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Contemporary Issues in Sustainable Finance

Banks, Instruments, and the Role of Women

Edited by Mario La Torre · Sabrina Leo

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Palgrave Studies in Impact Finance

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About This Book

This book delves into the contemporary challenges of sustainable finance, both in theory and practice. Specifically, it focuses on three crucial issues. Firstly, the benefits that sustainable finance can bring to banks and the financial industry at large. By integrating sustainable finance into their business processes, financial institutions can reduce risk, enhance their reputation, and create new opportunities that contribute to a more sustainable world. Secondly, the book highlights the significance of sustainable bonds as a crucial tool in sustainable finance. These bonds provide a source of long-term financing for sustainable projects, promote accountability and transparency, stimulate market growth, manage risk, and ultimately benefit the environment and society. Lastly, the book emphasises women's crucial role in sustainable finance. Women help to develop creative and practical solutions, address gender issues, serve as role models, and increase their involvement in the financial sector to drive sustainable finance forward.

Contents

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CHAPTER 1

Introduction

Mario La Torre and Sabrina Leo

This book sheds light, theoretically and empirically, on three contemporary challenges of sustainable finance: the path of banks in favour of sustainable growth, the market of sustainable financial products, mainly sustainable bonds, and the role of women in sustainable finance.

Bank sustainability and non-financial impact are hot topics in the financial sector, and the role of women in this industry is gaining increasing recognition (Bolibok, 2021).

Bank sustainability refers to the integration of environmental, social, and governance (ESG) factors into the strategies and practises of financial institutions. It involves considering the long-term impact of the bank's activities on the environment, society, and overall economic stability (Chang et al., 2021; Citterio & King, 2023; Doumpos et al., 2016).

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Banks can contribute to environmental sustainability by assessing and managing their own environmental footprint. This includes reducing energy consumption, minimising waste generation, and adopting eco-friendly practises within their operations. Banks can also promote green finance by providing funding for renewable energy projects, sustainable infrastructure, and environmentally friendly initiatives (Nobanee & Ellili, 2016). A bank could conduct an environmental audit of its branches and headquarters to identify areas where energy efficiency can be improved. It could then invest in solar panels and energy-efficient lighting to reduce its carbon footprint. Additionally, a bank could offer special green loan programmes applying lower interest rates to customers investing in renewable energy projects or purchasing eco-friendly homes or vehicles. This would not only contribute to environmental sustainability, but also stimulate the green economy and create jobs in the renewable energy sector.

Furthermore, banks have the responsibility to consider the social impact of their activities. This involves ensuring fair treatment of customers, promoting financial inclusion, and supporting community development initiatives.

Social impact refers to the effect of an organisation's activities, programmes, and policies on society and the well-being of individuals and communities (Boyle, 2022). Overall, social impact in the financial sector involves using financial resources, expertise, and influence to create positive social change, promote inclusive economic growth, and improve the well-being of individuals and communities.

In the context of the financial sector, social impact refers to the positive contributions that financial institutions make to address social challenges and create positive change in society (Schinckus, 2017).

Banks can provide access to financial services for underserved populations, offer affordable credit options, and support initiatives that address social issues, such as poverty alleviation, education, healthcare, and affordable housing (Kovalenko et al., 2022). There are four main business areas related to banks social impact activity:

– Supply of Inclusive Financial Products: by offering basic banking services, affordable credit, and savings options, financial institutions can empower individuals and communities, support entrepreneurship, and reduce poverty.

- Responsible and Sustainable Lending and Investment: banks can direct capital towards projects and businesses that have positive social outcomes, such as affordable housing, education, and healthcare.
- Support for Small and Medium Enterprises (SMEs): by providing financing and business advisory services to SMEs, banks can contribute to job creation and economic development.
- Philanthropy and Community Development: banks may establish or finance foundations, provide grants, contribute to social projects that address local needs; these initiatives can focus on areas such as education, healthcare, environmental conservation, and poverty alleviation.

Good governance practises are fundamental to bank sustainability. This includes responsible decision-making, accountability, and transparency. A bank that values good governance practices may also establish a transparent and accountable system for disclosing its financial information to the public. This can include publishing annual reports, holding regular shareholder meetings, and implementing strict internal controls to prevent fraudulent activities. This allows stakeholders, including investors and customers, to evaluate the bank's sustainability efforts and hold them accountable for their commitments.

Bank sustainability is important not only from an ethical perspective, but also from a business standpoint. Increasingly, investors and customers are considering sustainability factors when making financial decisions. Therefore, integrating sustainability into banking operations can contribute to long-term profitability, while good reporting increases reputation, both fostering positive environmental and social impacts. In this scenario, measuring and evaluating environmental and social impact is crucial for financial institutions to assess the effectiveness of their efforts and make improvements (Parker, 2002).

In the path towards sustainability, the role of women in the financial sector has evolved significantly over the years, and there is a growing recognition of the importance of gender diversity and inclusivity in the industry (Lodh & Nandy, 2017). Historically, women have been underrepresented in senior leadership positions in the financial sector. However, there is a growing emphasis on increasing gender diversity in leadership roles. Many organisations are actively working to ensure equal opportunities for women to advance into senior management and board positions. This includes implementing diversity and inclusion initiatives, setting

targets for gender representation, and creating supportive career development programmes for women. As for example, a large investment bank may implement a diversity and inclusion initiative by setting up a women's network within the organisation. This network could provide mentoring and networking opportunities for female employees, as well as hosting workshops and seminars focused on developing leadership skills. A bank may set targets for gender representation at each level of seniority, ensuring that there is a clear pathway for women to progress into leadership positions. Through these efforts, the bank aims at creating an inclusive and supportive environment that enables talented women to thrive and reach their full potential. By implementing these initiatives, the bank recognises the importance of diversity and inclusion in driving innovation and success. It also acknowledges the unique challenges that women may face in their career progression and is committed to breaking down barriers and creating equal opportunities for all employees.

Providing women with opportunities for mentorship, sponsorship, and professional development is crucial for their advancement in the financial sector. Mentoring programmes, both formal and informal, can provide guidance, support, and networking opportunities to help women navigate their careers and overcome barriers they may face. Empowering women through skills development, training, and mentorship can contribute to their professional growth and success in the industry.

Women play a vital role in promoting financial inclusion, both as consumers and as professionals in the financial sector. Financial institutions need to understand and address the unique needs and challenges faced by women when accessing financial services. By developing products and services that cater to women's financial needs, such as gender-responsive banking, microfinance, and targeted investment strategies, financial institutions can contribute to women's economic empowerment and promote gender equality.

Women-owned businesses are an important and growing segment of the global economy. Supporting women entrepreneurs and providing them with access to finance is crucial for fostering economic growth and job creation. Financial institutions can play a significant role in providing capital, business advisory services, and networking opportunities to help women start and grow their businesses. Additionally, supporting women-owned SMEs through targeted financing programmes can contribute to closing the gender gap in entrepreneurship.

Creating inclusive workplaces that value and promote diversity is important for attracting and retaining talented women in the financial sector. This involves implementing policies and practises that support work-life balance, flexible working arrangements, and family-friendly policies. Organisations that prioritise diversity and inclusion can benefit from a wider range of perspectives, improved decision-making, and enhanced innovation.

Women in the financial sector can advocate for gender equality, both within their organisations and across the industry. They can participate in industry networks, forums, and associations that promote gender diversity and advocate for policies and practises that support women's advancement. Collaboration between financial institutions, regulators, and industry associations is essential to driving meaningful change and creating an inclusive financial sector.

Promoting the role of women in the financial sector is not only a matter of gender equality but also brings significant benefits to organisations and society as a whole. Gender diversity in leadership and decision-making positions can lead to improved financial performance, better risk management, and enhanced innovation. Organisations that prioritise gender diversity and inclusivity are better positioned to address the needs of their diverse customer base and contribute to sustainable and inclusive economic growth (Shakil, 2021; Tardos & Paksi, 2018).

In the light of the above, the book focuses on three specific perspectives: (a) the strategies and initiatives adopted by banks to integrate sustainability into their core business models; (b) the market trends and developments surrounding sustainable financial products—mainly bonds—including their issuance, performance, and impact on financing sustainable projects; (c) the contribution of women in the field of sustainable finance, highlighting their leadership roles, innovative approaches, and efforts to promote gender equality within the industry.

The book is divided into three sections.

Chapters 2, 3, and 4 of this book focus on Debating ESG Financial Topics (Sect. 1). Chapter 2, titled "*Sustainability Literature Orientation: Evidence from Finance Academic Research*" by Lahmar, Piras, De Lisa, and Mandas, delves into the global attention that sustainability has garnered over the past few decades. The authors highlight how sustainability factors significantly impact economic growth, corporate management, and financial institution decision-making. They also note the increasing involvement of academic research in this area. The authors

use topic modelling on 3,271 scholarly articles to create a research map, extracting dominating subjects and studying their evolution.

Chapter 3, titled "*First assessment of EU Taxonomy regulation for Italian financial firms*" by La Torre, Santamaria, Cardi, Palma examines how disclosure can promote sustainability by analysing the new regulatory framework and disclosure requirements under the new taxonomy. Specifically, the authors evaluate the disclosure practices of Italian financial institutions in the first year of implementing Article 8 of the EU Taxonomy Regulation. The sample includes financial businesses in the "K" sector (Financial and Insurance Activities) on Consob's 2021 NFS list. The findings reveal differences in self-reported sustainability, probable business model, and company size among Italian financial businesses.

Chapter 4, titled "*Sustainable finance: A Quest for Value from ICO*" by Gimenez, analyses ICO funding policy; ICO has been raising funds for 50 years, primarily from foreign markets, since 1996. In 2015, launched the Spain's first social bond worth €1,000 million and issued their first €500 million green bond in 2019. ICO has issued €4,550 million in sustainable bonds, including seven social and two green bonds. They joined the Nasdaq Sustainable Bond Network, promoting market transparency. These bonds fund social and environmental projects, such as financing micro-enterprises and self-employed individuals in different Spanish regions and initiatives for renewable energy, pollution prevention, and sustainable resource management.

The second part of the book (Chapter 5, 6, 7), which is devoted to ESG Instruments and Sectors, opens with Chapter 5, "*A Bibliometric Analysis of Sustainable Finance*" by Dahbi, Carrasco Monteagudo, Petracci, which undertakes a systematic literature review and a bibliometric analysis of sustainable finance instruments. The authors thoroughly examined 303 articles from 119 journals in the Web of Science database, published between 2007 and 2022. Their review offers an up-to-date overview of the sustainable finance literature's current progression across academic categories and journals. The research aims to determine the primary research stream and evolutionary nuances while also including studies that provide empirical evidence on the impact of the COVID-19 pandemic on the green and social impact financial market. The results indicate that sustainable finance-related research was not detected until 2013. Of the 303 articles, 241 focus on green bonds, demonstrating the scholars' interest in this innovative financial tool. However, only one article covers sustainable bonds.

Chapter 6, "*Exploring the Shades of Green Premium: A Matching Approach*" by Mariani, Caragnano, D'Ercole, Brandonisio, and Frascati observes that since the climate change debate gains momentum, and investors are increasingly interested in a company's environmental commitment. The green bond market has grown significantly recently, from 1 billion in 2013 to half a trillion dollars in 2021. In the chapter, the authors aim at evaluating the persistence of a green premium in a market downturn caused by the pandemic by comparing conventional and green bonds using a nearest-neighbour matching approach. Additionally, this chapter examines how different labels and certifications of environmental commitment on green bond issuances can reduce information asymmetries and affect investor yield. Various brands, such as self-declarations, ESG disclosure, external guarantees, and self-documented greenness, are analysed to determine their impact on market perception.

Sustainable finance and EU policy are discussed in Chapter 7, titled "*Sustainable Finance for maritime development. A critical analysis of green bonds in the National Recovery and Resilience Plan*". Arnone and Crovella explore the role of new forms of finance in EU policies and Italy's National Plan for Recovery and Resilience (PNRR). The main focus of the research is to examine the impact of financial instruments, such as green bonds, on the shipping industry, as envisaged by the EU Next Generation. The study specifically looks at implementing the Cold Ironing Project, an innovative PNNR measure within the EU Next Generation, and its effects on the maritime sector. Cold Ironing provides sustainable power for ships while they are docked in ports to provide electricity, lighting, cooling, heating, and other auxiliaries. The study highlights the importance of reducing emissions in harbours, due to their proximity to human settlements.

The third part of the book (Chapters 8 and 9) is devoted to Governance and the Role of Women.

Chapter 8, "*Are women the panacea? Exploring the Direction of Socially Responsible Commitment*" by Caragnano, Zito, Brandonisio, D'Ercole, Frascati, focuses on the fact that firms play a crucial role and should implement environmentally oriented practices against climate change-related risks pursuing the transition towards renewable energy adoption. By empirically analysing a sample of highly capitalised European firms, constituents of the Bloomberg 500 Index, this chapter aims to deepen analysis of the benefits of renewable energy use connected to including women in management structures. In particular, the research focuses on

the partial brake represented by a positive perception concerning each firm's exposure to climate change. In this sense, this chapter contributes to the literature by underlining the need for a substantial commitment required for environmental engagement, which must not be limited to apparent practices and mere compliance.

Chapter 9, titled "*Social Sustainability in Equity Crowdfunding: Exploring the Influence of Women on Platform Boards*" authored by Bussoli, El Assal, Fattobene, Graziano, aims at investigating how the presence of female members or female CEOs on the board of directors of equity crowdfunding platforms (ECPs) affects the success of campaigns and the launch of innovative campaigns on the platforms. Analysing all the Italian platforms' campaigns launched, the study reveals a negative impact of the female presence on ECP boards on both campaigns' success and innovation. Interestingly, female CEOs on ECP boards are associated with a higher presence of innovative campaigns. The results shed light on the general mistrust of creators and investors towards female-led ECPs and offer valuable insights for scholars, entrepreneurs, managers, and policymakers.

References

Bolibok, P. (2021). The impact of social responsibility performance on the value relevance of financial data in the banking sector: Evidence from Poland. *Sustainability, 13*(21), 12006. https://doi.org/10.3390/su132112006

Boyle, M. (2022). The debt relief notice: Its effectiveness in improving the financial well-being of over-indebted individuals and its impact on social mobility. *Social Policy and Society, 1–17*. https://doi.org/10.1017/s1474746422000032x

Chang, H. Y., Liang, L. W., & Liu, Y. L. (2021). Using Environmental, Social, Governance (ESG) and financial indicators to measure bank cost efficiency in Asia. *Sustainability, 13*(20), 11139. https://doi.org/10.3390/su132011139

Citterio, A., & King, T. (2023). The role of Environmental, Social, and Governance (ESG) in predicting bank financial distress. *Finance Research Letters, 51*, 103411. https://doi.org/10.1016/j.frl.2022.103411

Doumpos, M., Gaganis, C., & Pasiouras, F. (2016). Bank diversification and overall financial strength: International evidence. *Financial Markets, Institutions & Instruments, 25*(3), 169–213. https://doi.org/10.1111/fmii.12069

Kovalenko, V., Sergeeva, E., & Ivanova, T. (2022). Corporate social responsibility in ensuring an effective management systems of banks "stakeholders"

relationships. *Financial and Credit Systems: Prospects for Development*, (1), 70–81. https://doi.org/10.26565/2786-4995-2022-1-07

Lodh, S., & Nandy, M. (2017). Gender inequality and disabled inclusivity in accounting higher education and the accounting profession during financial crises. *Industry and Higher Education, 31*(5), 335–347. https://doi.org/10.1177/0950422217725227

Nobanee, H., & Ellili, N. (2016). Corporate sustainability disclosure in annual reports: Evidence from UAE banks: Islamic versus conventional. *Renewable and Sustainable Energy Reviews, 55*, 1336–1341. https://doi.org/10.1016/j.rser.2015.07.084

Parker, S. (2002). Measuring impact and outcomes. *Performance Measurement and Metrics*, 3(3). https://doi.org/10.1108/pmm.2002.27903caa.001

Schinckus, C. (2017). Financial innovation as a potential force for a positive social change: The challenging future of social impact bonds. *Research in International Business and Finance, 39*, 727–736. https://doi.org/10.1016/j.ribaf.2015.11.004

Shakil, M. H. (2021). Environmental, social and governance performance and financial risk: Moderating role of ESG controversies and board gender diversity. *Resources Policy, 72*, 102144. https://doi.org/10.1016/j.resourpol.2021.102144

Tardos, K., & Paksi, V. (2018). Diversity management and gender equality outcomes in research, development and innovation organisations: Lessons for practitioners. *Szociológiai Szemle*, 28(4), 166–190. https://doi.org/10.51624/szocszemle.2018.4.8

PART I

Debating ESG Financial Topics

CHAPTER 2

Sustainability Literature Orientation: Evidence from Finance Academic Research

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1 Introduction

Sustainability is an issue of interest that shifted from being a concern discussed abstractly to being deeply rooted in our day-to-day life. Paris Agreement, signed in 2015 by 195 countries, was a concrete step

JEL Classification: G00; C45; Q51; Q56.

