimum investment volume presented by various parties to successfully address climate change mitigation and adaptation needs. One of the most renowned and largest coalitions of financial institutions is the Glasgow Financial Alliance for Net Zero (GFANZ), established by the UN's Special Envoy on Climate Action in April 2021 with the membership of more than 550 large financial institutions covering asset management, banking, insurance, investment consultancy and other financial services. According to the GFANZ's financial roadmap to reach net zero by 2050, USD 125 trillion of investments for direct capital expenditures are required globally (GFANZ, n.d.). In another study, the International Energy Agency (IEA) estimates the total financing need for energy investments of USD 5 trillion per annum by 2030 and USD 4.5 trillion per annum by 2050 (IEA, 2021). GFANZ positions private investors (e.g., institutional investors, infrastructure funds, private equity/venture capital funds, and commercial financial institutions) as the main providers of the necessary investment funding through capital markets (UN, 2021).

One of the most critical components of climate finance is the historical responsibility of countries. Under this perspective, countries which are responsible for the highest historical emission rates, are responsible for providing the necessary financial capital for

their and other countries' investments. The Paris Agreement's approach to climate finance aims to account for this historical difference by referring to common but differentiated responsibilities (UNFCCC, n.d.-a). Accordingly, countries are grouped under two lists. The Annex II countries are the members of the OECD (Organisation for Economic Co-operation and Development) as of 1992 while Annex I countries include selected countries in advanced economic transition in addition to the Annex II parties (UNFCCC, n.d.-b).

The parties agreed that USD 100 billion annual climate finance support is necessary to be provided by Annex II countries to the non-Annex I (i.e., developing) countries and countries listed as eligible to receive official development assistance (OAD) independent from their classification in Annex I (OECD, 2022a). However, the performance of Annex II countries to provide USD 100 billion commitment has been lagging. As of 2020, the annual flow of climate funds reached USD 83 billion, the highest value since 2013 (OECD, 2022a), still well below the target.

*3.2 **Developments in climate finance market and green bonds***

The climate finance market has expanded globally, and annual capital debt market volume (including bonds, loans, and asset-backed securities) exceeded USD 1 trillion and reached a cumulative volume of USD 2.8 billion by the end of 2021 (CBI, 2022). There are emerging names for climate finance products, including but not limited to

green, social, sustainability, and sustainability-linked loans/bonds. Each label has a different coverage area and structure.

The green, social and sustainability bonds/loans are grouped under ‘use of proceeds’ bonds since their eligibility factor is directly linked to the projects financed under each label (Chase, 2021). Green bonds focus on positive environmental impact, social bonds target creating positive impact in the economic and social realm, while sustainability bonds are instruments satisfying qualifications of both social and green bonds (OECD, 2022b). On the other hand, sustainability-linked bonds/loans are not instruments focused on use of proceeds. They are suitable for general purposes financing with links to overall sustainability or environmental, social, and governance (ESG) performance and strategy of the companies (Chase, 2021).

Green labels have dominated the climate finance product types, constituting 57% of cumulative issuances as of the end of 2021 (CBI, 2022). Hence, the use of proceeds from green-labelled capital market instruments carries the utmost importance to reach the required investment amounts for the green transition. The definitions, taxonomies, and external verification requirements are developing rapidly, albeit there is no consensus on what should be qualified as a ‘green’ project.

The first green bond was issued back in 2007 by the European Investment Bank (EIB), which defines green bonds as “committed to financing or re-financing investments,

projects, expenditure or assets helping to address climate and environmental issues" (Spinachi, 2022). Another widely used definition is that "Green bonds are an instrument which is used to finance green projects that deliver environmental benefits" (OECD, 2017). The green finance market started to attract significant attention after COP21 in December 2015 with the adoption of the Paris Agreement. 27 investors signed the 'Paris Green Bonds Statement' and committed to supporting the long-term development of climate finance markets and related policies (Whiley, 2015).

GBP defines green bonds as follows: "Green Bonds are any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible Green Projects" (ICMA, 2021, p. 3). For a project to be considered a green bond, GBP sets four core components that must be satisfied jointly: use of proceeds; process for project evaluation and selection; management of proceeds; reporting. Among these, the determinant component is the use of proceeds which must be linked to a green project. As of June 2021, a project's use of proceeds has to fall into one of the following categories to be considered a 'Green Project': renewable energy; energy efficiency; pollution prevention and control; environmentally sustainable management of living natural resources and land use; terrestrial and aquatic biodiversity conservation; clean transportation; sustainable water and wastewater management; climate change adaptation; eco-efficient and/or circular economy adapted product, production technologies and processes; and certified green buildings (ICMA, 2021, pp. 4-5).

ICMA allows the use of proceeds to be dedicated to the refinancing of eligible green projects and there is no requirement of involving greenfield investments in the use of proceeds. Greenfield investments cover funding dedicated to projects involving the construction of new assets or resources (IMF, n.d., p.3). Refinancing is using the new financial capital for repayments of all or part of an existing borrowing (OECD, 2001). Hence, the use of proceeds dedicated to refinancing does not contribute to the establishment of new assets.

GBP acknowledges that projects' definitions may change based on sectoral and geographical differences and the categories are provided as living indications subject to further updates aligned with the market developments. As a part of the issuances, ICMA strongly recommends issuers to provide a pre-issuance green bond framework and post-issuance annual green bond impact report until the full allocation of the planned investment volume. The green bond framework provides detailed information related to the planned use of proceeds while the annual impact report provides details on actual investment amounts and projects completed. Both document types are prepared by the issuer and ICMA encourages obtaining external review to assess ongoing aliment with GBP principles (ICMA, 2021, p. 6).

Although Sartzetakis (2021) pointed out international labelling standards as a key mitigation for greenwashing risk to unlock the potential of green bonds for providing

necessary capital to a wider range of low-carbon investments, my research goes deeper and investigates the quality of green bonds with international labels. The green bond sample in my research is selected only from ICMA-aligned green bonds. However, findings indicate that using an international label does not mitigate the risk of greenwashing on a stand-alone basis.

Another critical point is the relationship between green bond issuance volumes and various macroeconomic and institutional factors at the country level. Tolliver et al., (2020) scored the Nationally Determined Commitments (NDCs)[1] based on several factors including but not limited to the mitigation contribution type, GHG scope, and coverage of national emissions. Based on these, an NDC regulatory index is produced by the authors. The results support that there is a positive correlation between the strength of NDCs and green bond issuances. However, this study investigates the volume of green bond issuances rather than the quality of the 'green' use of proceeds financed. The finding of a positive correlation between the strength of NDCs and green bond volumes is critical albeit incomplete. In my research, aim is to uncover the effectiveness of green bonds for climate mitigation projects. Hence, it goes one step further by focusing on the use of proceeds and impact reports, not volume.

[1] UNFCCC: Nationally Determined Contribution (NDC) is a climate action plan to cut emissions and adapt to climate impacts. Each Party to the Paris Agreement is required to establish an NDC and update it every five years.

3.3 ***Greenwashing risk in green bonds***

Greenwashing risk is defined as a combination of poor environmental performance and positive communication about that action despite it (Delmas & Burbano, 2011). This misrepresentation can be observed at a firm or product level. There are different external, organizational, and individual factors with a potential to increase the risk of greenwashing. One of the market-led external factors is investor demand evaluated (Delmas & Burbano, 2011). Considering the increasing investor demand in green bonds observed as oversubscriptions and increasing market activity, this research is timely in assessing the transparency of the existing green bond issuances.

Green bonds are subject to greenwashing risks from three main perspectives. Firstly, green bonds use of proceeds may involve refinancing. In that case, it is difficult to quantify the level of green bonds contribution to the project and the possibility of the investment to materialize in the absence of refinancing with a green bond. Secondly, the positive environmental impact of the green bonds should be assessed as a direct link to what is financed using these instruments. In this realm, it is also important to understand what is not financed using a green bond, such as restrictions on fossil-based electricity generation. Lastly, the scope and validity of impact disclosures are critical to assess the actual impact of the project presented under green labels.

Gianfrate & Peri (2019) analyzed 121 green bonds issued between 2013 and 2017 to assess their suitability as a financial instrument compared to the regular (non-green) bond issuances using volume, maturity, and pricing data. Their findings indicate that the cost of green bond issuances is more advantageous for the issuers and green bonds are suitable for both financing and refinancing purposes. If green bonds will be promoted as more efficient ways of financing, the importance of these instruments will increase for climate action. In parallel, higher investor interest will increase the risk of greenwashing. By critically examining the features of green bonds, my research aims to shed a light on the potential improvement areas to decrease and mitigate greenwashing risk.

Bonds are generally used as ‘refinancing’ tools of existing debt considering the risk level reduces during the operational phase of the projects which makes it more suitable for bond investors. Similarly, the Climate Bonds Initiative (CBI, 2015) refers to refinancing as a fundamental driver of green bonds in the market. The only restrictions applied are in terms of look-back period, which defines the number of years a project has been in operation to be eligible for a particular green bond framework. Therefore, it is possible to use 100% of the proceeds of a green bond for refinancing.

Refinancing is a sensitive topic for additionality. The negative relation between additionality and refinancing was pointed out by other scholars (Tolliver et. al, 2019). In their study, the risk of associating green bonds with additional positive environmental

benefit is highlighted given the bonds heavy involvement in refinancing purposes. Accordingly, the involvement in refinancing reduces the additionality of the green bonds considering the already existing project would be financed using other tools in the absence of green bonds. My research provides strong evidence for the use of refinancing in green bonds by coding involvement in refinancing, share in potential refinancing amount and disclosure of refinancing in actual investments using green bond frameworks and impact reports.

Another critical issue is the data quality of impact related disclosures of the climate finance instruments. Naran et al. (2022), point out the private sector lacks sophistication and consistency in impact reporting, which makes the outcome of claimed climate positive investments questionable. Hence, they suggest that additional efforts are required to push the public and private sector to build a common definition of climate products focused on impact reporting. In my research, impact reports of 31% of the disclosed ICMA aligned green bonds are reviewed. The identified shortcomings can provide guidance for efforts to improve impact reporting practices of capital market products.

The importance of green bonds' transparency and additionality is sourced from their dominant share in green finance market. Hence, opportunities and risks associated with green bonds must be examined closely. Green bonds' promises to cure the ecological deficit through capital raised in the capital markets come with a significant potential to

create various socio-spatial effects (Jones et al., 2020). These products have the power to shape the environment by financing selected infrastructure projects for generations. Considering there are several different definitions of ‘green’ projects available, there is a risk of greenwashing. One of the main practical challenges identified by Jones et al. is protecting the integrity of green bonds.

Deschryver & de Mariz (2020) investigated the future of green bond market through market data analyis of pricing information of green bonds and interviews with eleven experts. Accordingly, the risk of greenwashing is pointed as one of the three key challenges behind expanding the green bond market further. They argue the other two factors are the complexity of the issuance process and lack of concrete green project pipelines. My research aims to contribute to the discussions concerning greenwashing risk by analyzing issuances with a specific focus on their reporting practices.
In their study, Tuhkanen and Vulturius (2022) have pointed out six key shortcomings in the green bond issuers’ reporting practices that make it difficult to attribute reported avoided emissions to green bond financing. These are lack of reporting on refinancing; lack of project-level reporting on the share of green bonds of total investment; mismatching or imprecise use of proceeds and impact reporting; lack of consideration of project co-ownership; variation of methodologies to calculate avoided greenhouse gas emissions; lack of harmonized impact methodology. These risks are highly associated with double counting, which involves claiming the environmental benefit associated with the project entirely by different financing parties, as opposed to

proportional allocation parallel to share in total financing. Hence, the magnitude of the projects' actual additional positive environmental benefit might be presented as much larger than the actual impact.

Verification of the positive environmental benefits is pointed as a critical point the quality of the green bond. Rose (2019) argues that the trustworthiness of the green bond market depends on the quality of reviews and assurances to verify the use of proceeds. The author argues that investors and issuers should be able to pursue claims against verifiers for misrepresentation of impact. The study identifies one of the challenges inherited in these products is verifying the environmental benefit of the so-called green project.