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toward a greater commitment to sustainability. Consequently, sustainability is present in different aspects of individuals' lives including, if not mainly, the business aspect. In fact, financial institutions are playing a crucial role in addressing their funds and future investments taking into consideration their compliance with environmental, social, and governance (ESG) attributes. Furthermore, policymakers are building more strict legal frameworks to decrease greenhouse gas emissions, and water consumption and increase the implementation of renewable energy. By establishing regulations and laws, the corporate management and financial investment landscape is changing noticeably in the last decades. ESG compliance exposes the standards and the responsibilities of businesses to match the ESG criteria, which is later communicated through non-financial reporting. There is a mounting exigency to comply with vigorous ESG frameworks and investors are increasingly pressing businesses to disclose and report their ESG management, hence encouraging a standardized, globally recognized ESG reporting framework.

Focusing on ESG activities, the latter can be defined as the set of managerial decisions and actions that involve ESG aspects in the business planning, implementation, and assessment phases. It is of great importance for businesses to be efficient, effective, and financially profitable that's why efforts are dedicated to building an equilibrium or a balance between ESG performance and financial performance. However, practitioners are still facing challenges in complying with ESG criteria, maintaining the balance, disclosing their activity to the public, and measuring their impact.

With the increasing importance of ESG criteria in the financial environment, the latter gained traction also among academic researchers. This importance can be seen through the increasing number of publications and the diversity of the research papers in terms of data, methodologies, scope, and purpose. Sustainability is an interdisciplinary research field encompassing studies in environmental, social, economic, managerial, and financial areas, which makes cruising prior works a daunting task. The

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evolution in quality and quantity of academic production results in some challenges in determining the dominant debates and the major issues to be further discussed and developed. In this chapter, we aim at drawing a research map to guide readers by applying a novel methodology: topic modeling (TM). The findings of this research indicate that the scale and complexity of this diverse corpus of research can be structured into 35 topics that can be arranged into 9 coherent macro-topics. They are useful to better navigate the literature and disentangle the broadness of the matter. We also track the evolution of the debate in the literature through the illustrated trends of the identified topics. The analysis suggests that new and growing pattern of research are gaining popularity and are expected to become more widespread in the near future such as ESG and green finance. On the other hand, topics related to socially responsible investment (SRI) are exhibiting a diminishing interest from scholars and the declining trend may continue for the next years.

For this purpose, we propose to answer the following research questions: (i) What are the main topics of ESG/sustainable finance debated in academic literature? (ii) How did these topics evolve over time? (iii) What are the main challenges likely to become more prevalent in shaping the future debates in the literature?

2 Literature Review

The increasing weight and attention given to sustainable practices by governments, investors, and stakeholders called the scientific community for broader and deeper investigations. It is important to highlight the fact that sustainability is the umbrella under which many other terms can fall. In fact, with the evolution of the issue, different terminologies are adopted in different contexts referring to the same area of research. Depending on the year of publication, the regulations established, and even the geographical area, one can find the following terms used interchangeably: Sustainability, Corporate Social Responsibility (CSR), Impact investment/finance, Sustainable finance, Green finance, and Environment Social Governance (ESG). These terminologies converge in the financial context in terms of their core meaning and implications. In other words, they refer to the managerial strategies, operational processes, and financial decisions that impact directly or indirectly the communities' welfare. The integration of social, environmental, and governance aspects in the

financial context has an undeniable impact on the common present and future welfare.

The global interest in sustainability and the continuously changing market dynamics called for deeper scientific research using novel methodologies and approaches to the matter. Examining the literature in finance research, one can find a wide range of articles debating different topics related to ESG (Darnall et al., 2022; Di Tommaso & Thornton, 2020; Friede et al., 2015), CSR (Broadstock et al., 2020; Cho et al., 2015; Jo & Na, 2012), and green finance (Flammer, 2021; Huang et al., 2022; Lee & Lee, 2022). The themes related to this field of research diverge from conceptual, theoretical studies, and practical managerial investigations to quantitative studies that seek to evaluate connections and impacts of sustainability and corporate activities.

In fact, examining the literature in financial studies, numerous papers analyzed the interaction between ESG and financial performance (Azmi et al., 2021; Friede et al., 2015; Hubbard, 2009; Revelli & Viviani, 2015). The debate about the nature of the ESG effect on financial performance is however not yet conclusive. In the same context, some scholars used the term CSR instead of ESG when assessing its impact on corporate financial performance (McWilliams & Siegel, 2000; Orlitzky et al., 2003; Waddock & Graves, 1997). Other studies were market-oriented, in the sense that ESG was studied in terms of its impact on investors' behavior and market reaction (Grewal et al., 2019; Wang et al., 2022). Another stream of research focuses on the methodologies and instruments used to evaluate and assess the environmental and social impacts of businesses on their local and extended environment (Choda & Teladia, 2018; Maas & Liket, 2011).

Topics are multiple and still, and the debates are not conclusive for a standardized impact measurement tool, evaluation framework, or even disclosure content which raises the question about the recent developments in academic research.

One could claim that bibliometric literature reviews can guide interested parties to understand the body of knowledge in the field. However, applying new methodologies such as TM can be beneficial not only to researchers but also to policymakers, and practitioners to identify the major themes, the content, and the most influential papers in the field.

3 Methodology

We apply a machine-learning technique: topic modeling, recently developed by Blei et al. (2003) aiming at detecting and identifying the latent topics in a corpus of documents. Topic modeling is a text-mining tool that uncovers hidden topics in a set of textual documents. In this context, latent topics are not explicitly known a priori and should be inferred based on the word clusters in a particular document and the way the latter are shared across the corpus. In fact, TM extracts patterns of words (aka word clusters) that frequently appear together in a textual document. The number of topics and the clusters of words (content) that successfully describe the corpus are not assessable in advance, but they are rather deduced. The number of topics (aka K) is the result of a two-step process, and the first is completely automatic while the second requires human intervention. The core of the automated phase is based on the perplexity score, where the model is estimated through probabilistic modeling, then tested by comparing the output with the actual content of the corpus. In other words, the perplexity score describes how well the model captures the topics that illustrate the corpus of documents opting for a particular number of topics. It is a score that calculates the difference in model performance for each number of topics. The lower the perplexity, the better the model is at capturing the main topics in the corpus. However, the perplexity score is not sufficient in determining K, that's where human intervention becomes crucial. The resulting graph is usually of an "Elbow" shape, where the researcher is supposed to identify the optimal K that is given by the elbow of the plot. Sometimes even the elbow is not clearly plotted, that's where the trial–error method is applied by setting different Ks and assessing the quality of output relative to each number of topics. Then based on how well-defined, informative, and clear the topics are, for a particular K, the researcher opts for it as an "optimal" number of topics.

To apply topic modeling there are different approaches developed aiming at categorizing a set of documents based on their content such as explicit or latent semantic analysis (LSA), structured topic modeling (STM), latent Dirichlet allocation (LDA), etc. In this chapter, we opt for the LDA approach as it is virtually the most used in academic financial literature as far as this chapter has been written. It is based on two assumptions. The first is that each document is composed of a set of topics and the second is that each topic is composed of a cluster of words. Before

implementing topic modeling, preprocessing the data is crucial to guarantee good quality output. Preprocessing entails the preparation of the corpus in terms of content and format.

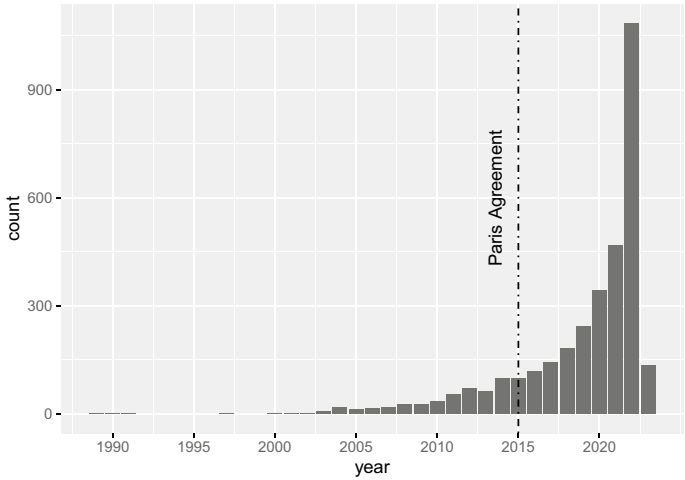
3.1 Sample Selection

For the purpose of this study, we select prior academic papers that are published in scientific journals from Scopus Elsevier. First, we set the list of search keywords that include terms potentially linked to sustainability in finance. We identified the list according to the objective description of the present book[1]: "ESG", "socially responsible investment", "sustainable finance", "impact investment", "green finance", and "impact finance". The output of this search is around 10,000 publications, where there are articles from different fields of research, subject areas, and languages. To eliminate the intruder articles, we used advanced search features available on Scopus Elsevier, where it is possible to limit the subject areas to the ones linked to finance and economics literature. Thus, we restricted the search to "Economics, Econometrics and Finance" and "Business management and accounting" subjects where publications are in English. We found 3,397 articles published between 1989 and 2023. After the download, and the omission of articles lacking the abstract, we ended up with 3,271 articles.

Graph 1 illustrates the distribution of the publications selected over time. The number of articles discussing sustainability-related topics in finance is increasing dramatically, displaying an exponential trend. This can be explained by the growing importance of the topic, the attention it has attracted in the last decade, the variety of the terms used to select the sample, and the increasing number of scientific publications in finance. It seems to be important to highlight the effect of the Paris Agreement (2015) on the academic interest in sustainability issues which can be seen through the mounting number of academic publications successively.

Table 1 shows the top 15 journals in terms of publications within the sample selected. The journal with the highest number of publications is the *Journal of Sustainable Finance and Investment* with 163 articles. From their titles, the majority of the journals have a tight link to sustainability issues translated by a sustainability-related vocabulary such

[1] https://link.springer.com/series/14621.



Graph 1 The Evolution of the number of publications over time

as Ethics, Cleaner, Environment, CSR, etc. It is important to shed the light on the fact that the increasing number of publications could be related as well to the date on which many of these journals started their publishing activity, that is from the beginning of the 2000s.

3.2 Data Preprocessing

Before applying the TM, we have to prepare the dataset in terms of content and format. The preprocessing of the corpus for TM is a standardized pipeline including (i) deleting symbols, characters, numbers, and punctuation, (ii) removing stop words, (iii) tokenizing the text, and (iv) lemmatizing.

Since TM considers the corpus as a bag of words where the order of the words is not significant, we eliminate special characters, symbols, numbers, and punctuation and the number of words is 15,725. Then we eliminate the stopwords defined as the most common words in a language such as articles, pronouns, and similar. Then, we omit other

Table 1 Top 15 journals in terms of publication number

Ranking	*Journal title*	*Number of publications*	*Starting year Scopus coverage*
1	Journal of Sustainable Finance and Investment	163	2011
2	Journal of Business Ethics	130	1982
3	Journal of Cleaner Production	102	1993
4	Business Strategy and the Environment	89	1992
5	Corporate Social Responsibility and Environmental Management	81	2003
6	Finance Research Letters	72	2004
7	CSR, Sustainability, Ethics and Governance	46	2013
8	Journal of Portfolio Management	42	1995
9	Resources Policy	41	1974
10	Sustainability Accounting, Management and Policy Journal	32	2010
11	Energy Economics	31	1979
12	International Review of Financial Analysis	30	1992
13	Social Responsibility Journal	27	2005
14	Global Finance Journal	25	1989
15	Journal of Asset Management	25	2009
16	Research in International Business and Finance	24	
17	Economic Research-Ekonomska Istrazivanja	23	
18	Borsa Istanbul Review	22	
19	Critical Studies on Corporate Responsibility, Governance and Sustainability	22	
20	Journal of Banking and Finance	21	
21	Springer Proceedings in Business and Economics	21	
22	Managerial Finance	20	

Ranking	*Journal title*	*Number of publications*	*Starting year Scopus coverage*
23	Corporate Governance (Bingley)	17	
24	Journal of Corporate Finance	17	
25	Technological Forecasting and Social Change	17	
26	Corporate Governance: An International Review	16	
27	Principles and Practice of Impact Investing: A Catalytic Revolution	16	
28	Economic Analysis and Policy	15	
29	Economic Modelling	15	
30	Environment, Development and Sustainability	15	
31	Global Business Review	15	
32	Journal of Business Research	15	
33	Journal of Risk and Financial Management	15	
34	Meditari Accountancy Research	15	
35	Review of Accounting Studies	15	
36	Australasian Accounting, Business and Finance Journal	14	
37	Ecological Economics	14	
38	Economics, Law, and Institutions in Asia Pacific	14	
39	Accounting and Finance	13	
40	Business and Society	13	
41	Journal of Applied Accounting Research	12	
42	Journal of Investing	12	
43	Management Decision	12	
44	Applied Economics Letters	11	
45	Cogent Business and Management	11	
46	De Gruyter Handbook of Sustainable Development and Finance	11	

(continued)

Table 1 (continued)

Ranking	*Journal title*	*Number of publications*	*Starting year Scopus coverage*
47	Financial Analysts Journal	11	
48	International Journal of Energy Economics and Policy	11	
49	International Review of Economics and Finance	11	
50	Investment Management and Financial Innovations	11	
51	Journal of Financial Economics	11	
52	Journal of Global Responsibility	11	
53	Journal of Risk Management in Financial Institutions	11	
54	Journal of Wealth Management	11	
55	Pacific Basin Finance Journal	11	
56	Applied Economics	10	
57	Business Ethics	10	
58	European Business Organization Law Review	10	
59	Problems and Perspectives in Management	10	
60	Qualitative Research in Financial Markets	10	
61	Contributions to Management Science	9	
62	Emerging Markets Finance and Trade	9	
63	Financial Markets, Institutions and Instruments	9	
64	Frontiers in Energy Research	9	
65	International Journal of Finance and Economics	9	
66	Journal of Business Economics and Management	9	
67	Journal of International Financial Markets, Institutions and Money	9	
68	Journal of Risk Finance	9	
69	Managerial and Decision Economics	9	
70	North American Journal of Economics and Finance	9	

Ranking	*Journal title*	*Number of publications*	*Starting year Scopus coverage*
71	Socially Responsible Finance and Investing: Financial Institutions, Corporations, Investors, and Activists	9	
72	China Finance Review International	8	
73	Emerald Emerging Markets Case Studies	8	
74	European Journal of Finance	8	
75	International Journal of Managerial Finance	8	
76	Issues in Business Ethics	8	
77	Modern China: Financial Cooperation for Solving Sustainability Challenges	8	
78	Risks	8	
79	Sustainable Investing: A Path to a New Horizon	8	
80	Accounting, Auditing and Accountability Journal	7	
81	British Accounting Review	7	
82	Economic Change and Restructuring	7	
83	Estudios de Economia Aplicada	7	
84	International Journal of Disclosure and Governance	7	
85	International Journal of Financial Studies	7	
86	Journal of Financial Reporting and Accounting	7	
87	Journal of Property Investment and Finance	7	
88	Journal of Social Entrepreneurship	7	
89	Organization and Environment	7	
90	Academy of Accounting and Financial Studies Journal	6	
91	Accounting, Finance, Sustainability, Governance and Fraud	6	
92	ACRN Journal of Finance and Risk Perspectives	6	
93	Business Ethics, Environment and Responsibility	6	
94	Corporate Ownership and Control	6	

(continued)

Table 1 (continued)

Ranking	*Journal title*	*Number of publications*	*Starting year Scopus coverage*
95	Emerging Markets Review	6	
96	Eurasian Studies in Business and Economics	6	
97	European Financial Management	6	
98	Global Policy	6	
99	International Journal of Financial Research	6	
100	Journal of Behavioral and Experimental Finance	6	
101	Journal of the Operational Research Society	6	
102	Management Science	6	
103	Palgrave Studies in Sustainable Business in Association with Future Earth	6	
104	Public Money and Management	6	
105	Quarterly Review of Economics and Finance	6	
106	Research in the Sociology of Organizations	6	
107	Review of Managerial Science	6	
108	Revista Espanola de Financiacion y Contabilidad	6	
109	South African Journal of Economic and Management Sciences	6	
110	Sustainable Innovation and Impact	6	
111	The Business Case for Sustainable Finance	6	
112	Accounting Research Journal	5	
113	American Business Law Journal	5	
114	Amfiteatru Economic	5	
115	Asia–Pacific Financial Markets	5	
116	Asian Economic and Financial Review	5	
117	Banks and Bank Systems	5	
118	Business Horizons	5	

Ranking	*Journal title*	*Number of publications*	*Starting year Scopus coverage*
119	Business Strategy and Development	5	
120	California Management Review	5	
121	Economics Letters	5	
122	European Accounting Review	5	
123	European Journal of Social Security	5	
124	International Environmental Agreements: Politics, Law and Economics	5	
125	International Journal of Bank Marketing	5	
126	International Journal of Emerging Markets	5	
127	International Journal of Productivity and Performance Management	5	
128	International Journal of Sustainable Economy	5	
129	Journal of Accounting in Emerging Economies	5	
130	Journal of Business Economics	5	
131	Journal of Economic Behavior and Organization	5	
132	Journal of International Financial Management and Accounting	5	
133	Proceedings of the International Conference on Industrial Engineering and Operations Management	5	
134	Public Finance Quarterly	5	
135	Review of Financial Studies	5	

words that do not seem to be informative or sufficiently discriminative.[2] These words' selection represents one of the main human contributions to the methodology. They are verbs, adverbs, and adjectives frequently used in scientific abstracts such as "study", "significantly", and "investigated" and appearing in more than 50 abstracts. On the other hand, we remove words that appear in less than 5 documents, likely to distort the TM by including words rather irrelevant to the study and we end up with a bag of 6,766 words.