There are other studies investigated the status future of the green bonds. Their scope and research objectives are different albeit related to my research. In a study focusing on the contribution of the green bonds to the bond market, issuers, investors, and climate policies an 'expectation gap' was defined (Shishlov et. al, 2016). Accordingly, there are varied motivations behind green bond issuances including risk mitigation against green policies or creating maximum possible positive environmental impact. These variances result in a misunderstanding of the role and power of green bonds between different actors. The study also evaluates the Green Bond Principles of ICMA as a guideline process for management and reporting instead of providing a definition and comparison base for the 'greenness' of the issuances. In the same study,

environmental integrity is defined as the level of actual environmental benefit measured with a common and standardized sets of definitions. The findings of my research provide evidence for the expectation gap and environmental integrity differences spotted.

The International Finance Corporation (IFC) has published a recent report focused on the impact reporting practices of 33 green bonds issued by financial institutions in emerging markets excluding China (IFC, 2022). IFC used Environmental Finance Database to identify issuers and used publicly available impact reports for assessment where available. If the reports are not available to the public, IFC reached out to the issuers for additional information requests. Moreover, 60 issuers, five stock exchanges, and six green bond investors were invited for interviews as a part of the study, of which only four issuers, one stock exchange, and one green bond investor participated in. Accordingly, the report emphasizes the challenges behind reaching out to the issuers and finding required information through desk research as a signalling point for weak transparency.

The report extracted the following information from impact reports: ease of finding (IFC scoring), report date, report title, length in pages, information on allocation of the issuance, project description, case studies, mapping to the UN SDGs, methodology, availability of a defined reporting period, information related to process for the project definition, integration of an external review/assurance, reference to other sustainability

programs, references to green bond frameworks, reporting level (project/bond/issuer), and allocation of the use of proceeds to finance vs. refinance (IFC, 2022). The report also provides a detailed mapping of the impact reporting metrics and best practices in the market through by assessing 33 green bonds. These are providing a detailed methodology for impact measurement, information of pro-rating share in financing to impact, including details on project descriptions and case studies, linking project selection to impact data availability of the projects for financial institutions, utilizing external reporting support if needed, and making sure the information is readily available to the public.

My research investigates a larger sample across different countries and sectors. In that respect, it filles a significant gap in the literature and contributes to the latest discussions in academia and practitioners by providing evidence-based findings to the quality of green bonds associated with positive environmental impact. In addition to this MES major research paper, the other outcome of my research efforts is the green bond database I have established using publicly available green bond reports. By creating a first-time publicly available green bond database, my aim is to provide a baseline for future research and discussions among different stakeholders including but not limited to investors, issuers and policymakers.

4 Methodology

4.1 Data Collection

The green bond frameworks and impact reports of selected sample of 241 green bond issuances are reviewed if these documents are publicly available. The selection was made from ICMA's green bond list. If the green bond framework is not available to the public but there is an "external review form" disclosed by ICMA, information in the external review form is used instead of the green bond framework. If the issuer provided a link to its GBF but the link is not working, it was not possible to access the GBF. In these cases, the market information template was used as the main source of information.

If there is no green bond framework or external review form of ICMA, the second party opinion (SPO) documents are not used for data collection. Due to strict information sharing and using restrictions applied to the SPOs, the research is kept limited to information shared by ICMA or the issuer itself for public use only.

In some cases, an issuer may have multiple GBFs published in different years. In these cases, the GBF selected from ICMA's list is used for the coding. For instance, if the selected sample is for the GBF published in 2020 but the issuer has another GBF published in 2019, the 2020 GBF was used for coding. This also has implications for impact reporting. If a GBF from 2022 is used for coding, the earliest impact report year

possible is 2022, considering same year reporting is possible. However, if there is only an impact report from 2021 available to the public, this is disclosed as “No impact report”. Because this impact report is associated with another GBF, dated earlier than the GBF used for coding. In some cases, impact reports may be disclosed after coding is completed. Hence, a bond recorded as “No impact report” may have an impact report available afterwards. Data collection was limited to a set of questions which are deemed critical for the purposes of this study.

It is possible to enlarge the transparency and additionality criteria with different metrics in the future. If a green bond impact report is not found using a reasonable level of effort, it is evaluated as not having an impact report. This process included extensively looking for publicly available impact reports in the company’s website or another platform if mentioned in the green bond framework. All screening is completed in English. The website sections such as annual reports, investor relations, financing, ESG, sustainability, green financing or capital market instruments were generally the places issuers disclose their green bond impact reports.

*4.2 **Data Extraction and Coding***

The fields in Table 1 are filled in using the documents collected at the data extraction and coding stage.

Table 1: The List of Variables

Variable	**Variable type**	**Source**
Name of the issuer	Text	ICMA green bond list
Jurisdiction	Text	ICMA green bond list
Issuer Category/Sector	Text	ICMA green bond list
Year of the green bond framework	Number	Green Bond Framework
The sub-sectors targeted through use of proceeds	Categorical	Green Bond Framework
Involvement in refinancing	Categorical (Binary)	Green Bond Framework
Disclosure of the share of refinancing	Categorical (Binary)	Green Bond Framework
Share of refinancing in total issuance	Percentage	Green Bond Framework
Commitment to disclose share of refinancing in during monitoring stage	Categorical (Binary)	Green Bond Framework
Disclosure of excluded activities from financing	Categorical (Binary)	Green Bond Framework

List of excluded activities	Text	Green Bond Framework
Availability of a reporting document in English	Categorical (Binary)	Green Bond Impact Report
Standalone impact report in English	Categorical (Binary)	Green Bond Impact Report
Impact report publication year	Number	Green Bond Impact Report
Country of the projects financed	Text	Green Bond Impact Report
Disclosure of yearly breakdown of investment amount	Categorical (Binary)	Green Bond Impact Report
Disclosure of the sub-sectoral breakdown of investment amounts	Categorical (Binary)	Green Bond Impact Report
Disclosure of the share of refinancing in actual investments	Categorical (Binary)	Green Bond Impact Report
Share of refinancing in investments	Percentage	Green Bond Impact Report

Disclosure of the ownership for non-financial institutions or share in total financing for financial institutions	Categorical (Binary)	Green Bond Impact Report
Disclosure of total project cost	Categorical (Binary)	Green Bond Impact Report
Verification of use of proceeds by a third-party	Categorical (Binary)	Green Bond Impact Report
Type of verification	Text	Green Bond Impact Report
List of the environmental Key Performance Indicators (KPIs) used	Text	Green Bond Impact Report
KPI calculation verification of a third-party	Categorical (Binary)	Green Bond Impact Report
Disclosure of expected lifetime environmental impacts	Categorical (Binary)	Green Bond Impact Report
Disclosure of the KPI calculation methodology	Categorial (for all KPIs, for some KPIs, none)	Green Bond Impact Report
Disclosure of a GHG emission avoidance/reduction or another quantitative metric	Categorical (Binary)	Green Bond Impact Report

Disclosure of the methodological base of the GHG avoidance/reduction or another quantitative metric	Text	Green Bond Impact Report

4.3 Transparency and Additionality Scoring

There are three different scores calculated: Additionality Score (for all issuances), Transparency Score – I (for issuances not involved in refinancing) and Transparency Score – II (for issuances partially or fully involved in refinancing). The reason behind having two different transparency scores is presence of a smaller number of disclosure related metrics that are applicable if a green bond is not involved in refinancing.

A critical differentiation between transparency and additionality is the presence of refinancing in a green bond issuance. The bonds are commonly used for refinancing purposes. The use of proceeds of the green bonds can also be dedicated to refinancing fully or partially. If the percentage of refinancing is disclosed, it improves the transparency of the issuance. However, if the use of proceeds is dedicated to refinancing fully or mostly, there is no additional green project financed. Hence, additionality of the product is low since there is no change in the level of positive environmental outcome before and after issuance of the green bond.

Each selected metric, such as disclosure of the excluded activities from financing, affects only transparency or additionality assessment. At the same time there are some interdependencies between metrics. For instance, the share of refinancing in total financing is a determinant of additionality. However, to be able to assess this, there should be a disclosure of the refinancing share which feeds the transparency score.

The additionality score in this research is focused on the potential and actual new positive impact creation. Hence, its scoring is based on a limited number of metrics (Involvement in refinancing, Share of refinancing planned for the use of proceeds in total issuance and Share of refinancing in actual use of proceeds) as presented in Table 3. However, each metric has a higher score in the additionality scoring compared to transparency scoring to differentiate the issuances not involved in refinancing from partially involved examples in a greater extent.

The transparency score is calculated separately for the issuances involved in refinancing and not involved in refinancing considering some of the disclosure metrics are applicable only if refinancing is part of the use of proceeds. As presented in Table 2, three metrics only apply to Transparency Score I are *Disclosure of the share of refinancing; Commitment to disclose share of refinancing in during monitoring stage; Disclosure of the share of refinancing in actual investments*.

The highest score possible for the additionality scoring is 10, for transparency involved in refinancing is 13 and for transparency not involved in refinancing is 10. The minimum score in all different scoring groups is zero. To make scorings comparable, each score is normalized to 0-100 minimum-maximum range.

Table 2: Transparency Metrics

From Green Bond Framework:	**Assessed for:**	**Score:**	**Reasoning:**
Disclosure of the share of refinancing	Transparency Score - I	If Yes: 1 If No: 0 Not applicable if no refinancing.	Disclosure of the portion to be used for refinancing allows to identify share of projects with new (additional) positive impact.
Commitment to disclose share of refinancing in during monitoring stage	Transparency Score - I	If Yes: 1 If No: 0 If 100% refinancing: 1 Not applicable if no refinancing	During monitoring phase, commitment to report actual refinancing

			improves monitoring practices.
Disclosure of excluded activities from financing	Transparency Score – I and Transparency Score II	If Yes: 1 If No: 0	Providing a list of excluded activities at the pre-issuance stage presents a clearer boundary for the use of proceeds.
From Impact Report:	**Assessed for:**		**Reasoning:**
Availability of a reporting document in English	Transparency Score – I and Transparency Score II	If Yes: 1 If No: 0	A post-issuance reporting is essential for transparency.
Disclosure of yearly breakdown of investment amount	Transparency Score – I and Transparency Score II	If Yes: 1 If No: 0	Monitoring the allocation of use of proceeds.

Disclosure of the sub-sectoral breakdown of investment amounts	Transparency Score – I and Transparency Score II	If Yes: 1 If No: 0	Monitoring the allocation of use of proceeds.
Disclosure of the share of refinancing in actual investments	Transparency Score – I	If Yes: 1 If No: 0 Not applicable if no refinancing.	Understanding the portion of use of proceeds dedicated to new projects
Disclosure of total project cost	Transparency Score – I and Transparency Score II	If Yes: 1 If No: 0	Disclosing the total financial capital required for project materialization
Verification of use of proceeds by a third-party	Transparency Score – I and Transparency Score II	If Yes: 1 If No: 0	Disclosing if the use of proceeds is reviewed by a third-party
For each KPI, verification of a third-party	Transparency Score – I and Transparency Score II	If Yes: 1 If No: 0	Disclosing if the impact measurement is verified by a third-party

Disclosure of the KPI calculation methodology (for all or some of the KPIs)	Transparency Score – I and Transparency Score II	If Yes: 1 If No: 0	Disclosing the methodology for reliability check
Disclosure of the expected lifetime positive environmental impact for at least one KPI	Transparency Score – I and Transparency Score II	If Yes: 1 If No: 0	Disclosing the project's impact beyond impact reporting period
Disclosure of the methodological base of the GHG avoidance/reduction or another quantitative metric	Transparency Score – I and Transparency Score II	If Yes: 1 If No: 0	Disclosing the methodology for reliability check

Table 3: Additionality Metrics

From Green Bond Framework:	**Assessed for:**	**Score:**	**Reasoning:**
Involvement in refinancing	Additionality Score	If Yes: 0 If No: 2	Involvement in refinancing results

			in less additional positive effect.
Share of refinancing planned for the use of proceeds in total issuance	Additionality Score	If Unknown: 0 If 100%: 0 If between 50-99%: 1 If between 1-49%: 2 If 0%: 4	If the share is higher, additionality is lower.
From Impact Report:	**Assessed for:**		**Reasoning:**
Share of refinancing in actual use of proceeds	Additionality Score	If Unknown: 0 If 100%: 0 If between 50-99%: 1 If between 1-49%: 2 If 0%: 4	Understanding the additional impact of the green bond. If refinancing is mentioned in the impact report but not mentioned in the additionality report, only the share of refinancing in actual use

			proceeds used for additionality scoring.