The lemmatization phase entails reducing words to their lemma, i.e., finance, finances, financed, financing is reduced to finance. As a result, the number of words on which the TM is applied is 2,981 lemma.

For the purpose of exploring the nature of the abstracts' content, it can be insightful to build a word cloud of the most frequent lemma in the corpus subject to analysis. A word cloud is a graphical representation of the most frequently used or significant words in a corpus of data. The size of each word reflects its frequency or significance. The words' layout is random but often creates a recognizable shape. Word clouds are used in text analysis, data visualization, and web design. Building the word cloud relative to the entire sample, results in the shape illustrated in Graph 2. The largest words in the word cloud are sustainability, environment, social, investment, ESG, and finance, words used

[2] "addition" "additional", "additionally", "address", "affect", "ahead", "aim", "align", "analyse", "analysis", "analyze", "annual", "appear", "answer", "apply", "approach", "argue", "article", "assess", "author", "average", "billion", "bring", "capture", "carry", "chapter", "collect", "conclude", "conclusion", "confirm", "consider", "consideration", "consist", "context", "create", "contribute", "contribution", "copyright", "decade", "database", "dataset", "date", "datum", "demonstrate", "define", "describe", "determine", "design", methodology", "approach", "direct", "directly", "discuss", "due", "emerge", "emphasize", "establish", "estimate", "estimation", "evaluate", "evaluation", "examine", "exist", "explore", "explain", "extent", "extend", "evidence", "field", "finally", "find", "finding", "focus", "gap", "journal", "hand", "help", "identify", "illustrate", "implement", "importance", "improve", "improvement", "include", "increase", "increasingly", "insight", "intend", "investigate", "investigation", "key", "large", "limitation", "limitations", implications", "list", "main", "major", "manner", "mean", "measure", "measurement", "medium", "method", "methodology", "motivate", "motivation", "moderate", "negative", "observe", "obtain", "ongoing", "originality", "paper", "period", "play", "positive", "positively", "provide", "purpose", "question", "range", "recent", "recently", "recognize", "reflect", "relate", "relative", "relevance", "relevant", "represent", "research", "researcher", "result", "reveal", "right", "robust", "robustness", "run", "sample", "set", "shed", "show", "significant", "significantly", "similar", "specifically", "strong", "strongly", "study", "suggest", "take", "understand", "weak", "weakly", "wide", "widely".

for the sample search and selection which explains the reason why they are the absolute frequent words in the corpus. Surprisingly, the governance dimension of ESG, unlike environmental and social, seems to be less significant and debated by scholars. One of the important themes linked to sustainability in finance is about the impact of ESG integration in corporate[3] management on risk exposure, and financial performance. The rest of the lemma included are either words used interchangeably with ESG such as CSR, SRI, green, etc., or terms associated with issues such as disclosure practices and information transparency (disclosure, report, information, policy, integrate), portfolio choice (portfolio, equity, bond, stock, price), impact measurement (score, indicator, index), and the general public commitment (public, government, institutional, global, economy, development).

Graph 2 Word cloud of the 50 most frequent words in the corpus

[3] The corporate management in this context involves also firm, fund, company as they are frequent lemma according to the word cloud.

3.3 Number of Topics k

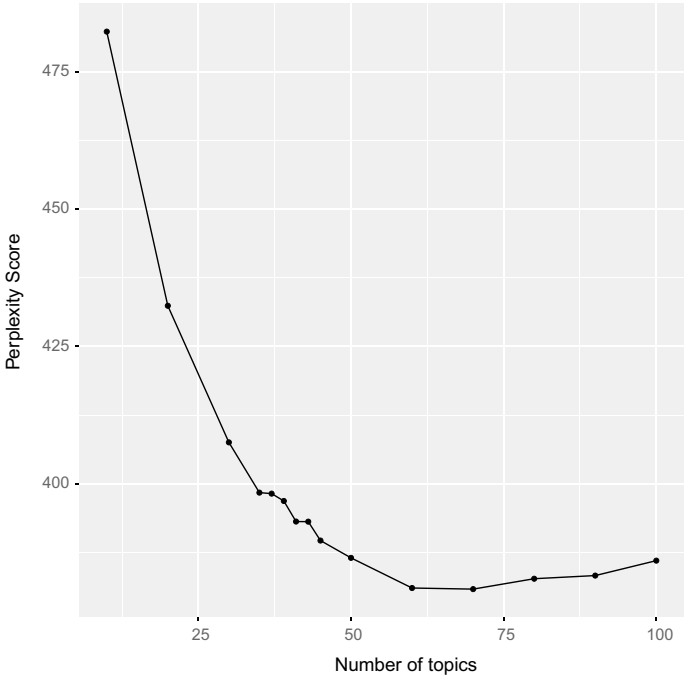
One of the challenges that encounter researchers when applying TM is determining the number of topics K to be extracted a priori. We use both the perplexity score to guide the choice of K and the trial–error method to gain more precision.

The plot reported in Graph 3 illustrates the perplexity score calculated for k ∈ {10,70}. The "Elbow" area lays in the interval {30,45}. We then, apply TM for K = 35, 39, 45. Comparing the output of each model for each K, we evaluate the quality of extracted topics in terms of clarity. We notice that when k = 45, 4 topics are too vague and hard to interpret. In fact, they include a set of words that are not coherent and challenging to make sense of them. The same remark can be reported for the output of the model when k is set to 39. Thus, we consider the output for k = 35 to be the clearest in terms of topic interpretability and intelligibility.

4 Results and Discussion

Table 2 shows the results obtained after performing TM setting K equal to 35. Each row includes the cluster of words referring to each topic from 1 to 35. Labeling each topic is a daunting task, especially when only based on the cluster of words. To guide our choice for each topic label, we performed a concordances analysis, in which we retrieved the most representative abstracts for each extracted topic and identified its main idea. Guided by the clusters of words and their respective abstracts we assign the label that we consider the most accurate. To be able to analyze the content of the topics, it seems necessary to group them in a way that facilitates the discussion of the results.

We set a taxonomy at the topic level according to the pertinence of the extracted terms to a particular semantic field. A semantic field in linguistics refers to a set of words and expressions that are semantically related and that belong to a particular theme or subject area. Semantic fields are generally characterized by a shared meaning or idea across a group of words. The common meaning helps to organize underlying concepts in order to build a deeper understanding of the studied issue. Thus, we used the semantic field of each group of topics to establish the corresponding macro-topic.



Graph 3 Plot of the perplexity score

4.1 Topics' Discussion

All reported topics are meant to be discussed in the framework of sustainability and ESG pillars as they are extracted from a corpus of textual documents treating these research fields. In other terms, some of the extracted themes are clusters in which the direct reference to the general search framework is missing. This can be explained by the fact that TM groups the highest co-occurring words in terms of frequency, where the ESG or/and sustainability-related terms are included in other particular clusters with a higher co-occurrence frequency.

Graph 4 illustrates the 9 macro-topics under which we categorize the extracted 35 topics. The established sequence of the 9 macro-topics will serve as a roadmap for organizing the content of the discussion.

[Macro-topic 1 and 2] ESG pillars have attracted growing attention in the last decades, not only from investors and policymakers but also from

Table 2 Extracted topics and word clusters

Macro-topic	*Topic*	*1*	*2*	*3*	*4*	*5*
ESG	**Gender diversity and corporate governance**	board	governance	corporate	diversity	gender
	ESG management	environment	social	governance	dimension	component
CSR	**Corporate social responsibility management**	corporate	csr	social	responsibility	activity
	CSP and CFP relationship	performance	relationship	variable	regression	score
	CSR theroretical background	institutional	stakeholder	shareholder	engagement	theory
Research methods	**Quantitative models**	model	factor	base	decision	indicator
	Statistical methods	effect	level	region	structure	impact
	Academic research	literature	review	future	academic	topic
	Theory and practice	practice	framework	implication	draw	theory
Regulation	**Sustainable development goals**	sustainable	goal	development	sdg	achieve
	Integrated reporting and transparency	report	disclosure	information	quality	transparency
	EU regulatory framework	policy	european	regulation	standard	global
SRI	**SRI funds**	fund	investment	manager	mutual	pension
	SRI and behaviour	investor	behavior	decision	individual	investment
	SRI	sri	responsible	social	investment	ethic
	Impact investing and social entrepreneuership	impact	social	investment	enterprise	venture
	Educational programs	business	lead	society	learn	challenge

Macro-topic	*Topic*	*1*	*2*	*3*	*4*	*5*
Financial markets	**ESG and cost of capital problem**	capital	cost	term	debt	equity
	Portfolio choice	return	portfolio	stock	investor	performance
	Market reactions	market	price	stock	event	time
	Stock markets in crisis times	index	stock	covid	market	volatility
Green finance	**Green bond pricing and rating**	bond	rate	rating	credit	low
	Sustainable real estate	investment	strategy	asset	real	manager
	Green banking and Islamic finance	bank	sector	product	islamic	role
	Green finance innovation for sustainable development	green	finance	development	innovation	china
Environment and economics	**Economic development and natural resources**	country	economic	development	growth	resource
	Climate change risk	risk	climate	change	reduce	management
	Sustainable supply chain	issue	industry	supply	challenge	integrate
	Sustainable production processes	management	system	water	process	network
	Renewable energy and carbon emission reduction	energy	carbon	emission	efficiency	policy
Residuals	**Public private partnership**	public	private	project	sector	government
	Effect on industrial performance	firm	effect	performance	impact	low
	ESG in other financial issues	financial	institution	finance	compete	lead

(continued)

Table 2 (continued)

Macro-topic	*Topic*	*6*	*7*	*8*	*9*	*10*
ESG	**Gender diversity and corporate governance**	director	ceo	woman	employee	influence
	ESG management	view	concern	aspect	balance	tourism
CSR	**Corporate social responsibility management**	stakeholder	reputation	brand	relation	management
	CSP and CFP relationship	empirical	impact	panel	test	csp
	CSR theroretical background	influence	manager	legitimacy	support	power
Research methods	**Quantitative models**	propose	criterion	process	incorporate	account
	Statistical methods	test	empirical	industrial	base	influence
	Academic research	current	attention	trend	perspective	debate
	Theory and practice	perspective	process	concept	outcome	value
Regulation	**Sustainable development goals**	term	concept	unite	agendum	objective
	Integrated reporting and transparency	integrate	ir	assurance	audit	voluntary
	EU regulatory framework	international	framework	requirement	principle	legal
SRI	**SRI funds**	conventional	screen	responsible	flow	criterion
	SRI and behaviour	preference	choice	survey	sr	influence
	SRI	invest	conventional	difference	islamic	sukuk
	Impact investing and social entrepreneuership	return	foundation	profit	microfinance	generate
	Educational programs	education	world	organization	societal	program
Financial markets	**ESG and cost of capital problem**	deal	activity	target	benefit	culture
	Portfolio choice	low	equity	asset	factor	screen
	Market reactions	trade	valuation	international	empirical	liquidity
	Stock markets in crisis times	crisis	pandemic	compare	uncertainty	conventional

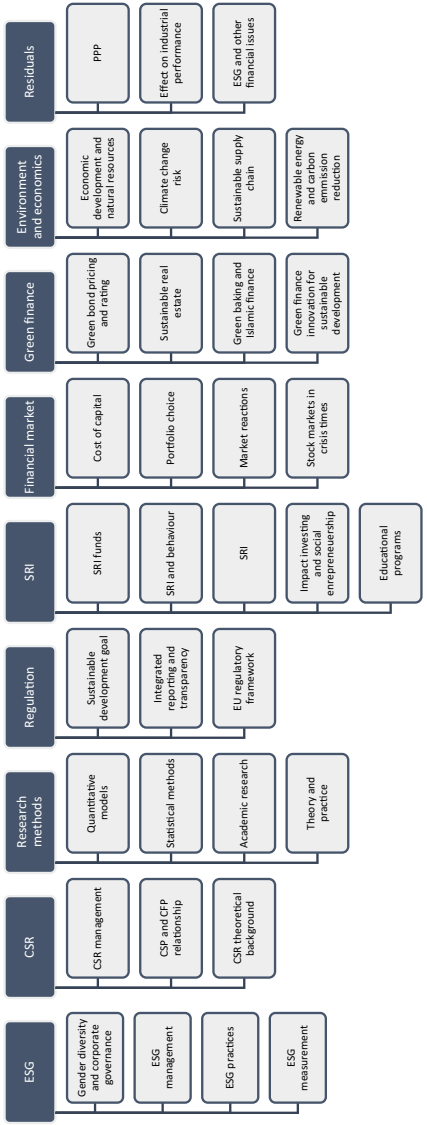
Macro-topic	*Topic*	*6*	*7*	*8*	*9*	*10*
Green finance	**Green bond pricing and rating**	agency	factor	issue	grow	issuance
	Sustainable real estate	class	benefit	traditional	decision	option
	Green banking and Islamic finance	industry	service	support	environment	customer
	Green finance innovation for sustainable development	policy	promote	technology	mechanism	digital
Environment and economics	**Economic development and natural resources**	world	natural	global	nation	rise
	Climate change risk	mitigate	exposure	systematic	global	agreement
	Sustainable supply chain	chain	opportunity	demand	south	global
	Sustainable production processes	implementation	plan	service	human	resource
	Renewable energy and carbon emission reduction	renewable	environment	consumption	reduce	production
Residuals	**Public private partnership**	development	role	infrastructure	instrument	support
	Effect on industrial performance	association	enhance	consistent	size	pronounce
	ESG in other financial issues	crisis	global	influence	relationship	base

(continued)

Table 2 (continued)

Macro-topic	*Topic*	*11*	*12*	*13*	*14*	*15*
ESG	**Gender diversity and corporate governance**	ownership	role	characteristic	compensation	relationship
	ESG management	stakeholder	role	business	sensitive	issue
CSR	**Corporate social responsibility management**	link	concern	assumption	term	business
	CSP and CFP relationship	cfp	hypothesis	control	observation	indicator
	CSR theroretical background	action	issue	organizational	pressure	target
Research methods	**Quantitative models**	objective	construct	select	category	develop
	Statistical methods	attention	model	panel	central	promote
	Academic research	definition	knowledge	direction	practitioner	offer
	Theory and practice	actor	organisation	propose	qualitative	account
Regulation	**Sustainable development goals**	achievement	role	critical	metric	nation
	Integrated reporting and transparency	earnings	standard	disclose	stakeholder	level
	EU regulatory framework	guideline	law	unite	national	initiative
SRI	**SRI funds**	time	money	wealth	hold	active
	SRI and behaviour	perceive	attitude	perception	retail	consumer
	SRI	australia	mainstream	movement	objective	gain
	Impact investing and social entrepreneuership	entrepreneurship	organization	base	goal	achieve
	Educational programs	book	change	strategy	subject	student
Financial markets	**ESG and cost of capital problem**	society	transaction	reduce	structure	leverage
	Portfolio choice	riskadjusted	ratio	outperform	alpha	expect
	Market reactions	news	share	term	reaction	participant
	Stock markets in crisis times	model	dynamic	hedge	time	spillover

Macro-topic	*Topic*	*11*	*12*	*13*	*14*	*15*
Green finance	**Green bond pricing and rating**	lead	premium	spread	default	relation
	Sustainable real estate	term	property	potential	offer	estate
	Green banking and Islamic finance	practice	base	stage	adopt	lend
	Green finance innovation for sustainable development	enterprise	economic	government	transition	fintech
Environment and economics	**Economic development and natural resources**	source	role	asian	russian	current
	Climate change risk	potential	transition	policy	lowcarbon	paris
	Sustainable supply chain	africa	integration	develop	material	mine
	Sustainable production processes	access	tool	technology	assessment	design
	Renewable energy and carbon emission reduction	pollution	model	clean	impact	gas
Residuals	**Public private partnership**	challenge	solution	tax	sib	policy
	Effect on industrial performance	literature	activity	control	cash	coverage
	ESG in other financial issues	role	link	condition	statement	entity



Graph 4 Macro topics and TM extracted topics

scholars who are seeking to deepen the understanding of the sustainability impact on the business as well as the social environment. TM highlights the main topics discussed in the literature that can be summarized into conceptual and functional debates.

The integration of ESG criteria in the financial environment generates conceptual challenges such as measuring the businesses' footprint on their surrounding social ecosystem. The ESG scores and ratings are basically calculated according to a set of standardized, though not always generally accepted, criteria and rules that aim at providing investors and stakeholders in general with more precise information on a company's ESG performance. The calculation of ESG scores typically involves the collection and analysis of quantitative and qualitative data about subject companies through corporate disclosures that describe their activities and commitment to ESG criteria (Lagasio & Cucari, 2019), rating agencies that may use publicly available information in addition to the disclosed information (Aiba et al., 2019) and experts' assessment that involves ESG analysts' reports and recommendations (Tamimi & Sebastianelli, 2017).

The literature analyzed in this study highlights important practical challenges management faces in implementing ESG practices into business (materiality). Relevant examples are provided by considering the extension of ESG commitment by all the parties involved in the supply chain. Furthermore, stakeholders may not have always aligned priorities and expectations. Hence, management is expected to communicate ESG initiatives and performance on the one hand and mediate with the stakeholders' feedback and concerns on the other hand. Aligning the stakeholders' expectations is not the only concern though. In fact, management is also expected to pair ESG criteria with the business strategy, investment value, and returns.

There is a wide literature on the association between ESG or CSR and corporate financial performance. The findings are not conclusive though. Some studies found a positive correlation between ESG/CSR commitment and positive financial performance which can be explained by the fact that ESG criteria became an important component in consumers' and investors' decision-making processes (Amel-Zadeh & Serafeim, 2018). Whereas other studies found a negative association between ESG engagement and financial performance which on the other hand could be explained by a higher risk exposure and consequential increase in the opportunity cost of capital.

[Regulation] As for the regulatory framework, scientific literature highlighted the impact of the policies established by the EU countries to promote and encourage ESG commitment by directing funds, addressing recommendations, and issuing incentivizing guidelines for ESG-committed businesses (Darnall et al., 2022). Furthermore, the European Securities and Markets Authority (ESMA) issued a roadmap to help investors better implement ESG criteria in decision-making and businesses to report and disclose their activities (Magli et al., 2017).

In fact, disclosure is another significant challenge facing not only businesses in the EU but also globally. The literature sheds the light on the lack of a standardized disclosure regulatory framework by which companies should disclose and communicate their ESG compliance in a rigorous but adaptable way where companies in different sectors and industries find a sufficient margin of maneuver to adjust and, at the same time, allowing investors and stakeholders to evaluate the effectiveness of their effort (Aureli et al., 2020). The voluntary aspect of integrative reports makes it difficult to unify the disclosure regulations or even enforce them, hence leaving too much room for narratives and impression management to influence and orient the sense of conveyed information.

[SRI] Socially responsible investments are those investments that seek to align both financial and non-financial goals. According to the papers analyzed in this study, the management of SRI funds involves several steps among which we find the screening phase (highlighted also by the cluster of words extracted by the TM) whereby managers need to set SRI selection criteria according to which some businesses and industries such as tobacco, alcohol, or weapon production and human rights violating companies are excluded (Oikonomou et al., 2018).

Within the cluster of topics, TM uncovers latent aspects with a significant interest to scholars, such as individual time preferences, risk perception, and specific investor attitudes toward the financial value of time in the frame of SRI decision-making (Sandberg et al., 2009).

In a holistic context involving sustainable financial systems, TM extracts basic, though significantly important topics in financial markets research. The cluster of words describing these themes shows the orthodoxy of scholars in treating sustainable and ESG-compliant asset classes and financial issues. It is important to put under focus terms such as cost of capital, transaction cost, capital structure, and information on the fundamental analysis side (Galema et al., 2008), and the effect of the

financial crisis, the pandemic, and financial culture on the systematic one (Broadstock et al., 2021).

[Green finance] Green finance is also a growing field of research following the typical approach of conventional bond markets which implies putting a great deal of attention on the risk profile, the default rate, and the degree of financial innovation but scholars seem also to be attracted by specific geographical areas (China) that raises several concerns. The connection between the financial innovation of this specific asset class and technology is also explored (Broadstock et al., 2020; Huang et al., 2022).

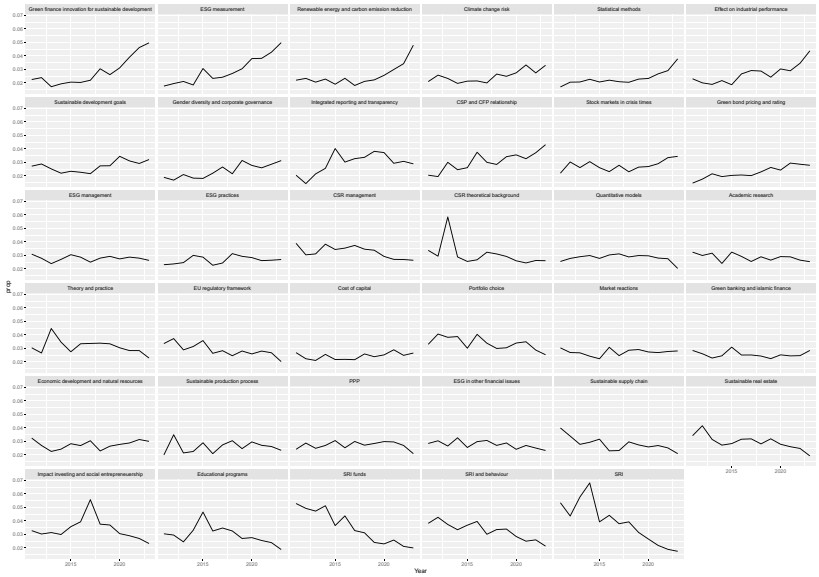
[Environment] The literature also shows a great interest in the theme of efficient use of natural resources and human capital in the context of sustainable economic development. Studies focused on the following features: production processes (Weber & Saunders-Hogberg, 2018) and supply chain (Wang & Sarkis, 2013), carbon emission reduction (Ren et al., 2020), and renewable energy (Li et al., 2021) as main inputs for long-term sustainable growth.

In conclusion, we find that the extracted topics through TM evidence a great variety of latent topics in the scientific debate, highlighting the richness of the stream of research and the growing interest shown by scholars worldwide. In general, findings in the literature are not conclusive for certain topics which can be explained by the emerging nature of the issue, sustainability, and the development of the research methodologies and data availability that bring to light new contributions to the body of literature.

4.2 Topics' Evolution

Topic evolution is also an insightful analysis that provides a deeper understanding of the level of attention each of the extracted topics has over time. Topic evolution helps also to identify topics with an emerging trend, topics that have a stagnant manifestation within the scientific literature in finance, and finally topics displaying a declining interest from scholars. In this section, we try to explore which topics have gained or lost interest over time, leaving to debate the potential factors that might explain these changes to those who may be interested (Graph 5).

There are mainly three topics exhibiting a well-defined increasing trend: "Green finance" starting from 2020, "ESG measurement" from



Graph 5 Extracted topics evolution over time

2015, and "Renewable energy and carbon emission reduction" around 2017.

On the other hand, there are three topics presenting a clear decreasing trend: "SRI funds", "SRI", and "SRI and behavior" starting from 2014.

Interestingly there are four topics that are worthy of particular attention as they exhibit peaks during a specific point in time. "Impact investing" in 2017, "ESG, and educational programs" around 2015, "Regulations" that present a peak in 2015 and then stable presence in the literature, and "Statistical methods" that show relative stability followed by an increasing trend in the last couple of years.

It is noteworthy to claim that in addition to the global initiatives, the geographic areas, policies, agreements, laws and regulations, investment strategies, and financial market dynamics, that significantly influence the orientation of academic research, the vocabulary used to analyze, discuss, and debate these topics is changing over time. In other words, the topic evolution may express not only the interest in some topics per se but also the terminology used during particular periods in the last twenty years.

Graph 6 Word cloud of the most frequent 50 words until 2010

This can be confirmed by Graphs 6, 7, 8 and 9 presenting the changes in the word clouds of our sample between 1989 and 2023, where some terms persist, other terms vanish or lose size (frequency), and other terms gain space in the graph thanks to their higher frequency in the corpus. Special consideration should be given to the word "SRI" that plays a major role in the literature until 2010 and, over time, displays a decline in the level of attention from scholars, confirming the previous analysis about the topics' evolution. On the other hand, the word clouds show new patterns of terms that are gaining popularity in academia such as ESG and environmental-related terms ("environment", "green", "climate", and "energy").

4.3 What's Next?

Analyzing and understanding the historical topics' evolution is valuable to track the latest developments and advancements in the field and identify trends and patterns that can provide beneficial insights into future challenges and research opportunities.

From a "topic life cycle" perspective, the increasing interest that have recently gained the topics related to ESG, green finance innovations, and energy efficiency suggests that they are placed in the early growth stage.

Graph 7 Word cloud of the most frequent 50 words between 2010 and 2015

Graph 8 Word cloud of the most frequent 50 words between 2015 and 2020

These topics are experiencing a significant increase in the interest from scholars and there are still opportunities for additional contributions and new ideas before maturing into a more established topic in the literature. Hence, the current debates are open to further development and there is potential for new questions to be explored, suggesting that they are expected to become more widespread in the future.

Graph 9 Word cloud of the most frequent 50 words between 2020 and 2023

On the contrary, the level of attention toward topics related to SRI present a downward pattern that put them in the decline stage of the "topic life cycle". They have already reached the peak of consideration by scholars in the past and it is challenging to identify opportunities where additional ideas or contributions can be added to the established literature on the specific field. It suggests that it will be difficult to find publications addressing new questions related to SRI and the declining trend may continue in the next period.

5 Conclusions

Sustainability has in recent years become a major concern in individuals' daily lives, and the Paris Agreement signed in 2015 by 195 countries marked the international commitment to addressing the issue, significantly affecting several aspects of economic activities. Furthermore, policymakers are committed to designing more effective legal frameworks to tackle greenhouse gas emissions, and water consumption, and incentivize the implementation of renewable energy. With the growing attention dedicated to ESG criteria in the financial environment, the latter gained traction also among academic researchers. This importance can

be seen through the increasing number of publications starting from the early 2000s and the diversity of the research papers.

Sustainability is a complex and extensive field of research that makes cruising the existing literature a daunting task. The evolution in quality and quantity of academic production results in some challenges in determining the dominant debates. In this chapter, we tried to draw a research map to guide readers by applying a novel methodology: topic modeling (TM). The findings of this research are useful to better navigate the literature. In fact, we extracted 35 major topics that summarize the scientific debate about sustainability and ESG. We then grouped these topics into nine macro-topics: "ESG", "CSR", "Research methods", "Regulation", "SRI", "Financial market", "Green finance", "Environment and economics", and "Others", that in our view, draw a comprehensive picture of the state of the debate.

Word clusters that describe some topics show the orthodoxy of scholars in treating sustainable and ESG-compliant asset classes and financial issues and researchers' tendency to remain on the rail of conventional approaches. At the same time, such a tendency shouldn't lead to an underestimation of the novelty and relevance of the matter. By contrast, it increases the thrust of the innovation wave.

The evolution of the topics seems to be significantly insightful for those who are seeking to identify trending topics and the most recent vocabulary adopted by researchers when discussing sustainability issues. In fact, many topics exhibiting a stagnant or decreasing trend use terms and keywords that are not used as extensively as the new terminology related to ESG, a fact that is confirmed by the evolution of the word clouds between 1989 and 2023.

References

Aiba, Y., Ito, T., & Ibe, Y. (2019). Network structure in ESG ratings suggests new corporate strategies: Evolving AI Technology to Quantify Qualitative Data 16.

Amel-Zadeh, A., & Serafeim, G. (2018). Why and how investors use ESG information: Evidence from a global survey. *Financial Analysts Journal*.

Aureli, S., Del Baldo, M., Lombardi, R., & Nappo, F. (2020). Nonfinancial reporting regulation and challenges in sustainability disclosure and corporate governance practices. *Business Strategy and the Environment*, *29*, 2392–2403. https://doi.org/10.1002/bse.2509

Azmi, W., Hassan, M. K., Houston, R., & Karim, M. S. (2021). ESG activities and banking performance: International evidence from emerging economies. *Journal of International Financial Markets, Institutions and Money*, *70*, 101277. https://doi.org/10.1016/j.intfin.2020.101277

Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent dirichlet allocation. *Journal of Machine Learning Research, 3*, 993–1022.

Broadstock, D. C., Chan, K., Cheng, L. T. W., & Wang, X. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance Research Letters*, *38*, 101716. https://doi.org/10.1016/j.frl.2020.101716

Broadstock, D. C., Matousek, R., Meyer, M., & Tzeremes, N. (2020).Does corporate social responsibility impact firms' innovation capacity? The indirect link between environmental ampamp; social governance implementation and innovation performance | Elsevier Enhanced Reader. https://doi.org/10.1016/j.jbusres.2019.07.014

Cho, C. H., Michelon, G., Patten, D. M., & Roberts, R. W. (2015). CSR disclosure: The more things change…? *Accounting, Auditing & Accountability Journal*, *28*, 14–35. https://doi.org/10.1108/AAAJ-12-2013-1549

Choda, A., & Teladia, M. (2018). Conversations about measurement and evaluation in impact investing. *African Evaluation Journal*, *6*. https://doi.org/10.4102/aej.v6i2.332

Darnall, N., Ji, H., Iwata, K., & Arimura, T. H. (2022). Do ESG reporting guidelines and verifications enhance firms' information disclosure? *Corporate Social Responsibility and Environmental Management*, *29*, 1214–1230. https://doi.org/10.1002/csr.2265

Di Tommaso, C., & Thornton, J. (2020). Do ESG scores effect bank risk taking and value? Evidence from European banks. *Corporate Social Responsibility and Environmental Management, 27*, 2286–2298. https://doi.org/10.1002/csr.1964

Flammer, C. (2021). Corporate green bonds. *Journal of Financial Economics, 142*, 499–516. https://doi.org/10.1016/j.jfineco.2021.01.010

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *J. Sustain. Finance Invest., 5*, 210–233. https://doi.org/10.1080/20430795.2015.1118917

Galema, R., Plantinga, A., & Scholtens, B. (2008). The stocks at stake: Return and risk in socially responsible investment. *Journal of Banking & Finance, 32*, 2646–2654. https://doi.org/10.1016/j.jbankfin.2008.06.002

Grewal, J., Riedl, E. J., & Serafeim, G. (2019). Market reaction to mandatory nonfinancial disclosure. *Management Science, 65*, 3061–3084. https://doi.org/10.1287/mnsc.2018.3099

Hubbard, G. (2009). Measuring organizational performance: Beyond the triple bottom line. *Business Strategy and the Environment*, *18*, 177–191. https://doi.org/10.1002/bse.564.