The name of jurisdictions and Issuer Category/Sector used is consistent with ICMA wording. Accordingly, ICMA has 19 issuer categories/sectors: agency, corporate-agriculture, corporate-consumer goods, corporate-consumer services, corporate-energy, corporate-healthcare, corporate industry, corporate-infrastructure, corporate-real estate, corporate technology, corporate-telecom, corporate-tourism, corporate-transportation, corporate-water, financial institutions, Multinational Development Banks (MDB), municipal, sovereign and utility.

The selected sample of 241 bonds preserves the same country and industry weight of the total green bond list provided by ICMA as of 25 November 2022. Please see Table 4 and Table 5 to compare the breakdowns of total ICMA green bond universe and sample. ICMA does not provide the sectoral classification methodology applied. ICMA does not provide a category/sector classification for six green bond issuances. Out of these, two of them (Lenovo Group Limited, 2022 GBF and The Mortgage Corporation of Japan, 2022 GBF) were selected to the sample and their category information was added manually.

Table 4: Country Breakdown of Issuances - ICMA Universe vs. Sample

	Total Universe		Sample	
Country Breakdown	**Number**	**Share (%)**	**Number**	**Share (%)**
EU	314	41%	98	41%
Japan	131	17%	41	17%
United States of America	107	14%	32	13%
Canada	25	3%	8	3%
Norway	19	2%	6	2%
Supra-national	19	2%	6	2%
United Kingdom	20	3%	6	2%
China	17	2%	5	2%
Switzerland	17	2%	5	2%
Hong Kong	11	1%	3	1%
Other	94	12%	31	13%
Total # of issuances	774	100%	241	100%

Table 5: Sectoral Breakdown of Issuances - ICMA Universe vs. Sample

	Total Universe		Sample	
Sectoral Breakdown	**Number**	**Share (%)**	**Number**	**Share (%)**
Financial Institution	176	23%	60	25%
Corporate-Energy	137	18%	44	18%
Corporate-Real Estate	122	16%	39	16%
Municipal	51	7%	17	7%
Corporate-Transportation	45	6%	14	6%
Utility	41	5%	12	5%
Agency	40	5%	10	4%
Corporate-Industry	22	3%	8	3%
Corporate-Infrastructure	23	3%	7	3%
MDB	20	3%	6	2%
Corporate-Consumer services	18	2%	6	2%
Corporate-Consumer goods	15	2%	5	2%
Corporate-Technology	11	1%	5	2%
Sovereign	27	3%	4	2%
Other	26	3%	4	2%
Total # of issuances	774	100%	241	100%

5 Results

5.1 Observations From Green Bond Frameworks

Among the 241 green bonds reviewed, five of them do not have a GBF or market information template provided by ICMA to the public. The results presented below are conducted among 236 green bonds out of which 39 were coded using market information template due to the absence of a green bond framework.

5.1.1 ***ICMA Sub-sectoral Breakdown***

In this study, I used ICMA's list of standardized sub-sectors targeted with the green bonds' use of proceeds. However, the some of the sub-sectors mentioned in the GBFs slightly differed from ICMA's official naming, such as using "Green and Energy Efficient Buildings" instead of "Green Buildings". These two were grouped as "Green Buildings" for the purpose of this study, and a similar approach was taken for other small discrepancies in wording. 66% of the sample has "Renewable Energy" as one or many of the sub-sectors targeted, followed by "Energy Efficiency" and "Green Buildings" mentioned in 46% and 45% of the GBFs' use of proceeds section respectively. Table 6 provides details for each sub-sector. Please note that one GBF can target more than one sub-sector.

Table 6: Sub-sectoral Use of Proceeds Breakdown

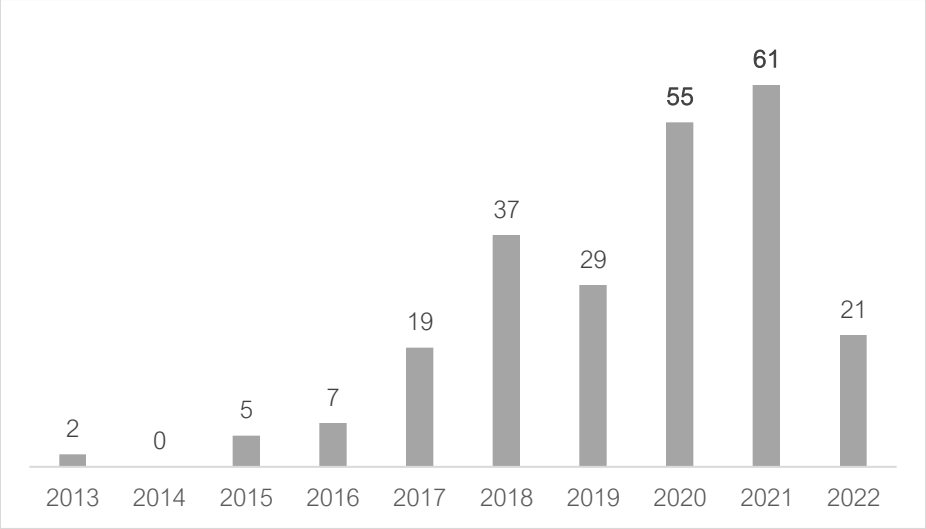
Sub-sector	**Mentioned in ... of the sample**
Renewable energy	66%
Energy efficiency	46%
Green Buildings	45%
Clean Transportation	35%
Water management	28%

Waste management	22%
Pollution prevention and control	17%
Resource conservation	10%
Adaptation	10%
Sustainable land use	8%
Circular economy/products	7%

5.1.2 ***Yearly Breakdown***

As a part of the data coding process, the year of each GBF's disclosure is collected. This can be different than the issuance year of the green bonds since more than once issuance across several years can be conducted using one framework or an issuer may not immediately issue a green bond following the disclosure of the GBF. As presented in Figure 1, the sample is dominated by the GBFs disclosed in 2020 and 2021.

Figure 1: Number of the GBFs Disclosed Each Year



5.1.3 ***Involvement in Refinancing***

In the sample, 88% of the use of proceeds include potential involvement in refinancing as presented in Figure 2. Moreover, only 15% of the GBFs including refinancing disclose the planned share of refinancing, which varies between 23% and 100% of the total. Among these green bonds with a disclosure of planned refinancing, most engage in full refinancing (100% share), as presented in the breakdown of refinancing shares provided (Figure 3).

Figure 2: Involvement in Refinancing and Disclosure of Refinancing Share

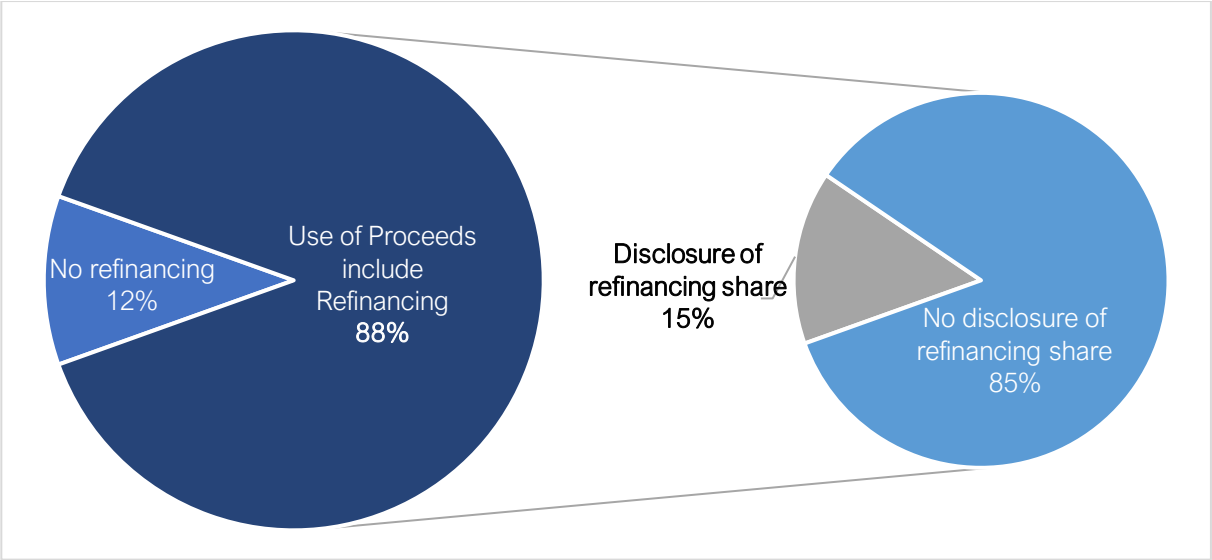
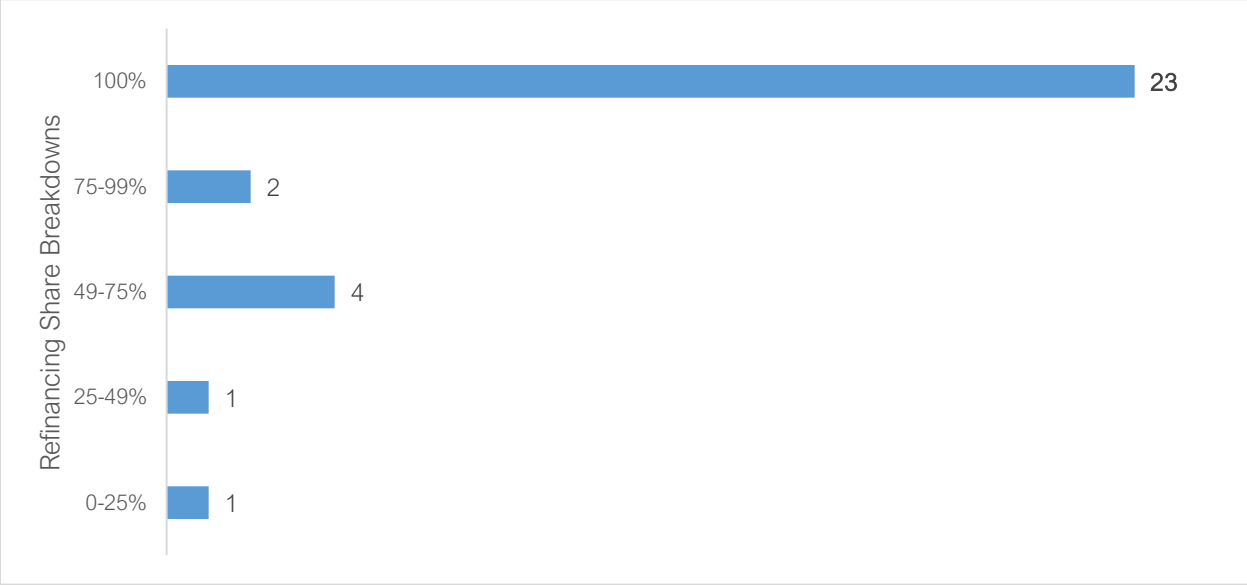


Figure 3: Number of Green Bonds by Refinancing Share - GBFs

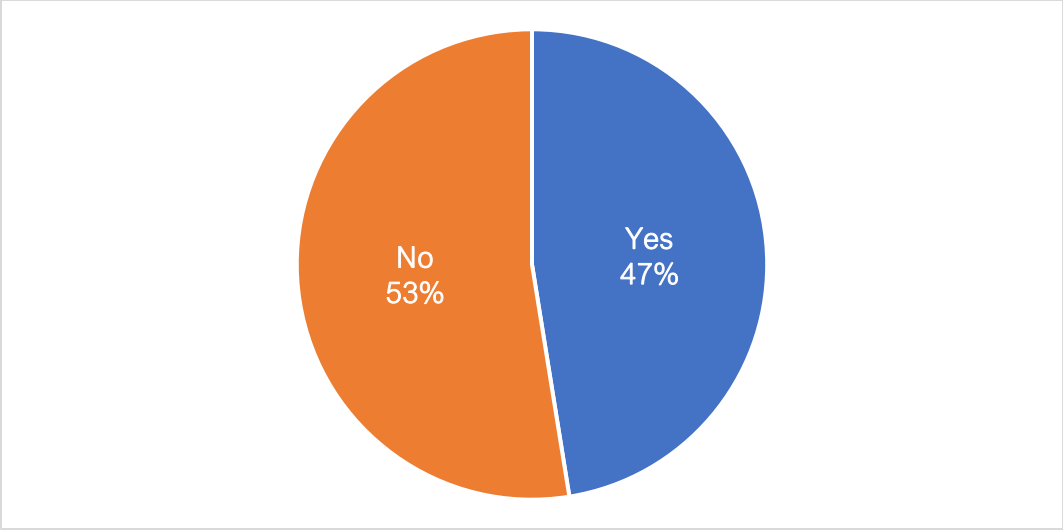


5.1.4 ***Exclusion of Activities***

Providing a list of excluded activities from financing is a way of negative screening. It is important as a disclosure to make it clear to investors and the public which sectors are not going to be part of the use of proceeds. Considering that the breakdown of use of proceeds are provided at sub-sectoral level, having an exclusion criterion improves the transparency score of an issuance.