Huang, Y., Chen, C., Lei, L., & Zhang, Y. (2022). Impacts of green finance on green innovation: A spatial and nonlinear perspective. *Journal of Cleaner Production, 365*, 132548. https://doi.org/10.1016/j.jclepro.2022.132548

Jo, H., & Na, H. (2012). Does CSR Reduce Firm Risk? Evidence from controversial industry sectors. *Journal of Business Ethics, 110*, 441–456. https://doi.org/10.1007/s10551-012-1492-2

Lagasio, V., & Cucari, N. (2019). Corporate governance and environmental social governance disclosure: A meta-analytical review. *Corporate Social Responsibility and Environmental Management, 26*, 701–711. https://doi.org/10.1002/csr.1716

Lee, C.-C., & Lee, C.-C. (2022). How does green finance affect green total factor productivity? *Evidence from China. Energy Econ., 107*, 105863. https://doi.org/10.1016/j.eneco.2022.105863

Li, M., Hamawandy, N. M., Wahid, F., Rjoub, H., & Bao, Z. (2021). Renewable energy resources investment and green finance: Evidence from China. *Resources Policy, 74*, 102402. https://doi.org/10.1016/j.resourpol.2021.102402

Maas, K., Liket, K., 2011. Social impact measurement: Classification of methods, In R. Burritt., S. Schaltegger., M. Bennett., T. Pohjola., M. Csutora (Eds.), *Environmental management accounting and supply chain management, eco-efficiency in industry and science* (pp. 171–202). Springer Netherlands, Dordrecht. https://doi.org/10.1007/978-94-007-1390-1_8

Magli, F., Nobolo, A., & Ogliari, M. (2017). Alternative performance measures and ESMA guidelines: Improving stakeholders' communication. *International Journal of Business and Management, 12*, 15. https://doi.org/10.5539/ijbm.v12n12p15

McWilliams, A., & Siegel, D. (2000). Corporate social responsibility and financial performance: Correlation or misspecification? *Strategic Management Journal, 21*, 603–609. https://doi.org/10.1002/(SICI)1097-0266(200005)21:5%3c603::AID-SMJ101%3e3.0.CO;2-3

Ng, A. C., & Rezaee, Z. (2015). Business sustainability Performance and cost of equity capital. *The Journal of Corporate Finance*, *34*, 128–149. https://doi.org/10.1016/j.jcorpfin.2015.08.003

Oikonomou, I., Platanakis, E., & Sutcliffe, C. (2018). Socially responsible investment portfolios: Does the optimization process matter? *The British Accounting Review, 50*, 379–401. https://doi.org/10.1016/j.bar.2017.10.003

Orlitzky, M., Schmidt, F. L., & Rynes, S. L. (2003). Corporate social and financial performance: A meta-analysis. *Organization Studies, 24*, 403–441. https://doi.org/10.1177/0170840603024003910

Ren, X., Shao, Q., & Zhong, R. (2020). Nexus between green finance, non-fossil energy use, and carbon intensity: Empirical evidence from China based on a vector error correction model. *Journal of Cleaner Production, 277*, 122844. https://doi.org/10.1016/j.jclepro.2020.122844

Revelli, C., & Viviani, J. -L. (2015). Financial performance of socially responsible investing (SRI): what have we learned? A meta-analysis. *Business Ethics: A European Review*, *24*, 158–185. https://doi.org/10.1111/beer.12076.

Sandberg, J., Juravle, C., Hedesström, T. M., & Hamilton, I. (2009). The heterogeneity of socially responsible investment. *Journal of Business Ethics, 87*, 519–533. https://doi.org/10.1007/s10551-008-9956-0

Tamimi, N., & Sebastianelli, R. (2017). Transparency among S&P 500 Companies: An Analysis of ESG Disclosure Scores. *Management Decision, 55*, 1660–1680. https://doi.org/10.1108/MD-01-2017-0018

Waddock, S. A., & Graves, S. B. (1997). The corporate social performance-financial performance link. *Strategic Management Journal, 18*, 303–319. https://doi.org/10.1002/(SICI)1097-0266(199704)18:4%3c303::AID-SMJ869%3e3.0.CO;2-G

Wang, J., Hu, X., & Zhong, A. (2022). Stock market reaction to mandatory ESG disclosure. *Finance Research Letters*, *103402*,. https://doi.org/10.1016/j.frl.2022.103402

Wang, Z., & Sarkis, J. (2013). Investigating the relationship of sustainable supply chain management with corporate financial performance. *International Journal of Productivity and Performance Management, 62*, 871–888. https://doi.org/10.1108/IJPPM-03-2013-0033

Weber, O., & Saunders-Hogberg, G. (2018). Water management and corporate social performance in the food and beverage industry. *Journal of Cleaner Production, 195*, 963–977. https://doi.org/10.1016/j.jclepro.2018.05.269

CHAPTER 3

First Assessment of EU Taxonomy Regulation for Italian Financial Firms

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1 Introduction

Sustainable finance has long constituted the focus of European institutional initiatives. The 2018 Action Plan on financing sustainable growth had already developed a comprehensive strategy to further connect finance with sustainability, highlighting among the planned actions that

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of redirecting capital flows toward a more sustainable economy. In fact, the scale of investment needed for projects geared toward achieving European climate, environmental, and social goals is far beyond the capacity of the public sector; hence, the need for a sustainable finance regulatory and institutional framework that can properly channel private financial flows toward pertinent economic activities.

Therefore, the significant transformation process first initiated by the Action Plan initiatives was further strengthened through the measures of the Next Generation EU Recovery Plan and the policies for the development of sustainable finance in the European Green Deal. Yet, the same direction is pursued with the Strategy for Financing the Transition to a Sustainable Economy, published in July 2021; its implementation required a number of pieces of legislation aimed at outlining a clear and harmonized European regulatory framework for sustainable finance.

For the perspective of this chapter, it is worth mentioning Regulation (EU) 2020/852 of 18 June 2020 ("Taxonomy Regulation"), which introduced into the European regulatory system the Taxonomy of economic activities that can be considered sustainable based on alignment with EU environmental objectives and compliance with certain social clauses.

From the taxonomic clarification of sustainable activities, it stems the further need to promote an efficient sustainability information ecosystem. Indeed, sustainability-oriented information is a key element in the effectiveness of the financial system's mission in fostering the transition to new models of sustainability.

The regulatory framework is enriched with disclosure duties regarding alignment with the Taxonomy that significant public interest institutions will be required to disclose using a set of key performance indicators (KPIs). Specifically, Article 8 of the Taxonomy Regulation imposes disclosure requirements for financial and non-financial firms. As of January 1, 2022, under a phased-in entry into force of the regulation, financial companies are required to include in their non-financial statements the percentage of exposures in Taxonomy-eligible economic activities, out of their total assets and additional specific indicators.

What emerges is a regulatory framework (in several respects still under construction) that makes sustainability-related information the engine of transformation in environmental and social challenges.

Indeed, the presence of reliable and comparable non-financial information is essential to enable market participants to incorporate sustainability

into their decision-making process and to channel resources into sustainable activities properly priced by financial markets.

In light of the above, this chapter aims to analyze the new regulatory framework on Taxonomy and new disclosure duties, with a view to capturing the relevance of the role that disclosure can play in moving toward sustainability. To this end, we examine the extent of disclosure put in place by Italian financial institutions in the first year of application of Article 8 of the Taxonomy Regulation.

The sample analyzed consists of the companies operating in the financial sector (NACE Sector "K": Financial and Insurance Activities) included in the Consob list of subjects that have published the non-financial statement ("NFS") in 2021. Specifically, subject to the obligation to publishing a NFS are relevant public interest entities (RPIEs),[1] i.e., Italian companies that issue securities listed on an Italian or European Union regulated market, banks, insurance, and reinsurance companies that have had an average of more than five hundred employees during the year and have exceeded at least one of the following two size limits as of the balance sheet date:

A. a balance sheet total of 20,000,000 euros;
B. a total net sales and service revenues of 40,000,000 euros.

The purpose of our analysis is to highlight the self-reported sustainability status of Italian financial firms and possible peculiarities arising from business model and firm size.

The analysis is structured as follows: Sect. 2 summarizes the scope of the Taxonomy of Sustainable Assets and the resulting disclosure requirements for financial firms; Sect. 3 reviews the relevant literature; Sect. 4 describes the data used and the methodology. Section 5 discusses the implications of our results and suggests conclusions.

[1] As defined by Legislative Decree no. 39 of January 27, 2010.

2 Taxonomy and Non-financial Disclosure: The European Regulatory Framework

The regulatory focus in recent years in Europe has regarded the need to provide a defined and harmonized framework for sustainable finance and related Taxonomy aspects.

As is well known, the Action Plan on financing sustainable growth adopted by the Commission in March 2018 developed a comprehensive strategy to further connect finance with sustainability, highlighting (among others) the need to introduce a well-defined EU classification system for climate change and environmentally and socially sustainable activities, in order: (i) to provide a harmonized nomenclature for all players in the financial system to be used in different areas (e. g. standards, labels, sustainability benchmarks); (ii) to introduce specific measures with regard to the sustainability duties of financial intermediaries, improving transparency of companies on ESG issues, and effectively provide investors with the right information. Following up the Action Plan, EU Regulation 2020/852 (and its delegated acts), introduced into the European regulatory system the Taxonomy of eco-compatible economic activities, a classification of activities that can be considered sustainable based on alignment with EU environmental objectives and compliance with certain social profiles.

The Taxonomy Regulation applies to financial market participants offering financial products and to financial and non-financial firms that fall under the scope of Directive 2014/95/EU (Non-Financial Reporting Directive—"NFRD").[2]

The first Taxonomy statement focused on environmental sustainability, while the Taxonomy on social impacts is, at present, under consultation.

The environmental Taxonomy is structured around the following six objectives:

1. climate change mitigation;
2. climate change adaptation;
3. sustainable use and protection of water and marine resources;
4. transition to a circular economy;

[2] The Taxonomy Regulation also applies to member states and the EU in the context of the introduction of obligations on financial market participants or issuers regarding the sale of financial products or corporate bonds labeled as "environmentally sustainable".

5. pollution prevention and control;
6. protection and restoration of biodiversity and ecosystems.

With reference to the first two objectives, the Delegated Acts specify in detail for each NACE sector[3] a set of activity-specific technical screening criteria, subject to which economic activities meet the twofold condition: on the one hand, making a substantial contribution to at least one of the six identified environmental objectives; on the other hand, not causing significant harm to any of the other five objectives ("Do No Significant Harm—DNSH" clause). In addition, respect for fundamental labor and human rights must be ensured in line with the OECD Guidelines for Multinational Enterprises and the UN Guiding Principles on Business and Human Rights (*minimum safeguards principle*).

Finalization of the Taxonomy related to the other 4 environmental targets is currently underway by the Sustainable Finance Platform, an expert group set up by the European Commission to replace the TEG. Following this, will be the adoption of further Delegated Acts containing the detailed guidance.

Thus, given also further evolving perspectives, the financial landscape is currently equipped with a unified classification system for sustainable activities that provides an articulated identification of what can be considered "sustainable", and under which conditions. The EU Taxonomy represents a functional tool that paves the way for further development actions for sustainable finance and poses new strategic challenges for financial firms.

In this respect, the implications concern, on the one hand, the different degree of alignment to the Taxonomy expressed by the asset portfolios held by intermediaries; on the other hand, the effects from the disclosure to the market of these strategic policies.

In fact, the regulatory effort in the direction of nomenclature of sustainable activities is combined with the direction of transparency and availability of sustainability-related information.

To this end, a set of indicators (Key Performance Indicators—KPIs) is structured to determine whether, and to what extent, an activity

[3] The Statistical Classification of Economic Activities in the European Community, commonly referred to as NACE (for the French term "nomenclature statistique des activités économiques dans la Communauté européenne"), is the industry standard classification system used in the European Union. The current version is revision 2 and was set up by Regulation (EC) No 1893/2006.

falls within the scope of the Taxonomy, also contemplating a different classification of the various economic sectors.

However, it is worth recalling that regulatory actions at the EU level on sustainability-related information are numerous and articulated, precisely in light of the awareness of the essential role assumed by information transparency in this context.

We shall merely recall here the foundational regulatory initiatives that affect sustainability disclosures for financial market participants, as well as larger financial and non-financial companies.

The first piece that is worth mentioning in the framework of the regulation introducing sustainability reporting rules is the NFRD which established the rules on disclosure of non-financial and diverse information by certain large companies, in particular requiring them to disclose about how environmental and social risks affect their business and about their own impact on people and the environment.[4]

The NFRD has been recently subject to a proposal for amendment by the Commission that was the result of provisional political agreement on June 2022, between the Council and the European Parliament. The new Corporate Sustainability Reporting Directive (CSRD) was approved by the European Parliament on November 2022 and entered into force on January 2023. The rules will start applying between 2024 and 2028:

- from 1 January 2024, for large public interest companies (with over 500 employees) already subject to the NFRD, with reports due in 2025;
- from 1 January 2025, for large companies that are not presently subject to the NFRD (with more than 250 employees and/or €40 million in turnover and/or €20 million in total assets), with reports due in 2026;
- from 1 January 2026, for listed SMEs and other undertakings, with reports due in 2027.

The CSRD thus amends the NFRD, introducing new detailed reporting requirements and ensuring more and better information about the social and environmental performance and impacts by all large listed and

[4] NFRD only applied to larger companies, defined as those with more than 500 employees.

unlisted companies. In fact, the CSRD expands the range of companies that must comply with the above-mentioned regulation, including all large companies and all companies listed on regulated markets and listed SMEs, albeit with a more distant timeline for the application of the rules.

Therefore, for the purpose of our analysis, it is worth highlighting that the rules on non-financial reporting (NFRD and subsequently CSRD) require listed and larger financial intermediaries to prepare the non-financial statement, within which they communicate strategies, actions, and results from an Environmental, Social, and Governance impact perspective in order to provide their stakeholders with maximum transparency on non-financial matters. In the direction of greater uniformity of information, the CSRD would oblige companies under scope to comply with European sustainability reporting standards adopted by the European Commission as Delegated Acts.[5]

The regulatory framework—thus outlined—calls for a joint consideration of the Taxonomy aspects, on the one hand, and the way they are disclosed to the market, on the other. Indeed, Taxonomy Regulation obliges any undertaking which is subject to the CSRD to include in its non-financial statement, or consolidated non-financial statement, information on how and to what extent the undertaking's activities are associated with economic activities that qualify as environmentally sustainable (Article 8(1)).

Article 8(2) specifies just for non-financial enterprises the key performance indicators (KPIs) related to turnover, capital expenditure (CapEx), and operating expenditure (OpEx) to be reported, but does not specify equivalent indicators for financial firms, namely large banks, financial asset managers, investment firms, and insurance and reinsurance companies. This specification was later provided by EU Delegated Regulation 2021/2178 of July 6, 2021, (the "Disclosures Delegated Act") specifying the

[5] More specifically, the task of developing the draft EU Sustainability Reporting Standards was assigned to the European Financial Reporting Advisory Group (EFRAG), a private association established in 2001 with the encouragement of the European Commission to serve the public interest. EFRAG expanded its mission in 2022 as a result of EFRAG's new role in CSRD, providing technical advice to the European Commission. The timeline contained in the CSRD proposal assumes the development of draft sustainability reporting standards in parallel with the legislative process of the CSRD proposal.

content, methodology, and presentation of information to be disclosed by large financial and non-financial undertakings on the share of their business, investments, or lending activities that are aligned with the Taxonomy Regulation.

The Disclosures Delegated Act clarifies that by "**Taxonomy-aligned economic activity**" is meant an economic activity that meets the criteria for environmentally sustainable economic activities set out in the Taxonomy (Article 3), i.e., contributing substantially to one or more of the environmental objectives and not significantly harming any of them. Whereas a **"Taxonomy-eligible economic activity"** is defined as an economic activity that is described in the Delegated Acts, irrespective of whether that economic activity meets any or all of the technical screening criteria laid down in those Delegated Acts.

The timeline (Disclosures Delegated Act, art. 10) provides for a gradual adjustment on the part of companies: in fact, in the first phase of compliance with the new regulatory framework, the eligibility reporting will allow companies to prepare for subsequent alignment disclosure. This has been further clarified in the FAQs published by the European Commission[6], which state that the timeline for the application of reporting requirements is as follows:

As of January 2022, all large undertakings must report the proportion of their activities (or the proportion of their exposures to activities) that are considered as eligible and non-eligible in their turnover, capital ('CapEx') and operational expenditure ('OpEx'), and total assets (in the case of financial undertakings). Furthermore, financial undertakings and non-financial undertakings have to disclose qualitative information as of January 2022. In 2022, large entities are not required to assess the Taxonomy-alignment of these activities.