Less than half of the GBFs analyzed provided a list of excluded activities (Figure 4). Although it does not mean the other half is involved in these activities, it leaves the question open, thus leaving investors and the public with incomplete information.

Figure 4: Disclosure of Excluded Activities



These exclusions may involve fossil-fuel activities, nuclear energy, large capacity hydro power plants and any other activity listed in the exclusion list. Even if the green project definition of ICMA provides a boundary to the use of proceeds area, listing the excluded sectors also has a signaling effect.

In the exclusion list of 112 GBFs, “fossil fuels” was mentioned in 55 GBFs, “coal” was mentioned in 16 GBFs and “carbon” was mentioned in 8 GBFs. Nuclear energy, tobacco, gambling, weapons and defense industries are also among the most highly mentioned activities in the exclusion lists.

5.2 **Observations From Impact Reports**

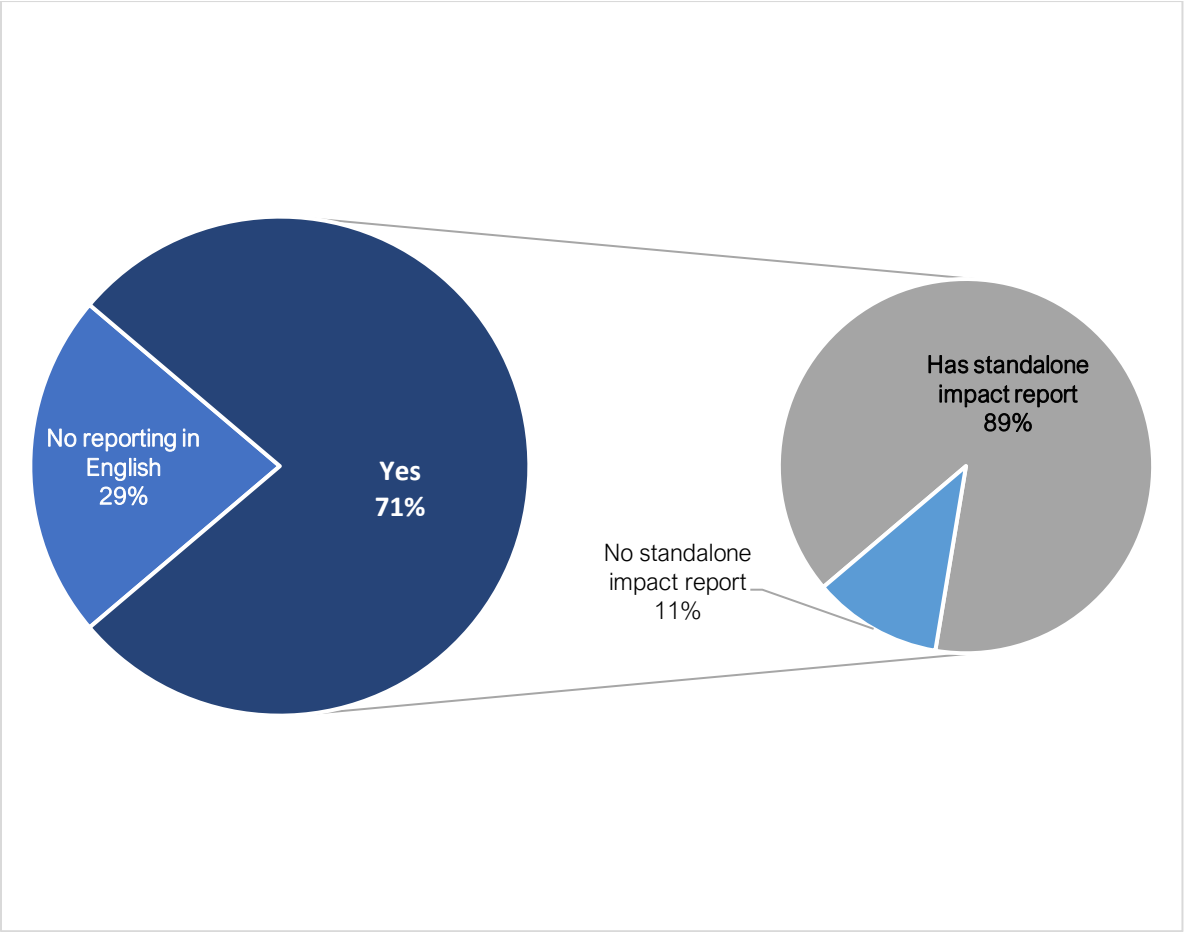
5.2.1 ***Impact Reporting***

Among the 236 green bonds analyzed, 21 of them had GBFs disclosed in 2022 (Figure 1). Note that the date of GBF *disclosure* can be different from the date of green bond *issuance*. However, this study does not collect s no information on the date of issuance. Hence, the date of GBF disclosure is assumed to be the same as the date of green bond issuance. Out of these 21, only 5 of them had a green bond impact report disclosed in 2022. Despite this, all 21 green bonds with a GBF published in 2022 were excluded from Figure 5, considering there was a less than one-year time to issue an impact report following the GBF disclosure. If the GBF was issued earlier than 2022, no exclusion was applied considering there was enough time (more than one year) to disclose the first

annual impact report. Please note, this is different than the publication year of an impact report. For instance, a GBF disclosed in 2020 may have the latest impact report published in 2022. This is included in the sample considering there has been sufficient time to publish an annual impact report.

In this sample of 215 impact reports, 71% of the green bonds have a publicly available impact report in English. 89% of the impact reports were prepared as a standalone impact report and 11% of impact information was within their websites but not in a report format. For transparency scoring, having an impact data is considered sufficient even if it is not in a standalone report format.

Figure 5: Availability of Impact Reports in English

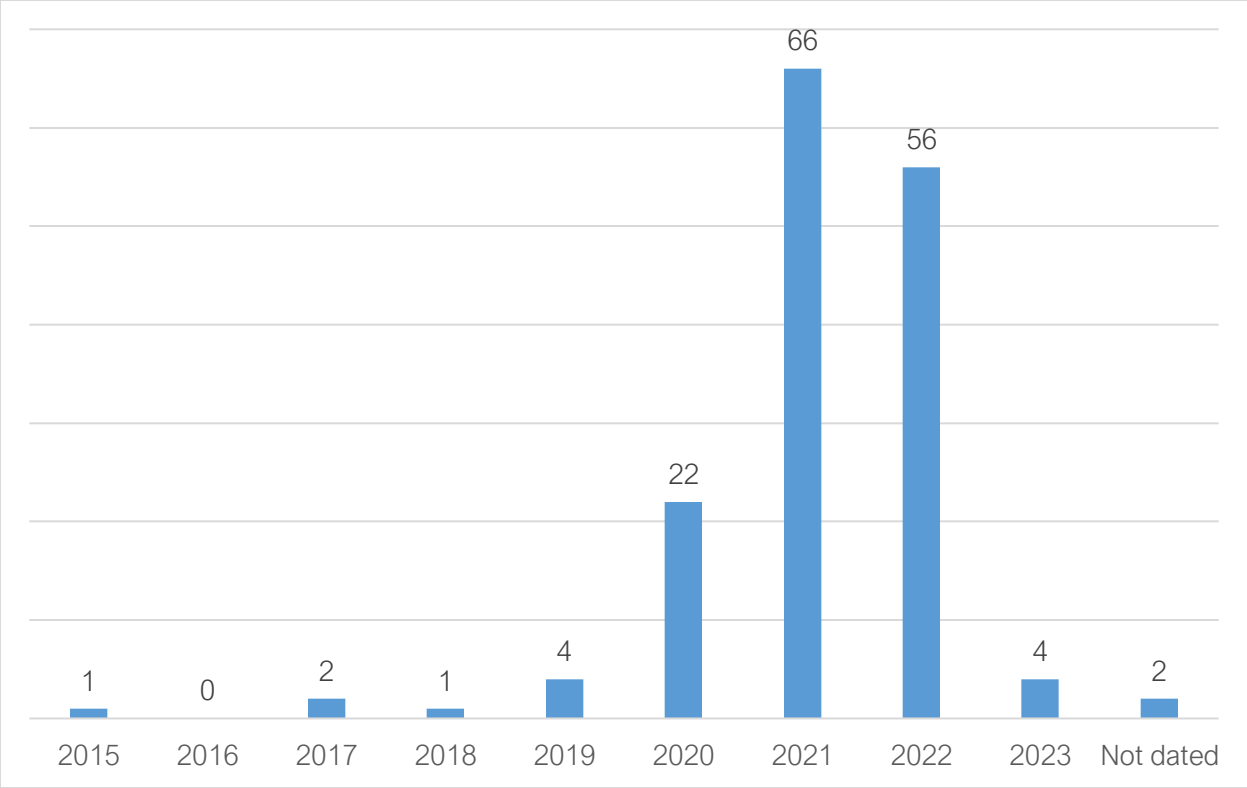


Including GBFs published in 2022 (among 236 green bonds coded), 158 of the issuers have disclosed impact data. This can be in the form of standalone impact report, impact report as a part of other reporting or impact data disclosed on the website. Breakdowns provided below from Figure 6 to Figure 15 are based on all available impact data of 158 issuances which is referred as “impact reports” below even if data was not provided in a report format.

Table 7: Number of Green Bonds

Group of Green Bonds	**Number of Bonds**
ICMA green bond list	774
Research Sample	241
Green Bonds with GBF or Market Information Form	236
Green Bonds Disclosed Impact Data	158

Figure 6: Number of Impact Reports by Publication Year



5.2.2 ***Sub-sectoral and Yearly Breakdowns***

The most basic information provided in the impact reports is the breakdown of investments across years and sub-sectors. This information gives the reader insight into the utilization of the use of proceeds over time and across different themes such as renewable energy and transportation. However, even at this level the impact reports content was limited.

There was no yearly investment breakdown information disclosed in 43% of the impact reports (Figure 7). In this case, it is not possible for a reader to understand how the fund allocation changed over time. On the other hand, the majority of the impact reports (95%) provided a sub-sectoral breakdown of the allocation of the total proceeds (Figure 8).

Figure 7: Disclosure of the Yearly Breakdown by Investment Volume

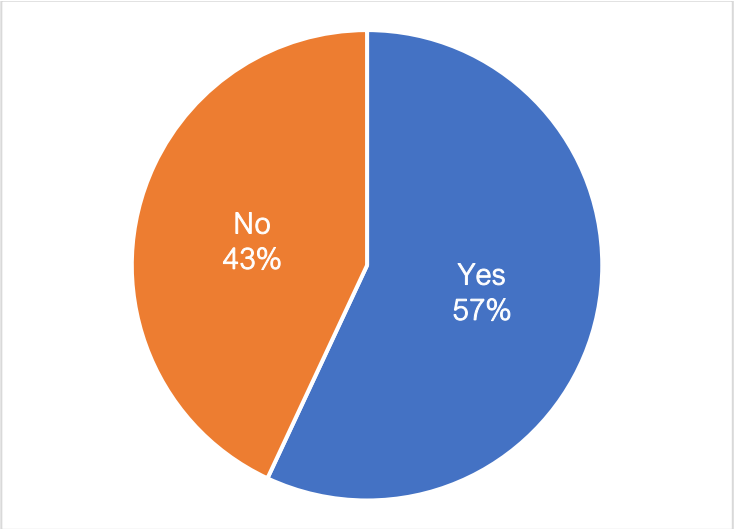
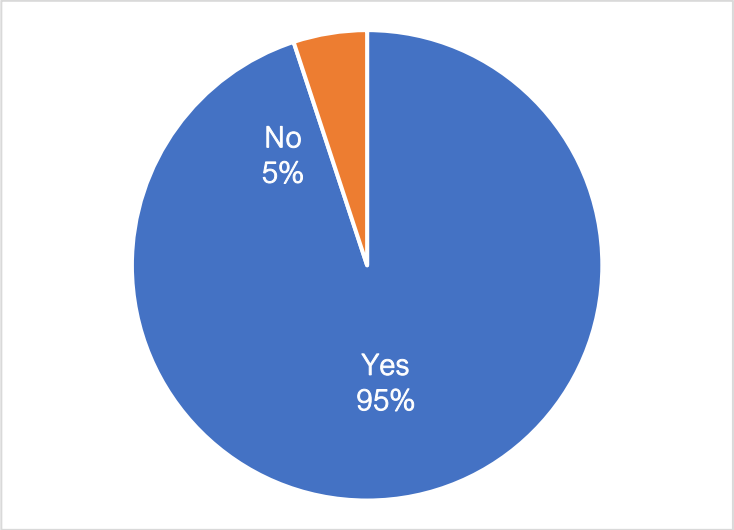


Figure 8: Disclosure of the Sub-sectoral Breakdown by Investment Volume



5.2.3 ***Share of Refinancing***

As presented in Figure 2, 88% of the GBFs included refinancing as one of the potential use of proceeds area. Among them, 85% of the frameworks did not provide a share of refinancing. The general wording used in the GBFs is “to be allocated to finance or refinance (in whole or in part).

On the other hand, in the 158 issuances with impact data disclosure, 40% of them provided an actual percentage share of refinancing in the impact reports. If refinancing was not mentioned as a potential use area at the GBF, it is not relevant for an impact

report to disclose the refinancing share. It is labelled as “No refinancing” below and constituted 9% of 158 impact reports (Figure 9).

Even if the share is higher than disclosures in the GBFs, it was not possible to understand the breakdown between refinancing and greenfield financing from half of the impact reports published. Hence, these impact reports do not provide insight into the additional positive environmental impact. In other words, it is not possible to answer the question: In the absence of green bonds what portion of the green assets financed by these green bonds would still be operational?

Figure 9: Disclosure of the Share of Refinancing

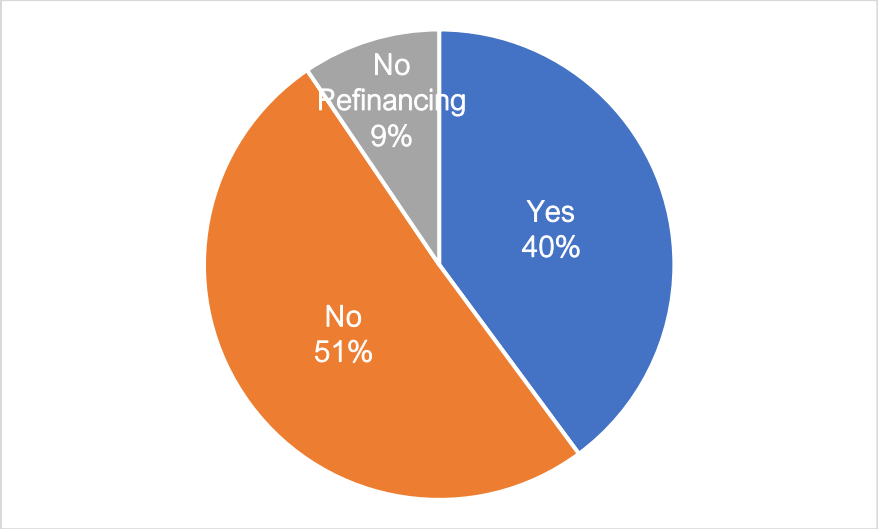
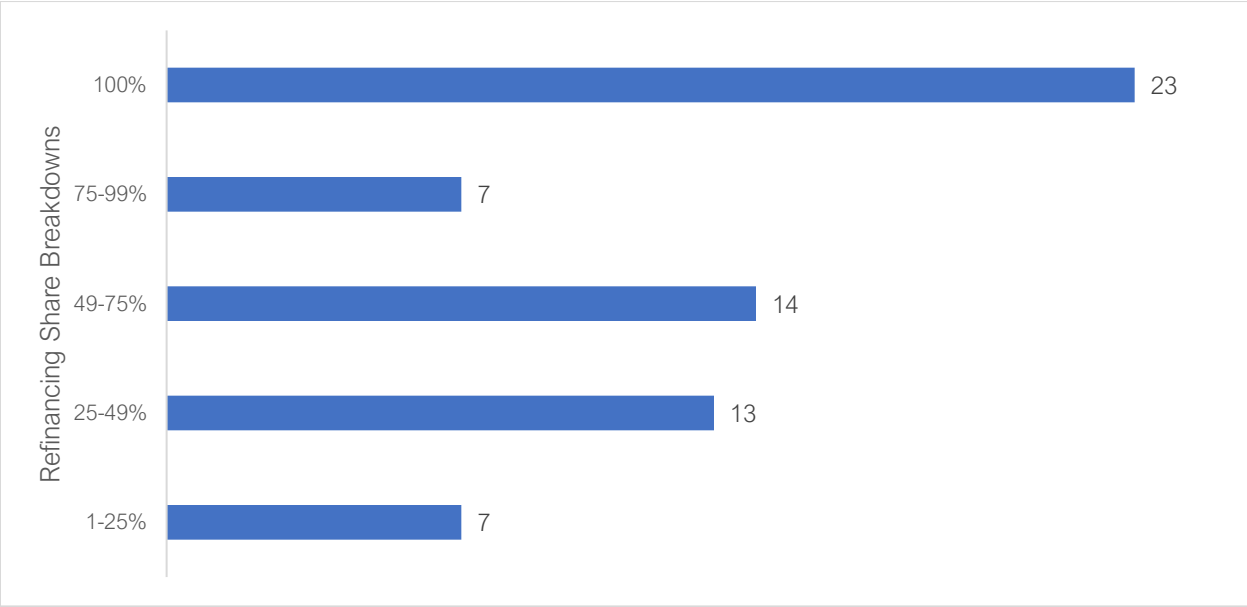


Figure 10: Number of Green Bonds by Refinancing Share - Impact Reports



In terms of the share of refinancing in the disclosed impact reports (40% of 158 impact reports), most of them are fully dedicated to refinancing. Figure 10 presents the actual share of refinancing in use of proceeds. This is aligned with the results presented in Figure 3 which shows the planned share of refinancing in the GBF.

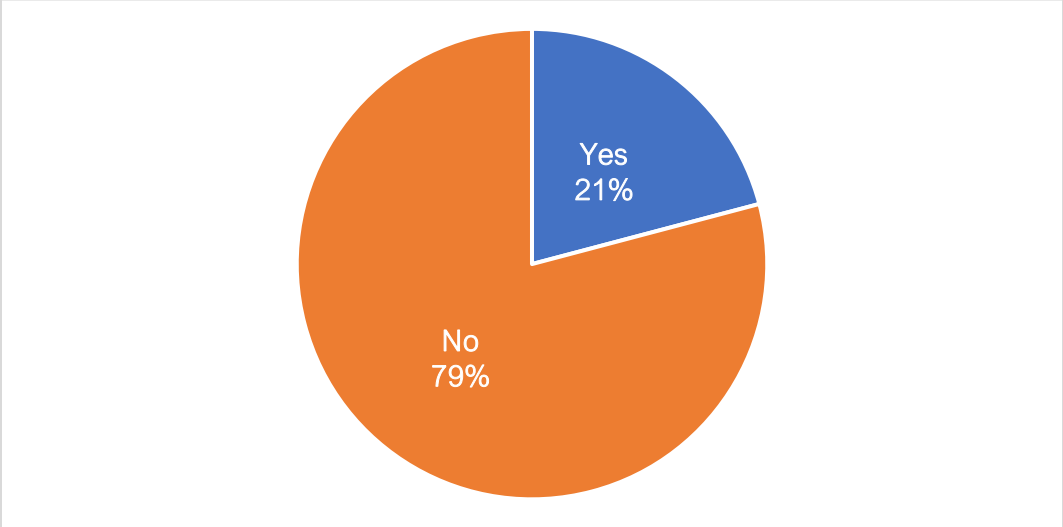
5.2.4 ***Disclosure of Share in Ownership or Financing***

Ownership and share in financing are analyzed under the same metric to capture the difference between financial and non-financial institutions. For financial institutions, their share in impact is associated with their total share in the financing package which may involve other lenders and equity shares provided by the project owner. For non-financial

institutions, the same logic applies to their share in the ownership of the asset which determined their share in equity.

In the sample, one of the major shortcomings identified is the disclosure of ownership or financing shares. As presented in Figure 11, only 21% of the impact reports provided information about the share of the issuer in the green project's ownership or financing. As a result of this, it is not possible to identify the share of the issuer in the total impact of the majority of green projects. Even if there are plenty of impact metrics disclosed, without understanding the share of the issuer it is not possible to identify the realistic role of a specific green bond in the claimed positive impact.

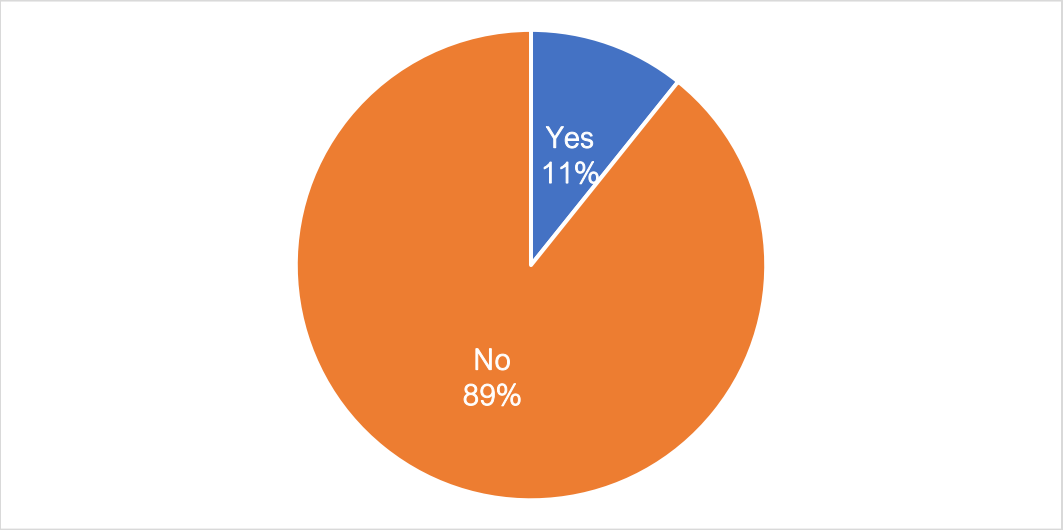
Figure 11: Disclosure of the Share in Ownership of Financing



5.2.5 ***Disclosure of Total Project Cost***

Another critical, albeit overlooked disclosure, is total project cost. Even a smaller number of issuers disclosed total project costs compared to disclosure of share. Total project cost can be sensitive commercial information subject to higher standards of non-disclosure agreements. However, if more issuers disclose total project costs associated with the green projects financed under the GBFs, a financing benchmark for different sub-sectors could be established. It can also create a source of climate finance volume information which is much needed considering the need of significant annual flow to climate related activities in a short period of time to address climate change.