In light of the timeframe just recalled, the first indicators that financial firms are required to report from January 2022, include:

[6] European Commission, "FAQs: How should financial and non-financial undertakings report Taxonomy-eligible economic activities and assets in accordance with the Taxonomy Regulation Article 8 Disclosures Delegated Act?", December 2021 (updated January 2022). Further guidance for reporting was provided by the Appendix 1 "Platform considerations on voluntary information as part of Taxonomy-eligibility reporting" published by the Platform on Sustainable Finance on December 20, 2021.

- the proportion in their total assets of exposures to Taxonomy **non-eligible** and Taxonomy-**eligible** economic activities;
- percentage of exposures to central governments, central banks, and supranational issuers;
- percentage of derivatives exposures;
- percentage of exposures to enterprises not subject to the requirement to publish non-financial information;
- qualitative information required by the Delegated Regulations.

Credit institutions shall also disclose the share of their trading book and on demand interbank loans out of their total assets. Insurance and reinsurance undertakings shall also publish the share of eligible and non-eligible non-life insurance assets according to the Taxonomy.

As of January 2024, the reporting requirement for financial firms will be extended to additional performance indicators, specified in the Annex V—KPIs of credit institutions—paragraph 1.2.1.

In particular, among the others, banks should report the proportion of their Taxonomy-aligned exposures through the Green Asset Ratio (GAR): this would be the main key performance indicator for credit institutions that are subject to the disclosure obligations as it will be the most demanding in terms of resources and effort required to construct the indicator and the most relevant in terms of information reported to understand the level of alignment of activities. The GAR shall show the proportion of the of credit institution's assets financing and invested in Taxonomy-aligned economic activities as a proportion of total covered assets. In that sense, the GAR should relate to the credit institutions' main lending and investment business, including loans, advances and debt securities, and to their equity holdings to reflect the extent to which those institutions finance Taxonomy-aligned activities.

As for the contents of the information that financial intermediaries must provide, the Disclosures Delegated Act specifies them according to their business model.

Table 1 lists the various types of financial undertakings and the regulatory references containing the disclosure requirements according to the aforementioned new regulatory framework.

Therefore, the following analysis deals with the initial investor disclosures based on the EU Taxonomy—due at the beginning of 2022, covering the financial year 2021—made by non-financial firms under the provisions of the new regulatory framework described above.

Table 1 Article and annexes of delegated regulation by types of financial undertakings

Types of Financial undertakings	*Article and Annexes of Delegated Regulation*
Asset managers	3; III and XI
Credit institutions	4; V and XI
Investment firms	5; VII and XI
Insurance and reinsurance undertakings	6; IX and XI

In light of the evolution of the overall sustainability framework just described, what emerges is the importance of the role assumed by information on the degree to which the activities carried on by the reporting entities are aligned with the EU Taxonomy. The design of an effective non-financial information reporting system set by the European regulations highlights the prominence, in this context, of the logic of "accountability of sustainable activities". This gives rise to considerations of financial sustainability duties: in fact, transparency of non-financial information requires due consideration of the sustainability implications of corporate strategies.

In this sense, from the logic of accountability of sustainable activities (understood in the proper sense of "giving account") derives a new profile of responsibility for financial intermediaries, which also poses the need to mitigate reputational risks, by disclosing the extent to which their business is aligned with the Taxonomy and their plans to improve environmental performance. By having to disclose these points, firms will need to start a reflection on risks determined by ESG factors and how they might impact their business going forward.

3 Literature Review

Non-financial information is a key element in enabling the financial system to promote the transition to new sustainability paradigms. Moreover, the reliability and comparability of such information is essential to enable market participants to incorporate sustainability into their decision-making process. This issue has already been analyzed by several authors, highlighting the central role played in this context, both by the financial system as a provider of resources (Battiston et al., 2021; La Torre, 2022;

Steffen & Schmidt, 2021), and by the information on the sustainability performance of companies, for the purpose of effective investor decision-making (Dimson et al., 2020; Shanaev & Ghimire, 2021; Ilhan et al., 2021).

In this regard, the regulatory framework has been enhanced by disclosure requirements regarding alignment with the Taxonomy, recalled in the previous paragraphs.

As a result, several authors have focused on the recent evolution of the European non-financial disclosure framework (Linciano et al., 2022) and new disclosure duties (Santamaria, 2022).

The literature specifically related to the EU Taxonomy is rather limited for the time being, given its recent introduction within the regulatory framework.

In this regard, some authors analyze the EU Taxonomy from an ESG perspective: as is well known, ESG ratings represent a relevant and widely used source of non-financial information for investors (Dimson et al., 2020; Krueger et al., 2020); however, ESG ratings given by different providers can sometimes be misaligned with each other (Berg et al., 2020; Billio et al., 2020; La Torre et al, 2022). In this sense, the introduction of the Taxonomy, by harmonizing the definition of sustainable activities and their measurement, could be an important element of convergence also for assessment metrics such as ESG ratings, at least for the environmental component (E rating). According to Dumrose et al. (2022), the information value of the Taxonomy could also be reflected in greater uniformity of ESG ratings: in particular, the authors—using EU Taxonomy-related firm data in Tobit regressions—show that environmental ratings from three out of four ESG data providers are significantly related to the EU Taxonomy.

Further studies highlight the pivotal role of Taxonomy in promoting the transition to fully sustainable performance (Marullo Reedtz, 2022). As for the influence of the EU Taxonomy on the environment, the bibliometric analysis by Lucarelli et al. (2020) highlights the cooperation between regulators, academics, and industry underlying the working method that led to the EU Taxonomy and the expectation of further positive environmental effects as EU Taxonomy issues are incorporated into policy measures.

With specific regard to the financial implications of the Taxonomy, few authors have estimated its possible financial impact: in this regard

is the analysis by Alessi et al. (2019) who estimate the financial investments currently supporting Taxonomy-eligible activities, using security-by-security data covering the whole European bond and equity markets; the study also estimates the additional financial investment needed to allow the EU to reach its targeted reduction in carbon emissions. They conclude that the increased financial investments toward relevant sectors appear to be within reach. From a portfolio point of view, on the other hand, Alessi and Battiston (2022) perform an analysis of the greenness of a financial portfolio in terms of the share of investments aligned with the EU Taxonomy, combining the measurement of greenness with that of the level of transition risk exposure of the financial portfolio, highlighting the interplay between greenness and transition risk in financial portfolios.

Overall, the above literature review highlights the great relevance of the Taxonomy topic and the need to analyze its future implications. It also emerges that there are no studies specifically exploring the resulting extent of disclosure put in place by financial institutions in the first year of application of Article 8 of the Taxonomy Regulation.

Considering the novelty of this line of analysis, this chapter aims to offer new insights and perspectives on the aforementioned issues.

4 The Taxonomy in Italy: A Qualitative Analysis

The NFRD was transposed into Italian law by Legislative Decree 254/2016, which assigned to Consob (the public authority responsible for regulating the Italian financial markets) the role of supervising Non-Financial Statements (NFS) and of annually publishing the list of entities that have mandatorily or voluntarily issued an NFS.

Since the legislative decree came into force (fiscal years 2017–2020), about 800 NFSs have been published in Italy, meaning an average of 208 companies disclosing non-financial information each year.

As of 2021—the first year in which companies publishing an NFS are also required to report the information required by the Taxonomy Regulation—209 documents have been published, broken down as follows: 146 (69.9%) documents published by companies with shares listed on the main Euronext Milano market, 46 (22%) by other relevant public interest entities, and 17 (8.1%) voluntary documents (these do not involve being subjected to a review process by an independent third party or the publication of the KPIs of the EU Taxonomy).

Table 2 Breakdown by NACE sectors of Italian companies' subject to NFDR

NACE Sector		#	%
C	Manufacturing	70	33.5
D	Electricity, Gas, Steam and Air Conditioning Supply	16	7.7
E	Water Supply; Sewerage, Waste Management and Remediation Activities	6	2.9
F	Construction	4	1.9
G	Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	9	4.3
H	Transportation and Storage	12	5.7
I	Accommodation and Food Service Activities	1	0.5
J	Information and Communication	17	8.1
K	**Financial and Insurance Activities**	**57**	**27.3**
M	Professional, Scientific and Technical Activities	9	4.3
N	Administrative and Support Service Activities	3	1.4
P	Education	1	0.5
Q	Human Health and Social Work Activities	3	1.4
S	Other Service Activities	1	0.5
Total		**209**	**100.0**

Table 2 shows the breakdown by NACE sectors of Italian companies that have published an NFS for 2021[7].

The objective of the analysis that follows is to verify the level of disclosure adopted, under the new regulatory framework, by the 209 companies referred to in the table; this was done by first verifying the companies' identification as "financial" or "non-financial" for the purposes of the relevant reporting requirements.[8]

[7] Data are taken from Bloomberg infoprovider and, where not available, from the Business Register, held by the Chamber of Commerce, Industry, Agriculture, and Handicrafts (CCIAA), to which all companies are required to register and file annual financial statements. Sectors under which no company falls have not been represented in the table.

[8] In fact, several specific KPIs are required to be disclosed for the latter (Taxonomy Regulations, Art. 8) such as the proportion of their turnover derived from products or services associated with economic activities that qualify as environmentally sustainable and the proportion of their capital expenditure and operating expenditure related to assets or processes associated with economic activities that qualify as environmentally sustainable.

Moreover, the ultimate purpose of the chapter is to provide an initial insight into the level of eligibility of the Italian financial industry, in light of the disclosures required by the Taxonomy Regulation and specified in the Delegated Acts for companies operating in the financial sector.

The following section outlines the database useful for the analysis and the methodology adopted.

4.1 Sample and Data Collection

The analysis is focused on the first year of implementation of the Taxonomy Regulation by financial institutions and, in particular, on the KPI reporting approaches used by the Italian financial system. Given the limitations arising from the early stage of the new European regulations, as well as the narrowness of the sample,[9] it was necessary to proceed through a descriptive analysis methodology. However, this study is functional in understanding the non-financial information maturity of the main financial entities and provides first insights into the level of climate resilience of the assets of the Italian financial system.

For the purpose of selecting the analysis sample,[10] we focused on entities operating in the NACE K sector, "Financial and Insurance Assets sector": the breakdown by NACE Sector is also consistent with the climate Delegated Act. The preliminary analysis of 57 documents showed that 11 companies did not publish the KPIs expected for financial entities. Specifically, 7 companies are holding companies of industrial groups, 2 companies took advantage of the exemption provided in the regulations for companies that prepare NFS on a voluntary basis, and finally 2 companies are part of European groups that publish a consolidated statement in their home country (Fig. 1).

[9] As mentioned above, the focus of the analysis is the Italian market.

[10] According to EU Commission Delegated Regulation, a 'financial undertaking' is "*an undertaking that is subject to the disclosure obligations laid down in Articles 19a and 29a of Directive 2013/34/EU and is an asset manager, a credit institution as defined in Article 4(1), point (1), of Regulation (EU) No 575/2013 of the European Parliament and of the Council22, an investment firm as defined in Article 4(1), point (2), of Regulation (EU) No 575/2013, an insurance undertaking as defined in Article 13, point (1), of Directive 2009/138/EC of the European Parliament and of the Council23, or a reinsurance undertaking as defined in Article 13, point (4) of Directive 2009/138/EC*".

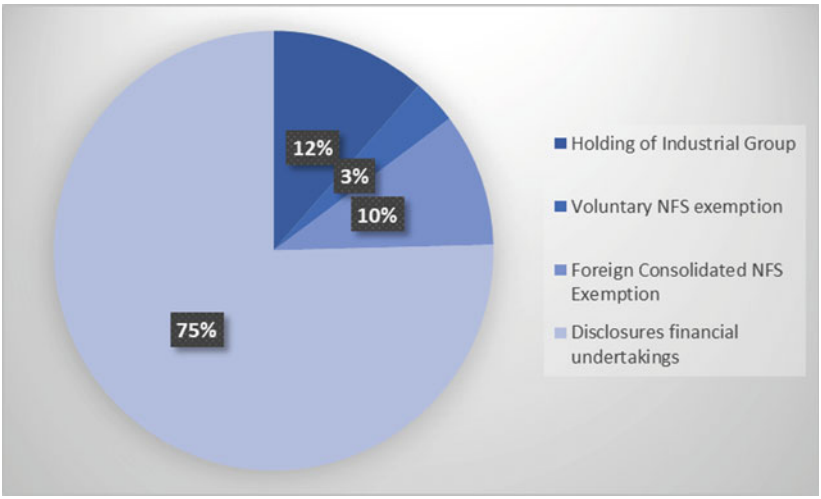

Fig. 1 Overview of entities operating in the NACE K sector by type of disclosure published

Therefore, our analysis focused on the 46 companies that have published the KPIs required for financial entities under the Taxonomy Regulations and which report data on the eligibility of own assets at least through proxies. As part of the sample selection, we found that one company classified as a predominantly banking financial conglomerate also voluntarily published insurance KPIs, while another company with a mixed financial/non-financial business model voluntarily published both KPIs for asset management companies and those for insurance companies: for these reasons, the overall sample consists of 48 entities. The analyses are based exclusively on a review of the information published by the companies.

Table 3 summarizes the composition of the final sample based on the disclosures under the aforementioned Delegated Act.

Once the sample was identified, the dataset was manually constructed by extracting values directly from the non-financial documents published by financial institutions with reference to 2021.

Table 3 Composition of the final sample

Types of Financial undertakings	#	%
Asset managers[11]	2	4.2
Credit institutions[12]	35	72.9
Insurance and reinsurance undertakings[13]	11	22.9
Total	**48**	**100**

The data collection phase, carried out in 2022, collected the values of KPIs that financial institutions were required to report in the non-financial statement for 2021 under Article 10 of EU Delegated Regulation 2021/2178.

Specifically, the purpose of this first disclosure is related to defining the proportion of assets labeled as Eligible, i.e., financial activities that contribute to the financing of an economic activity described in the Delegated Acts related to the environmental objectives of the Taxonomy, regardless of whether the respective technical selection criteria are met. Therefore, this indicator represents only the potential, and not the actual, environmental sustainability of a company's activities.

In fact, as mentioned earlier, a reduced reporting scope is required for the current reporting year; moreover, verification of an activity's Taxonomy eligibility is the first step required by the regulator to define portfolio alignment. This includes an initial indication of the proportion of the business volume covered by the Taxonomy (Taxonomy-relevant), as this is only applicable to certain parts of the portfolio (e.g., assets outside the European economic area are not included). Next, the percentage of economic activities and sectors to be checked for Taxonomy compliance (Taxonomy eligible) is disclosed.

In addition, according to Article 8(4) of the Delegated Act, financial enterprises must use the most recent available information provided by the investee entity or the underlying financial or non-financial counterparty

[11] As previously mentioned, includes voluntary disclosure of 1 mainly non-financial undertaking.

[12] Including one Italian government investment bank and one Italian government agency active in financing strategic sectors for development and employment that are disclosed as credit institutions.

[13] As previously mentioned, this includes voluntary disclosures of two subsidiary insurance groups.

for their eligibility disclosures, as well as for their annual accounts; consequently, the mandatory disclosures must be prepared on the basis of actual data without the use of estimates and forecasts. Furthermore, the European Commission clarified that "*if the information is not readily or publicly available, financial undertakings could use voluntary disclosures to provide Taxonomy-related information. In that case, financial undertakings could choose to estimate their eligibility disclosures and report the information on a voluntary basis, separately from the mandatory disclosures under the Disclosures Delegated Act.*"[14] The briefing of the Platform on Sustainable Finance provides further advice on best practices for voluntary reporting of eligibility information in the first year(s) of reporting.

In short, institutions should use actual data to be compliant with mandatory disclosure, but—if they are unable to do so due to lack of data, or if there is additional relevant information to disclose—they can use proxies or estimates in voluntary disclosure.

The published DNFs show that the major players have taken a heterogeneous approach in how they represent data, in some cases including only mandatory disclosures. No particular homogeneity was observed in the data collection strategy either. However, some institutions have adopted a common approach, reporting data through the templates suggested by the Platform for Sustainable Finance. For this reason, in the following section we propose an analysis for each category of financial intermediary, instead of providing a general overview that would be less relevant due to the considerable heterogeneity observed.

The reported evidence is also confirmed at the European level, where heterogeneous approaches were used both in terms of classification and data collection methods; therefore, considering the lack of comparability, therefore, the focus of the analysis is on the Italian context.