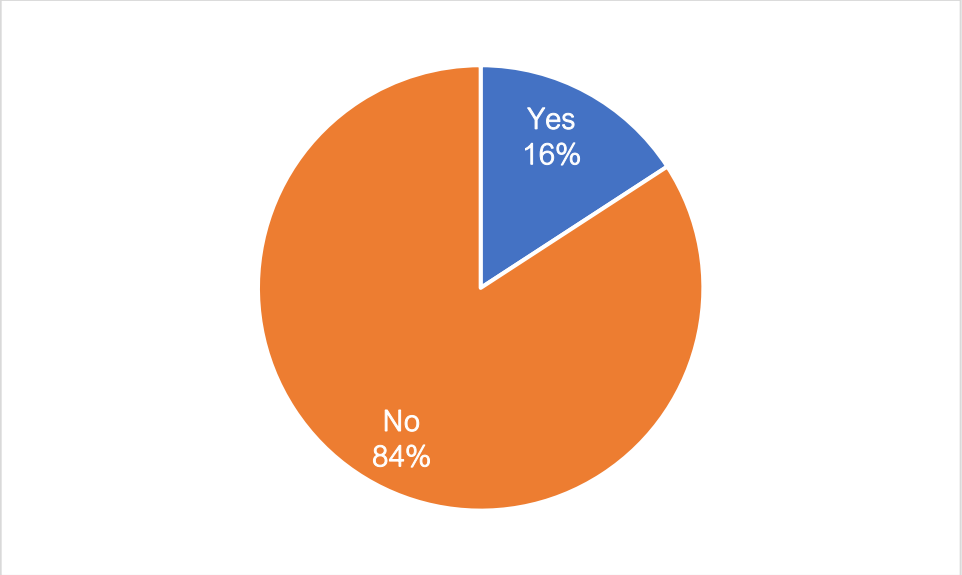
Figure 12: Disclosure of Total Project Cost



5.2.6 ***Disclosure of Lifetime Positive Environmental Impact***

The impact reports provide information about the reporting period. However, projects have a longer-term impact which is generally even beyond the maturity of the bonds. Hence, disclosing the lifetime impact of the green projects enhances the transparency of the issuance. However, only 16% of the impact reports have disclosure of lifetime environmental impact for at least one KPI as presented in Figure 13.

Figure 13: Disclosure of Lifetime Positive Environmental Impact



5.2.7 ***Disclosure of KPIs***

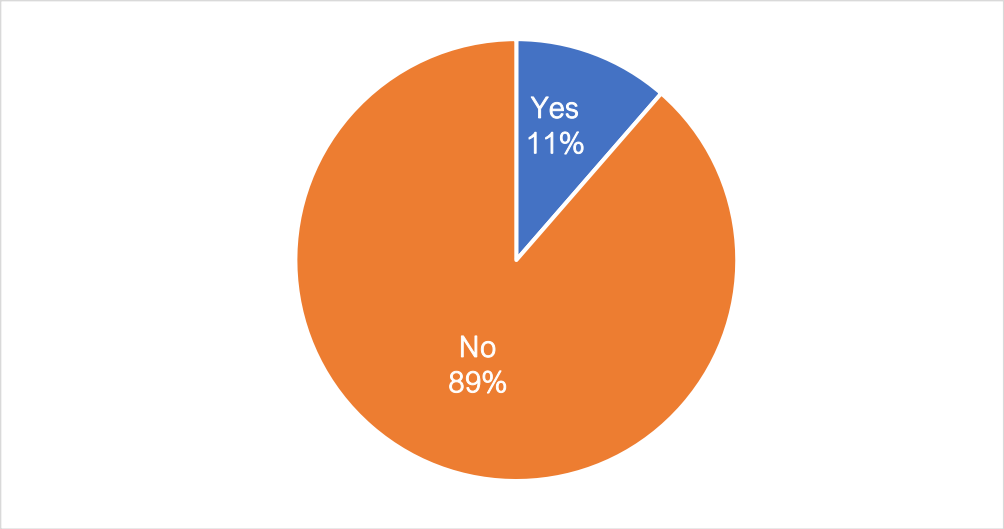
There is no consistent naming or grouping used by issuers for the KPIs listed in the impact reports. Hence, the analysis is focused on identification of the most common keywords mentioned (Table 8). Please note, generally each impact report presents multiple KPIs.

Table 8: Key Words Mentioned in the Impact Reports

Key words in the KPIs	**Mentioned in ... of the sample of 158 impact reports**
CO2	65%
MW	40%
GHG	32%
Water	23%
Waste	15%
Energy savings	13%
Building	11%
Passenger	6%

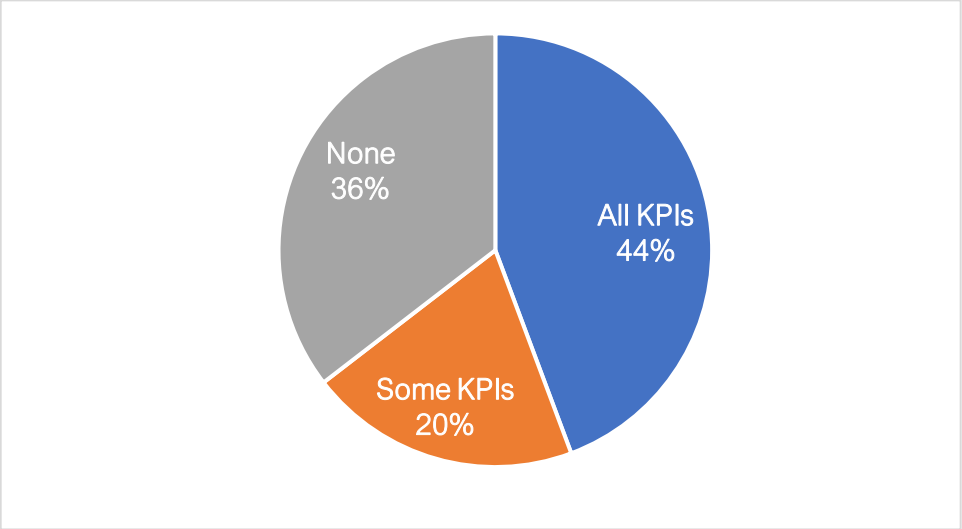
Another data field coded for KPIs is the verification of the outputs by third parties. For this field, green building certifications are considered as third-party KPI verification. Even if only some of the KPIs were verified, it is recorded as “Yes” considering not all the KPIs are suitable for verification, such as MW capacity additions which do not require a third-party verification since they are straight forward project information disclosures. In other words, these type of KPIs do not have an underlying calculation based on assumptions which can differ from case to case. Accordingly, only 11% of impact reports, KPIs were verified by third parties.

Figure 14: Verification of KPIs



Another field was the disclosure of the KPI calculation methodology. Even if there is no third-party verification, issuers can still disclose the underlying methodology of KPIs such as the grid factor used to calculate CO2 emissions mitigated. 44% of the impact reports provided the methodology for all KPIs, 20% for some KPIs and 36% for none. For scoring purposes, all and some KPIs are considered sufficient to receive a transparency score of 1 (for none score is zero) since it is not necessary to provide a methodology for all KPIs such as MW renewable energy which are more straight-forward information related to projects and do not require additional third-party verifications. Whereas other KPIs such as GHG emissions avoided or water savings require assumptions in their calculation, which can differ from case to case. For this type of KPIs, disclosing the full methodology gives the reader a better understanding of how the result is calculated.

Figure 15: Disclosure of KPI Calculation Methodology



*5.3 **Transparency and Additionality Scores***

As presented in Table 2 and Table 3 three different scores are calculated in two aspects. For Transparency, there are two scores: Transparency Score I for the issuances involved in refinancing and Transparency Score II for the issuances not involved in refinancing. For the Additionality Score, each issuance is evaluated using the same metrics.

*5.3.1 **Scoring Examples from Selected Green Bonds***

Having a higher score in additionality or transparency does not mean the bond is also highly ranked in both aspects. The green bond issuance of Sociedade Bioelétrica do Mondego presented in Table 9 received the highest score in Transparency Score I while its additionality score was zero.

Table 9: Example I

Issuance	Sociedade Bioelétrica do Mondego
Country	Portugal
ICMA Sub-sector	Corporate-Energy
Additionality Score	**0 / 100**
Transparency Score	**92.3 / 100**
Green Bond Framework Year	2019
Use of Proceeds	Renewable Energy, Clean Transportation, Residential Green Buildings, Public Green Buildings, Terrestrial and Aquatic Biodiversity Conservation and Climate Change Adaptation, Sustainable (Waste) Water Management
Impact Report Year	2019
Details About Additionality Score	This issuance received zero for the additionality score because 100% of the use of proceeds were dedicated to refinancing.
Details About Transparency Score	This issuance received the highest transparency score due to the disclosure of: - Planned refinancing share (100%) - Commitment to share refinancing in actual investments - Exclusion list - Impact report - Yearly breakdown of investments - Sub-sectoral breakdown of investments - Share of financing - Verification of use of proceeds by a third-party - Verification of KPI calculations by a third-party - Disclosure of expected lifetime environmental benefits - Disclosure of KPI calculation methodology. There was no explicit information about total project costs. Hence, the issuance did not receive 100 out of 100.

Commentary	Even if the issuance received 0 out of 100 from additionality, it is an example of best practice for transparency compared to the market.

The second issuance presented in Table 10 is an example of a low score for both additionality and transparency.

Table 10: Example II

Issuance	**Agricultural Bank of China Ltd.**
Country	China
ICMA Sub-sector	Financial Institution
Additionality Score	**0 / 100**
Transparency Score	**15.3 / 100**
Green Bond Framework Year	2015
Use of Proceeds	Renewable Energy, Energy, Efficiency, Waste Management, Clean Transportation, Sustainable Use of Land, Water Management
Impact Report Year	2021
Details About Additionality Score	The Green Bond Framework of this issuance does not mention refinancing as a potential use of proceeds area. Hence, it received the highest score from the framework. However, in the impact report refinancing is mentioned without providing a weight. Hence, its additionality score is reduced to zero.
Details About Transparency Score	The transparency score is among the lowest with disclosure of only exclusion of activities among transparency metrics.
Commentary	This issuance received a low score on both additionality and transparency aspects. This issuance is a useful example of the role of impact reporting. If only the green bond framework was used, the additionality of the bond was assumed to be higher while in the actual impact report refinancing is mentioned.

Table 11 provides an example of an issuance received a higher score in for transparency and additionality simultaneously.

Table 11: Example III

Issuance	**KfW**
Country	Germany
ICMA Sub-sector	Agency
Additionality Score	**100 / 100**
Transparency Score	**70 / 100**
Green Bond Framework Year	2019
Use of Proceeds	Renewable Energy, Green Building
Impact Report Year	2020
Details About Additionality Score	This issuance received a full score from additionality by not being involved in refinancing based on its impact report and green bond framework.
Details About Transparency Score	For the following reasons this issuance has not received full score: - Total project cost is only disclosed for two examples (score of 0 out of1) - A detailed allocation report is provided but it is not verified (score of 0 out of 1) - Expected lifetime of the environmental KPIs is not disclosed (score of 0 out of 1)
Commentary	The impact report analyzed is from 2020 linked to the green bond framework published in 2019. The latest impact report published in 2022 is linked to another green bond framework published. There is a third-party verification to the allocation report for the 2022 impact report which is outside of the scope of this specific issuance's transparency score.

*5.3.2 **Findings***

There are 236 green bonds with GBF or Market Information Form. For scoring, if there is no impact reporting available, the issuance received zero from the metrics derived from impact reports. However, in the sample out of 21 green bond frameworks published in 2022, 16 of them did not have an impact report published during the data extraction stage that ended in March 2023. Considering there was limited time for the annual impact report to be published, all 21 GBFs published in 2022 were excluded from all scores. The five issuances (which disclosed a GBF in 2022 and also have an impact report) are also excluded from this analysis. This is to avoid only including the examples with impact disclosures while not penalizing the 16 of the issuances with no impact reports.

The scores are normalized to 100 to be able to provide a comparable result between the three scores. In Table 12, descriptive statistics of three scores are presented. An issuance can only be part of Transparency Score I or Transparency Score II.

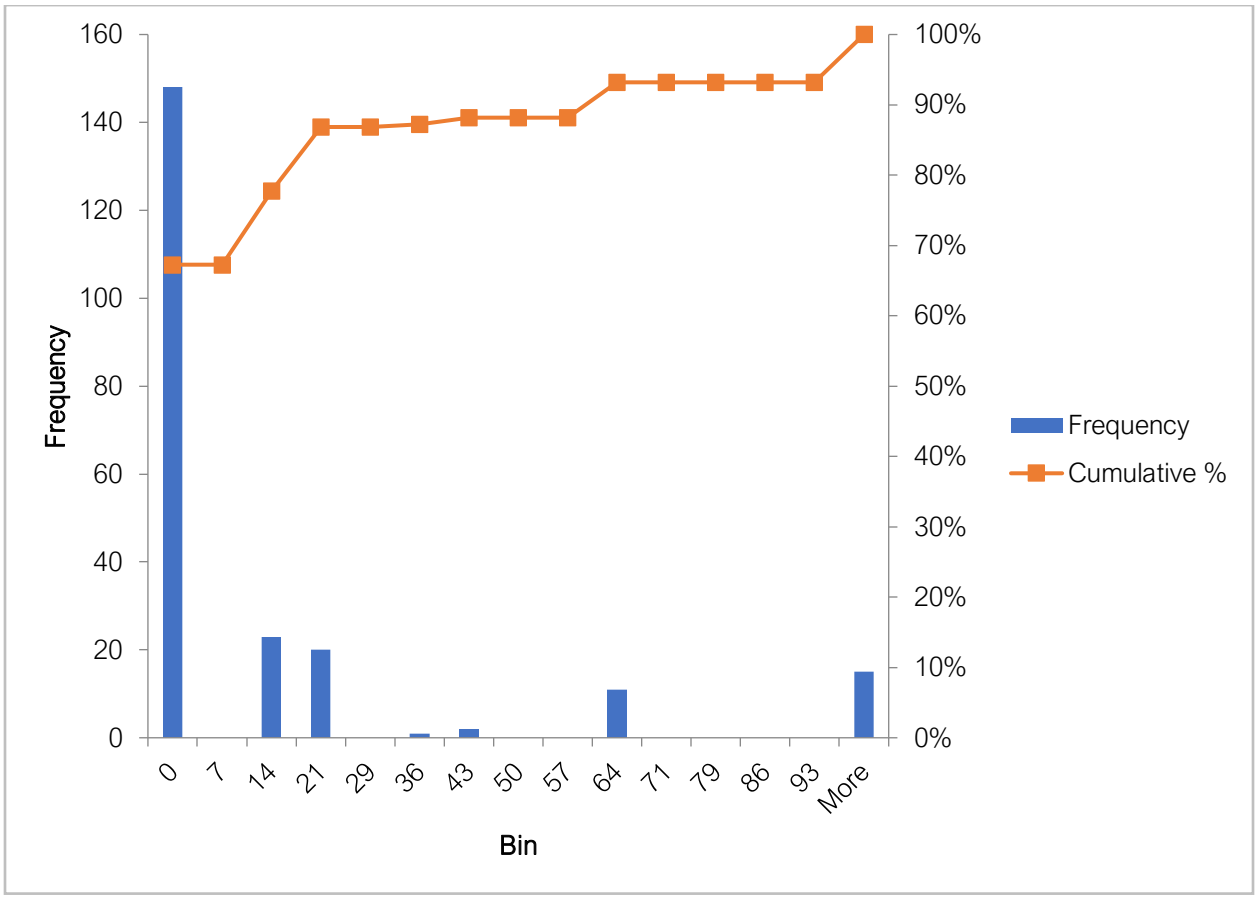
The additionality score has the lowest median at zero, which indicates that the additionality of the sample is low. For transparency, issuances involved in refinancing (Transparency I) have a higher median than issuances not involved in refinancing (Transparency II).

Table 12: Descriptive Statistics

Confidence Level 95%	**Additionality**	**Transparency I (Involved in Refinancing)**	**Transparency II (Not Involved in Refinancing)**
Mean	12.7	36.6	26.8
Standard Error	1.8	1.6	5.3
Median	0.0	38.5	30.0
Standard Deviation	26.9	22.1	26.3
Kurtosis	4.8	0.0	-1.5
Skewness	2.4	92.3	0.3
Minimum	0	0	0
Maximum	100.0	92.3	70.0
Count	**220**	**195**	**25**

Figure 16 shows that the majority of the bonds received the score of zero from additionality. This means that 100% of the use of proceeds are planned to be dedicated to refinancing at the green bond frameworks and used for refinancing based on the disclosures provided in the impact reports. This finding is aligned with Figure 2.

Figure 16: Histogram - Additionality Score



Comparing Figure 17 and Figure 18, issuances scored under Transparency Score I have a higher score, also evidenced by the higher mean and median in Table 12. This does not necessarily show that bonds involved in refinancing have higher transparency practice in all aspects. Please see Table 15 and Table 16 for details.

Figure 17: Histogram - Transparency Score I

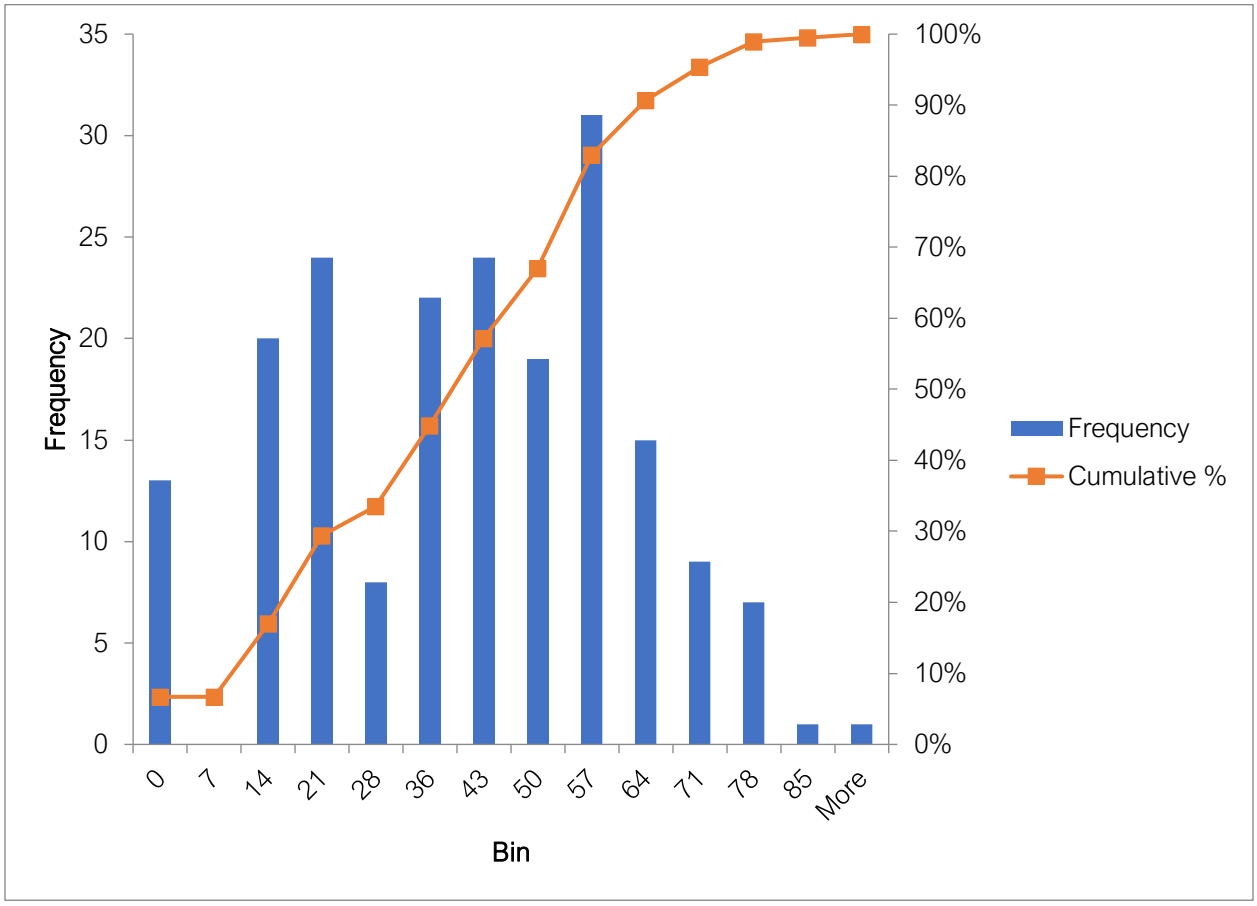


Figure 18: Histogram - Transparency Score II

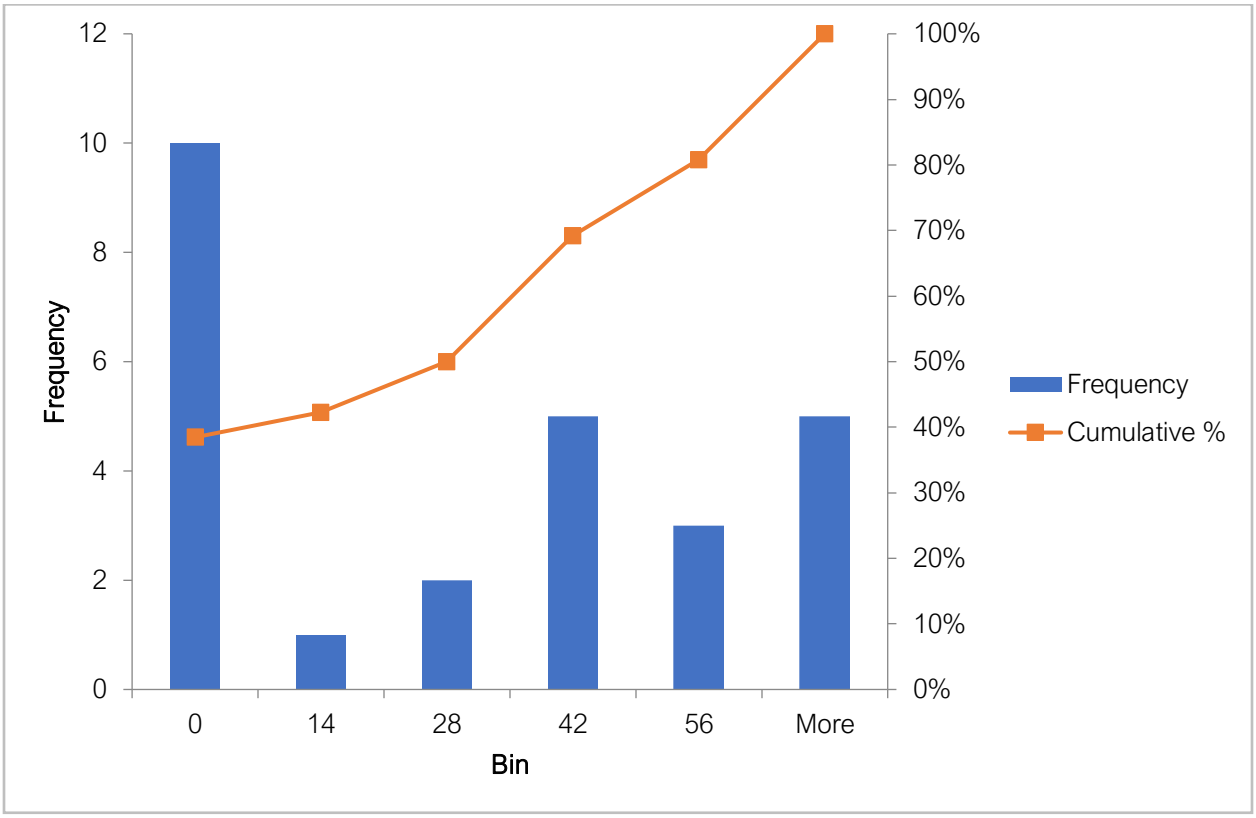


Table 13, Table 15 and Table 16 below show the share of issuances that received the highest scores in each metric (Additionality Score, Transparency Score I and Transparency Score II). The highest score is determined in accordance with the score tables given in Table 2 and Table 3.