4.1.1 Credit Institutions

This section focuses on the disclosures provided by the 35 analyzed credit institutions; it is worth recalling here the essential role they play within the Italian economy, which is typically centered on the banking system. Out

[14] https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/sustainable-finance-taxonomy-article-8-report-eligible-activities-assets-faq-part-2_en.pdf.

Table 4 Types of Credit Institution in the sample

Credit institutions	#	%
Significant Institutions (SIs)	13	37.1
Less Significant Institutions (LSIs)	20	57.1
Others	2	5.7
Total	**35**	**100**

of the 35 institutions analyzed, 13 are Significant Institutions (Sis), therefore subject to direct supervision by the European Central Bank (ECB). Thus, this group includes all significant Italian banks, accounting for 82% of the country's banking system assets[15].

Conversely, 20 banks are Less Significant Institutions (LSIs), i.e., as known, small banks (total assets < €30 billion) with exclusively domestic operations. Finally, the remaining 2 institutions are governmental financial institutions that do not trade with the public and are not subject to prudential supervision, but given that their main business is corporate financing, they identify and make disclosures for Taxonomy purposes as credit institutions (Table 4).

With regard to the disclosure extent, it should be reminded that the mandatory disclosure required by Art. 8 implies the availability of a broad dataset of specific information on each individual credit position and, at the same time, precludes the use of proxies andx estimates, as noted above. It is also likely that smaller companies, with mainly local operations and limited workforce, may find it difficult to meet the implementation timelines of the new regulations. This is compounded by a persistent and widespread difficulty in finding data: according to the Climate Stress Test conducted by ECB, the gap between regulatory requirements and available data is widening, and most banks are making extensive use of proxies instead of actual counterparty data (i.e., data directly available in counterparty disclosure documents) to measure climate-related aspects. Although proxies are considered a first step in filling data gaps, banks need to invest further in the methodological assumptions used (Bank of Italy, 2022).

This results in a *sustainable data gap* for climate change and sustainable finance analysis, i.e., a gap in the availability, usability, access, and reliability of information (NGFS, 2021).

[15] Bank of Italy, *Annual Report for 2021.* Rome, 31 May 2022.

Considering the above, the EU Commission has introduced the option to publish estimates on a voluntary basis, if actual data are not available, at least for the first year, while waiting for financial institutions to adapt their internal data collection and processing systems to the Taxonomy Regulation structure.

Regarding **assets eligibility**, given the exceptions allowed by the gradual enactment of the regulation, three strategies implemented by Italian credit institutions can be highlighted:

- disclosure restricted to asset eligibility as mandatorily required;
- mandatory disclosure expanded by voluntary disclosure;
- no mandatory disclosure, due to the absence of actual data, but voluntary disclosure through proxies and estimates.

It should be noted that no company has mentioned lack of available data as a sufficient reason for not disclosing at all, as shown in Table 5.

It is notable that four LSIs (11.4%)—the three smallest banks within the selection and one consumer bank—disseminated poor information, also with reference to the mandatory financial statement indicators (the values of which were, however, almost entirely inferable from periodic financial information)[16].

The analysis of the value used in the reports as the denominator for KPIs shows that most institutions use **total covered assets** as the denominator; therefore, although the regulations provided, until 2023, for the possibility of reporting eligible assets over **total assets**, most companies

Table 5 Types of disclosure published by Credit Institutions

Taxonomy-eligible asset disclosed by Credit institutions	#	%
Only actual data and mandatory disclosure	7	20.0
Also use of proxies or estimates in voluntary disclosure	12	34.3
Data not available + voluntary disclosure	16	45.7
Data not available: no disclosure	0	0
Total	**35**	**100**

[16] The consumer bank also specified that following the industrial restructuring of the joint venture that controls it, this will be its last year of publication of an Italian NFS.

are already aligned with the planned methodology for calculating the Green Asset Ratio (GAR), which will have to be reported mandatorily from 2024.

As specified by the European Commission, "*covered assets are the total assets on-balance sheet minus the assets that are excluded from the GAR calculation. This means that covered assets are all assets on an asset manager's balance sheet or portfolio, excluding exposures to central banks, supranational issuers, and central governments*" (EC, 2022).

Figure 2 shows total covered assets as part of total assets; moreover, excluded assets also comprise: the trading book; exposure to sovereign issuers—central governments; exposure to central banks; and assets related to supranational issuers.

Therefore, institutions that opt to use total covered assets as the denominator should clearly disclose which assets are excluded from the ratio and the percentage of eligible covered assets out of total assets.

The sample analysis shows that six credit institutions disclose results referring to total assets; instead, 29 institutions use total covered assets as the KPI denominator. However, among them, only eight institutions specify the amount of total covered assets, which, on average, is 66.83%, as shown in Table 6.

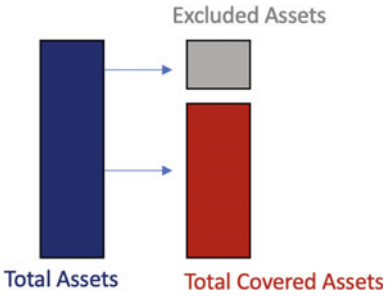

Fig. 2 Definition of total covered assets compared to total asset

Table 6 Summary statistics of total covered assets

Total covered assets as % of Total assets by Credit institutions	*Avg. (%)*	*Median (%)*	*Min. (%)*	*Max. (%)*
All credit institutions (13)	66.83	69.00	44.70	78.00
Significant banks (8)	66.18	69.00	44.70	78.00

In light of the definition of **eligible-activities,** and analyzing the ratio **numerator**, we found some common characteristics across credit institutions. Specifically, for those banks that have disclosed the mandatory disclosure (19/35), the numerator consists mainly of the following items—or a portion of them:

- residential real estate loans and loans secured by residential Real Estate;
- loans for home renovation;
- motor vehicle loans;
- green bonds;
- data collected by NFDs.

With respect to the current reporting period, almost no information on corporate counterparties and related KPIs in the Taxonomy is publicly available; thus, in this first year of mandatory reporting, eligible activities are mostly housing and household loans.

The Frequently Asked Questions (FAQs) document published by the European Commission in December 2021 specifies that information on the eligibility of financial undertakings in relation to financial or non-financial undertakings falling within the scope of Article 8 of the Taxonomy must be based on the information actually provided by the latter.

As this information will be first disclosed during 2022, the assessment of the eligible economic activities of the Taxonomy of corporate enterprises on the basis of the Climate Act is currently not fully possible. Best practices include the use of data for FINREP reports as recommended by the Q&A.

Table 7 shows the composition of the numerator of Taxonomy-eligible KPI disclosed by credit institutions.

In addition, we identified some emerging trends aimed at achieving the required data granularity:

– customer survey during the loan application phase;
– use of data provided by the customer's NFS.

Table 7 Composition of the numerator of Taxonomy-eligible assets (mandatory disclosure)

Assets categories constituting the numerator reported as mandatory disclosure	*Number of ICs Reporting the asset category*	*% of of ICs Reporting the asset category*
Residential real estate loans and secured by residential real estate	19	100
Housing renovation loans	19	100
Motor vehicle loans	6	32
Green bonds	2	11
Data collected by NFDs	3	16

Finally, the Table 8 represents the key data that emerged from our analysis, in light of the new European Taxonomy framework: the share of eligible assets in total covered assets was disseminated timely by 19 lending institutions, 10 of which are Significant Institutions.

Thus, a significant finding emerges: the potential contribution level of Italian banks is about 20% over total eligible assets (slightly higher for significant banks, at 22.58%; however, the median value is centered between 21.26% and 22.10% of SIs). In particular, in light of the different business models of the intermediaries analyzed, it follows that, on the one hand, commercial banks develop the highest levels of eligible assets; on the other hand, intermediaries operating in consumer credit or NPL management turn out to have an average of eligible assets below 3%.

As a summary figure, we have tried to give an economic dimension to the values represented above. To this end we used the total covered assets reported by 13 credit institutions (four LSIs, eight SIs and one Other).

Table 8 Summary statistics of eligible activities (mandatory disclosure)

Eligible activities (Mandatory disclosure, actual data)	*Avg. (%)*	*Median (%)*	*Min. (%)*	*Max. (%)*
All credit institutions (19)	19.38	21.26	0.04	30.96
Significant banks (10)	22.58	22.10	16.30	30.10

The total assets of the subgroup of banks account for € 1.760 million[17]. We multiplied credit institutions' total assets, first by total covered assets, and then by the proportion of eligible assets.

$$\text{Economic value of eligible assets} = \sum_{i=1}^{n} \text{Total Assets Bank}_i * \%\text{GAR Bank}_i * \%\text{Eligible Assets Bank}_i$$

In summary, the economic value of eligible assets is approximately 259.8 million euros (equal to a weighted average of 14.69% of this banks' sub-selection).

Regarding the information reported in the voluntary disclosure, the eligibility level is calculated using proxies mainly from external providers and counterparty NACE codes; in particular, the proxy-based numerator used by credit institutions (27/35) is mainly composed of the following items-or part of them:

- exposures to households (e.g., residential real estate and residential real estate-backed loans; home improvement loans; motor vehicle loans).
- credit exposures to all counterparties;
- credit exposures to the corporate sector;
- credit exposures to companies subject to the NFRD;
- Capex—share of an asset's capital expenditure—related to exposures to households.

Table 9 shows the numerator composition of Taxonomy-eligible KPIs voluntarily reported by credit institutions.

Finally, Table 10 shows the eligible assets provided by 22 credit institutions[18]—ten of which are Significant Banks—through proxies and estimates (Voluntary Disclosure).

Extending the set of assets on which the eligibility analysis was implemented, the data processed through voluntary disclosure show that the

[17] However, a single significant bank alone represents 60.5% of these assets.

[18] Of the 27 institutions that publish voluntary information, 5 use the share of total assets and not the share of total assets covered as the denominator to ensure data comparability, the following institutions have therefore been excluded.

Table 9 Composition of the numerator of Taxonomy-eligible assets (voluntary disclosure)

Types of Assets constituting the numerator reported as voluntary disclosure	*Number of ICs Reporting the asset*	*% of of ICs Reporting the asset*
Exposures to households[19]	7	26
Credit exposures to all counterparties	6	22
Credit exposures to the corporate sector	12	44
Credit exposures to companies subject to the NFRD;	7	26
Capex related to household exposures	1	4

Table 10 Summary statistics of eligible activities (voluntary disclosure)

Eligible activities (Voluntary disclosure, proxies data)	*Avg. (%)*	*Median (%)*	*Min. (%)*	*Max. (%)*
All credit institutions (22)	24.19	23.91	0.51	49.85
Significant banks (10)	28.55	24.00	12.97	49.85

average eligible assets held by credit institutions is 24.19%, while that resulting from mandatory disclosure is lower, precisely, 19.38%.

In the following, we analyze the additional KPIs published by credit institutions in line with Article 10 of Delegated Regulation (EU) 2021/2178.

In consideration of the heterogeneity of the proxies and data used by the banks that do not have data actual, this section will comment on the KPI values of the credit institutions limited to the 20 companies that did not used estimates, accounting for about 57.1% of the Italian banks subject to the Taxonomy (of these, 7 refer to mandatory disclosure and 13 also to voluntary disclosure).

[19] This type of asset is present in all eligibility disclosures: as seen above, some (19) calculate them with point data, others through proxies.

Table 11 Summary statistics of exposure to central governments, central banks and supranational issuers

% of exposures to central governments, central banks and supranational issuers	*Mean (%)*	*Median (%)*	*Min. (%)*	*Max. (%)*
All credit istitutions (20)	32.09	31.66	15.29	55.30
Significant banks (11)	30.17	27.60	15.29	55.30

With reference to the "*percentage of exposures to central governments, central banks and supranational issuers*", excluding a priori, the average value is close to 30% both for the significant banks and for the entire selection. Both the minimum and maximum value do not belong to commercial banks: in the first case it is a merchant bank, in the second to an investment bank (Table 11).

In the case of the "***percentage of derivatives exposures***" there are two different disclosure strategies as previously mentioned: in fact, 16 banks communicated the data on *total assets*, while the remaining 25% used the *total covered assets* as denominator. In any case, it can be stated that in most cases (75%) the exposure is of extremely limited value (less than 1%) and only in one case equal to 19% (of *total covered assets*).

With regard to the "***percentage of exposures to enterprises not subject to the requirement to publish non-financial information***" first, it should be noted that this group of companies currently makes up the majority of Italian companies, considering that about 200 companies (among the largest in Italy) are required to publish an NFS according to the NFRD. Moreover, 7 (35%) banks communicated data on *total assets*, the other 13 (65%) with *total covered assets* as denominator. In any case, from the analysis of the disclosure it is possible to conclude, as expected, that 14 banks out of 20 have an exposure to non-NFRD companies exceeding 40%, and even 2 of them exceeding 80%, as shown in Table 12.

In particular, relying on the customer's NFS is limiting since the number of companies that disseminate an NFRD-compliant report is, as seen, just over 200 units. The enactment of CSRD will greatly increase the number of Italian companies required to publish sustainability disclosures and would likely ease the data collection process.

Finally, further considerations relate to the remaining specific indicators set for credit institutions: in this regard, two disclosure strategies

Table 12 Summary statistics of exposure to enterprises not subject to NFRD

Exposures to enterprises not subject to NFRD	*0 − < 20%*	*20%–< 40%*	*40%–< 60%*	*60%–< 80%*	*80%–100%*
N° of Credit institutions	3	3	10	2	2

Table 13 Summary statistics of trading portfolio and inter-banks loans

% of Trading portfolio + % of Inter-banks loans	*Mean (%)*	*Median (%)*	*Min. (%)*	*Max. (%)*
All credit istitutions (20)	3.37	1.14	0.06	21.00
Significant banks (10)	5.82	2.14	0.10	21.00

also emerge with reference to the share of the trading book and inter-bank overnight loans out of the total. Specifically, 5 banks (75% of the total, including 2 SIs) publish the data of the two values jointly, not providing an appreciation of the single component, while the remaining banks publish the two KPIs separately. Again, in order to ensure greater comparability of our descriptive analysis, we therefore added the two KPIs for the remaining 15 banks as well in order to represent the data in Table 13.

Once again it can be observed that the prevalence of commercial banks in the Italian banking sector lowers the indicator to an average of 3.37% (5.82% for IS, probably due to their more diversified business models).

4.1.2 Insurance Companies

The Taxonomy Regulation requires insurance companies, which are obliged to publish the non-financial statement, to report information on environmentally sustainable economic activities related to investment and underwriting activities, according to Delegated Regulation (EU) 2021/2178.

As mentioned above, in addition to the indicators foreseen for all financial companies, Article 10 also requires insurance and reinsurance companies to disclose the percentage of eligible and ineligible non-life insurance business.

In fact, according to the EU Taxonomy, insurance companies can contribute to the EU's climate goals both by offering insurance coverage to protect against climate change-related damages and by leveraging their role as long-term investors to redirect capital flows to environmentally sustainable businesses and activities.

From an operational perspective, the European Commission's Call for Advice (CfA) specifies three insurance-specific ratios as a starting point, tasking EIOPA—the European Insurance and Occupational Pensions Authority, as known, one of the European Supervisory Authorities—to develop the relevant ratio (s) that insurance or reinsurance undertakings, covered by the NFRD, must mandatorily report (EIOPA, 2021).

As a first step, insurance undertakings should then disclose the following indicators:

- proportion of total assets invested in Taxonomy-compliant economic activities;
- proportion of total non-life insurance underwriting exposure associated with Taxonomy activities;
- proportion of total reinsurance underwriting exposure associated with Taxonomy activities.

Finally, EIOPA specifies that companies should use all the publicly and privately available information; moreover, they can be complemented by approximations and proxies, where necessary: the use of proxies as well as of applied methodologies and accounting policies shall be disclosed and explained. Potential limitations regarding the availability of sufficiently granular, relevant, and reliable information shall be explained.

The set of companies that reported the KPIs required for insurance companies consists of 11 companies, of which one company is a subsidiary of a predominantly non-financial company and one corresponds to the insurance division part of a predominantly banking financial conglomerate. With regard to the main indicator required by the Taxonomy, i.e., the percentage of total assets of exposures to eligible economic activities, we found that, unlike credit institutions, less than half (45.46%) of the documents contain accurate data without the use of proxies and estimates. One (9.1%) of the five companies expands the disclosure voluntarily. Of the remaining, all of them made voluntary disclosure on the basis of

Table 14 Types of disclosure published by Insurance companies

Taxonomy-eligible asset disclosed by Insurance companies	#	%
Only actual data and mandatory disclosure	4	36.4
Also use of proxies or estimates in voluntary disclosure	1	9.1
Data not available + voluntary disclosure	6	54.5
Data not available: no disclosure	0	0
Total	**11**	**100**

proxies, so there are no companies that do no disclosure at all due to lack of data, as shown in Table 14.