For instance, the high score for Involvement in Refinancing is a score of 4 if there is no refinancing mentioned for the use of proceeds in the GBF. Whereas the low score is a score of 0 which means 100% of use of proceeds are dedicated to refinancing. The medium score only applies to Share of Refinancing and in the GBF and Share of Refinancing in the Impact Reports under Additionality score (Table 14). These two

metrics have 4-level scorings (Lowest 0, medium 1 or 2, and highest 4) while the rest of the metrics have either 0 (low) or 2 (high) scores. Please refer to Table 2 and Table 3 for full list of scores and reasonings.

In Table 13 to 16, if the number of bonds that received the highest score is larger than the number of bonds that received lower score, the metric is highlighted in green. For instance, in Table 15 74% of green bonds have a post-reporting in English. In this case, the better practice is more prevalent in the sample and thus the metric is highlighted in green. On the other hand, only 15% of the bonds disclose the share of refinancing which means majority of the bonds in the sample are not adhered to the best practice and this metric is highlighted in red.

Accordingly, in all three metrics of additionality, the majority of the issuances received the lowest score by being involved in refinancing and dedicating 100% of the actual use of proceeds to refinancing. There was no additional positive impact creation associated with the financing of new green projects through these issuances directly. It is important to highlight that additionality only looks into the direct link between a green bond and greenfield green project such as the construction of a new solar power plant. There might be cases where the refinancing ability of the green project may increase the investors' interest in the project. However, it is not possible to quantify this indirect link without analyzing the financing discussions of each associated green project. The scope

of this research is limited to the direct link defined as dedicating the use of proceeds to new projects with new positive environmental impacts.

Table 13: Share of High Scores in Additionality Metrics

Additionality	**Highest Score Answer**	**Share of the Highest Score Answer**
Involved in refinancing	No	11%
Share of refinancing in the GBF	0%	11%
Share of refinancing in the impact reports	0%	7%

Table 14: Share of Medium Scores in Additionality Metrics

Additionality	**Medium Score Answer**	**Share of the Medium Score Answer**
Share of refinancing in the GBF	Involved but less than 100%	4%
Share of refinancing in the impact reports	Involved but less than 100%	17%

Comparing Transparency Score I (Table 15) and Transparency Score II (Table 16), “Committed to disclose share of refinancing in impact report” is one of the metrics with a higher weight in High scores present in Table 15 and this metric is not part of the Table 16. This can partly explain the higher median score for Transparency Score I compared to Transparency Score II as presented in Table 12. Moreover, issuances involved in refinancing received a higher share in most of the metrics. For instance, 51% of the issuances evaluated in Transparency Score I (involved in refinancing) disclosed an exclusion of activities listed while only in 31% of the bond examined under Transparency Score II disclosed a list of excluded activities.

Among both scores, disclosure of total cost has the lowest share in high scores which means only 8% of issuances disclosed total project cost both in Table 15 and Table 16. The same applies to the verification of KPIs by a third-party. Another metric where disclosures were not present most of the time was the disclosure of expected lifetime positive environmental impacts. 88% and 92% of issuances in Transparency Score I and Transparency Score II do not provide information about this metric.

Table 15: Share of High Scores in Transparency I

Transparency Score I	**Highest Score Answer**	**Share of the Highest Score Answer**
Disclosure of the share of refinancing	Yes	15%
Committed to disclose share of refinancing in impact report	Yes	54%
Disclosure of an Exclusion of activities listed	Yes	51%
Post-reporting in English	Yes	74%
Disclosure of the yearly breakdown of investment amount	Yes	43%
Disclosure of the sub-sectoral breakdown of investment amounts	Yes	70%
Disclosure of the share of refinancing in actual investments	Yes	32%
Disclosure of the ownership/share in financing or impact	Yes	14%
Disclosure of total project cost	Yes	8%
Verification of use of proceeds by a third-party	Yes	46%

Verification of KPIs by a third-party	Yes	8%
Disclosure of expected life-time positive environmental impacts	Yes	12%
Disclosure of the KPI calculation methodology	Yes	48%

Table 16: Share of High Scores in Transparency II

Transparency Score II	**Highest Score Answer**	**Share of the Highest Score Answer**
Disclosure of an Exclusion of activities listed	Yes	28%
Post-reporting in English	Yes	56%
Disclosure of the yearly breakdown of investment amount	Yes	24%
Disclosure of the sub-sectoral breakdown of investment amounts	Yes	52%
Disclosure of the ownership/share in financing or impact	Yes	20%
Disclosure of total project cost	Yes	8%
Verification of use of proceeds by a third-party	Yes	28%
Verification of KPIs by a third-party	Yes	8%
Disclosure of expected life-time positive environmental impacts	Yes	8%
Disclosure of the KPI calculation methodology	Yes	36%

5.3.3 ***Country Observations***

The country breakdown is dominated by the European Union (EU), followed by Japan and the United States of America (USA) in terms of number of bonds. While there are limited examples from some other countries, it is not meaningful to compare a large number of examples from some countries with less than 10 examples from another country.

Nonetheless, from Table 17, the most outstanding result is the consistently low median scores for additionality across all countries. For Transparency Score I (involved in refinancing), the country median scores of Norway, United Kingdom and EU are higher than the overall sample median. For Transparency Score II (not involved in refinancing), examples are mostly from USA with a score of zero. These examples are dominated by the issuance of municipalities in the USA which do not have an impact report available to the public based on the best effort of the author to find the reports. Even if Canada has the highest median for Transparency Score II, there is only one example of issuance in this category which makes it harder to compare with other countries.

Table 17: Median Scores Grouped by Countries

MEDIAN Score	**# of Bonds**	**Additionality (0 -100)**	**# of Bonds**	**Transparency I (0 – 100)**	**# of Bonds**	**Transparency II (0 – 100)**
Canada	8	-	7	15.4	1	70
China	5	-	3	15.4	1	50
EU	90	-	87	46.2	4	55

Hong Kong	3	-	3	38.5	-	-
Japan	35	-	28	15.4	7	-
Norway	5	-	5	53.8	-	-
Supra-national	6	-	5	38.5	1	60
Switzerland	5	10	5	38.5	-	-
United Kingdom	6	10	6	50.0	-	-
United States of America	28	-	19	15.4	9	-
Other	29	-	27	38.5	2	5
Total	220	-	195	38.5	25	30

5.3.4 ***Sub-sector Observations***

Table 18 presents the median scores for each ICMA sub-sector. Similar to country breakdowns, the number of examples in each category differs significantly. Financial institutions have the highest weight in terms of the number of issuances followed by Corporate-Energy and Corporate-Real Estate.

Financial institutions are more experienced in issuing corporate bonds which may also give them a better understanding of green bonds and its issuance procedure. Hence, it is likely that financial institutions are better positioned in the market to channel their experience in capital markets to climate finance instruments. It is visible from their second-highest median score of 53.8 in Transparency Score I. Moreover, financial institutions have the highest share by the number of issuances which makes the higher median score of the sub-sector more remarkable and meaningful compared to other sub-sectors which are represented by a small number of issuances.

The Additionality Score of the Corporate-Technology sub-sector has the highest median. However, this is linked to two examples in this group fully dedicated to greenfield projects. This group also has the highest median score in Transparency Score I but is only represented by four issuances in the sample. If more examples are added to the group, it is uncertain if the high scores can be preserved. Hence, the sectoral analysis for the Corporate-Technology sector is not as robust as financial institutions due to the smaller number of issuances deriving the score.

Municipalities received one of the lowest scores in Transparency I. There are 10 examples in this score from different countries. There is a significant difference between the lowest performers which received a score of zero (out of 100) and the highest score of 69 (out of 100). For the Transparency II score, four out of the five examples received a score of zero. This group has three issuances from the US. Their disclosure practice was worse compared to other sub-sectors and countries due to the unavailability of the impact report.

Lastly, another interesting result was the MDB's (Multinational Development Banks) low performance in additionality with a median score of zero despite their higher than all group medians in transparency score. This is a result of their involvement in refinancing.

Table 18: Median Scores Grouped by ICMA Sub-sectors

MEDIAN Score	# of Bonds	Additionality (0 -100)	# of Bonds	Transparency I (0 – 100)	# of Bonds	Transparency II (0 – 100)
Agency	9	-	5	38.5	4	35
Corporate-Consumer goods	4	10	3	30.8	1	30
Corporate-Consumer services	5	-	5	15.4	-	-
Corporate-Energy	39	-	39	23.1	1	-
Corporate-Industry	8	-	7	30.8	1	-
Corporate-Infrastructure	7	10	7	46.2	-	-
Corporate-Real Estate	35	-	31	38.5	4	35
Corporate-Technology	4	55	2	61.5	2	35
Corporate-Transportation	14	-	12	30.8	2	25
Financial Institution	56	-	53	53.8	2	55
MDB	6	-	5	46.2	1	60
Municipal	15	-	10	19.2	5	-
Sovereign	4	10	3	46.2	1	60
Utility	11	-	10	38.5	1	-
Other	3	-	3	15.4	-	-
Total	**220**	**-**	**195**	**38.5**	**25**	**30**

6 Conclusion

The action window for climate change is narrowing down every year. Despite the clear and loud warnings from scientists and visible changes, we can easily observe in our daily life, there is not enough action in place to avoid the catastrophic consequences. In this inertia, climate finance has the power to play two very different roles. In the first scenario, climate finance can be an enabler of the change by providing the necessary financial capital for green transition projects. Considering the volume of the investments, this is an essential role despite its shortcomings.

On the other hand, climate finance can act as a mask. While making the “green” headlines more common, there can be no real action behind the curtains. This is a valid and dangerous risk. This can create a feel-good way of presenting the role of finance to society while in reality nothing changes, and time passes by.

In this research paper, I contributed to the climate finance literature in three distinctive ways. First, by creating a transparency scoring I have identified the disclosure practices of the green bond issuances. Using a first-hand coded sample of 241 green bonds, my research provides strong evidence of greenwashing risk in the green bond market.

Secondly, by making the additionality of green bonds as a capital market instrument in climate action, I have focused on the relationship between actual positive impact and green bonds. Detailed analysis of impact reports of each of the issuances in the sample

is a novel contribution to the literature and one of its kind. For both transparency and additionality scores, the research provided a fact checkpoint for all different stakeholders of the green bond market.

Lastly, I will make the sample open access to the public through York Library. Hence, the output of my major research paper is not only my research findings but also the green bond database itself. To my best knowledge, there is no similar database available to the public and similar databases are available only to a group of investors or paid subscribers.

The findings of this research paper have three main limitations. Firstly, due to the selection of a sample, some of the sub-sectors are represented with a small number of issuances. With a more extensive sample, we can achieve more meaningful comparisons between sub-sectoral issuer groups in the future.

Secondly, there is no analysis of the relationship between transparency and additionality scores. This analysis can reveal new findings in the future. Lastly, the sample is from ICMA-aligned green bonds only. With changing taxonomies and frameworks, the same scoring criteria can be applied to different voluntary frameworks or new versions of ICMA Green Bond Principles in the future to compare differences and understand the reasons behind different practices.

The findings of this research paper signal several action points. The issuers of green bonds claim a positive environmental impact by dedicating financial capital to green projects. Before heading into discussions about what is additionality, the first step should agree on the definition of “environmental impact”. If the impact is defined as a new and incremental change, refinancing should be a different category than greenfield project financing. The long-awaited climate finance capital can be a part of the solution only if it is serving the purpose of financing new projects to keep global warming below 2°C across all sectors and countries.

Considering the low additionality and transparency scores, investors should not be satisfied with the green bond stamp without analyzing the issuance-specific details. There are significant differences between the practices even if two issuances received the ‘green’ label using the same voluntary guidelines as ICMA Green Bond Principles. If investors put more effort into investing in high-quality green bonds, over time this can also have pricing implications.

The evolving taxonomies, standards, definitions, and voluntary guidelines have the power to shift the practices in the industry if policymakers can push for utilizing capital markets as a tool for direct, positive and additional impact creation. Despite the growing market, the findings of this research indicate that there is significant room for improvement in the impact reporting practices.

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