With regard to the indicator on eligible investments, the four insurance companions making mandatory disclosure collected actual data on real estate investments, capital properties, and mortgages.

In light of the first application of the regulations and the small sample size, compounded by the impossibility of comparing data, it is not possible at this time to comment on the quantitative results of mandatory disclosure on aggregate data.

Furthermore, with reference to voluntary disclosure, eight insurance companies calculate the share of eligible investments using proxies mainly from external suppliers and counterparty NACE codes; the indicator consists mainly of the following items-or part of them:

- direct and indirect investments;
- direct investments;
- corporate investments;
- investments in companies subject to the NFRD;
- equities and corporate bonds.

Table 15 summarizes the main quantitative values for eligible investments on the aggregated voluntary data.

Table 15 Summary statistics of eligible investments (voluntary disclosure)

%Taxonomy-eligible investment activities on voluntary disclosure	*Mean (%)*	*Median (%)*	*Min. (%)*	*Max. (%)*
Insurance companies (8)	11.14	10.54	7	16

Table 16 Summary statistics of eligible non-life insurance activities

%Taxonomy-eligible non-life insurance economic activities[21]	*Mean (%)*	*Median (%)*	*Min. (%)*	*Max. (%)*
Insurance companies (11)	18.80	15.21	2.30	44.20

Insurance and reinsurance undertakings shall also disclose the proportion of Taxonomy-eligible and Taxonomy non-eligible non-life insurance economic activities according to Art. 10 of EU Delegated Regulation 2021/2178.

In particular, eligible underwriting activity is defined as the amount of gross written premiums related to the specific lines of business that provide insurance coverage related to climate-related risks. The lines of business are specified in Annex II of EU Delegated Regulation 2021/2139 of the European Commission[20].

In terms of disclosure, all 11 insurance companies (100%) provide precise data on non-life business lines, shown below in Table X, in contrast with the investment-related indicator, as shown in Table 16.

Specifically, it is possible to state that businesses declare on average only 18.8% of their assets to be eligible for the purposes of the Taxonomy: however, the figure shows wide variability with a minimum of 2.3% to a maximum of 44.2%.

In addition, the underwriting activities identified as eligible are, in most cases (6/8), related to the following lines of business:

- other motor insurance;
- marine, aviation and transport insurance;
- fire and other property damage insurance.

In the residual cases, the values are referred to all business lines envisaged by the regulation, without a specific distinction.

[20] The lines of business indicated are: a. medical expense insurance; b. income protection insurance c. workers' compensation insurance; d. motor vehicle liability insurance; e. other motor insurance; f. marine, aviation and transport insurance; g. fire and other property damage insurance; h. assistance.

[21] In any case the proportion of Taxonomy non-eligible non-life insurance economic activities is the residual part to reach 100%.

4.1.3 Asset Manager

Finally, a further category of financial intermediaries included in the 2021 Italian NFSs is that of Assets managers consisting of one asset management company and one branch of a predominantly non-financial company. In fact, in both cases (100%), due to the lack of data, information was provided only through the use of proxies. In both documents, the estimates of an external provider were used to calculate the eligibility of a quota toward companies obliged to the NFRD, producing a value close to 10%.

5 Conclusions and Future Implications

This chapter falls in the strand of the literature on sustainable finance, with a focus on the operational and disclosure implications related to the introduction of the EU Taxonomy.

As we mentioned throughout the study, the Taxonomy represents an innovative and dynamic instrument, whose progressive updates over time will tend to reflect the evolving dynamics of the financial system and the pursuit of comparability objectives for firms and investors, among other things, mitigating the risk of greenwashing.

The analysis was aimed at providing an initial mapping of the degree of disclosure of the Italian financial system considering the new disclosure requirements arising from the EU Taxonomy; to the best of our knowledge, this is an original approach that has not been the subject of other studies to date.

The chapter highlights some interesting insights into the degree of eligibility of Italian intermediaries' portfolios and the related accountability.

Moreover, the chapter shows some temporary implications arising from the first application of the regulatory framework: as of when the Green Asset Ratio will be published, it will be possible to determine whether an asset can be considered as sustainable within the meaning of the EU Taxonomy Regulation. Currently, institutions are required to report only the portion of assets eligible for the Taxonomy.

An eligible exposure is defined as a financial activity that contributes to the financing of an economic activity described in the Delegated Acts related to the environmental objectives of the Taxonomy, regardless of whether the respective technical screening criteria are met. In view of

the above, this indicator represents only the potential, and not the actual environmental sustainability of a company's activities.

Taking these definitions into account, we found that the share of Taxonomy-eligible business of Italian credit institutions stands at about 20%, (when considering only actual data) rising to about 25% when also considering early estimates and proxies developed by intermediaries.

The results of our analysis show that the eligibility disclosure is currently subject to some limitations; first, at the present time, the portion of eligible assets is calculated taking into account a limited range of assets in the portfolio. Intermediaries are currently able to report only the "specialized lending", i.e., a type of credit with an explicit purpose. In this case, in fact, the eligibility assessment is linked to the nature of the actual purpose of the loan, verifying its presence in the list of eligible assets in the EU Taxonomy. Moreover, general purpose lending exposures involve a more complex path of defining eligible assets: in this case, the use of proxies does not guarantee compliance with the regulations, since the collection of actual data (published in counterparties' non-financial statements) is required. This kind of information was not available for the analyzed reporting year.

Furthermore, the Taxonomy currently does not cover all activities performed by companies or financed by banks. Therefore, activities not covered (e.g., activities under one of the four non-covered environmental objectives) will be included in the denominator of the report only. Nevertheless, it should be noted that activities not currently included in the Taxonomy are not necessarily considered harmful to the environment. In fact, eligibility is a picture of the activities that fall within the scope of the Taxonomy: the actual sustainability of these activities will be assessed at a later stage, through the application of the three-level test, as indicated by the European legislator.

It should also be highlighted that the data covered by our analysis are the result of the first application of regulatory disclosure requirements; hence, the need to await further implementations in the process of data collection and reporting by institutions for an overall assessment. To date, it is not surprising that the highest degree of compliance and alignment with regulations has been achieved by Significant Institutions. In particular, there is a significant lack of data relating to companies not required to comply with the NFRD: these are smaller companies, but significantly more widespread than those that currently publish an NFS annually. In light of the above, a great improvement is expected from the full

implementation of the CSRD[22] which will oblige a considerably greater number of companies to report on sustainability. Furthermore, the obligation to adopt the EFRAG sustainability standards[23] at the EU level will allow greater comparison between European companies, allowing an extension of this analysis. Once the EU Sustainable Finance Package will be fully operational, it will be possible to quantify its effects on the financial system as a whole.

The present chapter provides a first step of investigation. According to our results, further steps will be needed by institutions in order to fully implement disclosure processes and assessment methodologies. In any case, this first exercise in implementing the new regulatory framework is an important step toward the goal of improving non-financial disclosure in order to support the development of sustainable finance.

Given the great relevance of the topic of non-financial information and its further developments, we believe there will be ample room for future research useful in defining the overall scenario.

References

Alessi, L., & Battiston, S. (2021). *Two sides of the same coin: Green Taxonomy alignment versus transition risk in financial portfolios*, Working Papers in Economics and Finance 2021/14, European Commission–Joint Research Centre, 2021, JRC128099.

Alessi, L., Battiston, S., Melo, S., & Roncoroni, A. (2019). *The EU sustainability taxonomy: a Financial Impact Assessment*. EUR 29970 EN, Publications Office of the European Union, Luxembourg, 2019. https://doi.org/10.2760/347810, JRC118663.

Battiston, S., Monasterolo, I., Riahi, K., & van Ruijven, B. J. (2021). Accounting for finance is key for climate mitigation pathways. *Science 372* (6545), 918–920. https://doi.org/10.1126/science.abf3877

Berg, F., Koelbel, J. F., & Rigobon, R. (2019). Aggregate confusion—the divergence of ESG ratings. *SSRN J*. https://doi.org/10.2139/ssrn.3438533(SSRNElectronicalJournal)

[22] The Corporate Sustainability Reporting Directive was eventually approved by EU Parliament on November 10, 2022.

[23] The first 12 final drafts of standards (as a result of the consultation process held during 2022) were sent for final approval to the EU Commission on November 23, 2022.

Billio, M., Costola, M., Hristova, I., Latino, C., & Pelizzon, L. (2021). Inside the ESG ratings: (dis)agreement and performance. *Corporate Social Responsibility and Environmental Management, 28*(5), 1426–1445. https://doi.org/10.1002/csr.2177

Dimson, E., Marsh, P., & Staunton, M. (2020). *Divergent ESG Ratings. JPM, 47*(1), 75–87. https://doi.org/10.3905/jpm.2020.1.175

Dumrose, M., Rink, S., & Eckert, J. (2022). Disaggregating confusion? The EU Taxonomy and its relation to ESG rating. *Finance Research Letters, 48*, 102928. https://doi.org/10.1016/j.frl.2022.102928

European Central Bank. (2022). *2022 climate risk stress test*.

EIOPA. (2021). *Insurers' sustainability reporting: EIOPA's technical advice on key performance indicators under Article 8 of the Taxonomy Regulation,* EIOPA-21–184.

Ilhan, E., Sautner, Z., & Vilkov, G. (2021). Carbon tail risk. *Review of Financial Studies, 34*(3), 1540–1571. https://doi.org/10.1093/rfs/hhaa071

Krueger, P., Sautner, Z., & Starks, L. T. (2020). The importance of climate risks for institutional investors. *Review of Financial Studies*, *33*(3), 1067–1111. https://doi.org/10.1093/rfs/hhz137

La Torre, M. (2022). *Banche e finanza sostenibile: per un business model Esg-oriented*, Bancaria, n. 5/2022.

La Torre, M., Cardi, M., Leo, S., & Schettini Gherardini, J. (2022). *ESG Ratings, scores, and opinions. The state of the art in literature*. Palgrave—Contemporary issues in sustainable finance 2022.

Lavecchia, L., Appodia, J., Cantatore, P., Cappariello, R., Di Virgilio, S., Felettigh, A., Giustini, A., Guberti, V., Liberati, D., Meucci, G., Piermattei, S., Schimperna F., & Specchia, K. (2022). *Dati e metodi per la valutazione dei rischi climatici e ambientali in Italia,* Questioni di economia e finanza, N. 732, Banca d'Italia.

Linciano, N., Soccorso, P., Guagliano, C., (ed.) (2022). Information as a Driver of Sustainable Finance. *The European Regulatory Framework*. Palgrave Studies in Impact Finance. https://doi.org/10.1007/978-3-030-93768-3

Lucarelli, C., Mazzoli, C., Rancan, M., & Severini, S. (2020). Classification of sustainable activities: EU taxonomy and scientific literature. *Sustainability, 12*(16), 6460. https://doi.org/10.3390/su12166460

Marullo Reedtz, P. (2022). *La tassonomia europea e il finanziamento della transizione ambientale*, Bancaria, n. 5/2022.

NGFS (2021), *Progress report on bridging data gaps*, May 2021. Available on: https://www.ngfs.net/sites/default/files/medias/documents/progress_report_on_bridging_data_gaps.pdf

Santamaria, R. (2022). *La vigilanza della Consob sull'informativa non finanziaria*, Rivista Trimestrale di Diritto dell'Economia, supplemento n.2 al n. 1/2022.

Shanaev, S., Ghimire, B., (2021). When ESG meets AAA: the effect of ESG rating changes on stock returns. *Finance Research Letters*. https://doi.org/10.1016/j.frl.2021.102302.

Steffen, B., & Schmidt, T. S. (2021). Strengthen finance in sustainability transitions research. *Environmental Innovation and Societal Transitions*. https://doi.org/10.1016/j.eist.2021.10.018. MSCI (2020): MSCI ESG ratings methodology.

CHAPTER 4

Sustainable Finance: A Quest for Value from ICO

Isabel Giménez Zuriaga

1 Introduction

Public banks are enjoying nothing less than a modern-day resurgence within neoliberalism and financialization. Decades of bank privatization advocacy have quieted as public banks have proven integral to smoothing out the 2008–2009 global financial crisis and in catalysing now desperately needed low-carbon and green transition financial investments (not to mention helping to overcome the crisis of COVID-19).[1]

[1] Griffith-Jones and Ocampo (2018), Mazzucatto (2018), UNCTAD (2019), Xu et al. (2019), McDonald et al. (2020, 2021), and Marois (2021).

The author's text corresponds to her personal opinions and assessments. In no case can it be interpreted as ICO's or FEBF's opinions.

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Yet without public banks that can be democratically commanded to work in the public interest, there is no hope of sustainable and equitable development, let alone green and fair transitions for people and planet, as financial investors manoeuvre to control the functions of public banks for private ends. For this reason, it matters how we think about public banks. A dynamic view opens the realm of the possible public interest while being realistic about the social forces at play and struggles to come.

By contrast, orthodox political views still try to constrain the potential of public banks and to gear what public banks currently do to supporting private interests and endless capital accumulation. This is the core message of the World Bank's Maximizing Finance for Development agenda and the **United Nations' Finance for Sustainable Development strategy**.[2]

In this new orthodox narrative, public banks must only wrap projects in public guarantees, bending themselves to underwriting acceptable levels of private returns by socializing their risks. Heterodox development views hold more diverse aspirations for public banks. There are calls for patient public finance and public development banks to green investments and to launch a global green new deal.[3] Others emphasize the necessity of building up public banking capacity and influence to confront the overwhelming power of private finance and global financialization.[4]

Too often, however, heterodox approaches graft specific roles and sets of expectations onto public banks, asserting a very particular vision of public banks' 'reasons to be' (notably, variations of 'additionality'). The problem is not one of imagining or advocating progressive roles and responsibilities for public banks. No. Rather, the problem lies in granting otherwise normative and contestable aspirations under a timeless status that in turn seemingly bestows fundamental meaning on a bank by virtue of it being 'public'. Far from catalysing positive change, this can overly constrain possibilities, obscure pitfalls and undermine meaningful democratization. A good reflection should be to think about what good is it to command a representative and democratic say over public banks if what they are meant to do is already predetermined.

[2] IMF and World Bank (2015), Badré (2019), and UN IATF (2019), cf. Dafermos et al. (2021).

[3] Mazzucato and McPherson (2018).

[4] Beitel (2016), Marshall and Rochon (2019), and Brown (2019).

Similarly, it is a strategic mistake to assume that, by virtue of being publicly owned, any institution, let alone public banks, will advance a green and just transition for people and planet without supportive and motivated social forces actively shaping the institution and holding it accountable to the democratic public interest. At a time when public banks are resurgent, it is a blunder of colossal proportions to either dismiss the creative energies of pro-public social forces or to underestimate the structural power of private interests to bend public banks to their own accumulation ends. Hence, the practical need to rethink the role of public banks.

An alternative dynamic view thus matters because in rethinking public banks, it internalizes struggle and acknowledges the normative orientations of contending social forces. It looks to the historical and material conditions of public banks' reproduction. By doing so, a dynamic view allows us to see the operational contradictions of public banks and understand the relationships of power and politics at play within class-divided, gendered and racialized society. In this way contending public and private interests can be brought into the light as we act on the possibilities for change. It follows that a dynamic view does not rest upon any conceptual surety that a public bank, by virtue of being public, is meant to do this or that. Nor does a dynamic view blithely right off the catalytic and public interest potential of public banks merely because they are deemed ultimately corrupt and essentially inefficient. Instead, a dynamic view concedes that this cannot be known in advance.

Rather, how public banks function and for whom are the results of historical social forces acting within the shadow of capitalism? The functions that public banks do inform the evolving meaning of being a public bank. For those social forces concerned with a green and just future for people and planet, this historically and evidence-based conceptualization opens the possibility, if never the necessity, of public banks being made to respond in the public interest. It also accepts that public banks can be made to privilege environmentally destructive and decidedly unjust ends. What a public bank is ultimately depends, and that, in the final analysis, is what is most liberating about a dynamic view of public banks and why it matters.

For all but the most hard core of climate change deniers, the environmental challenge before us is real and substantial. We must transition from our current carbon-intensive and environmentally destructive regime to a low-carbon, environmentally resilient one. On this point, mainstream

and radical perspectives converge. Divergence appears when discussing the nature and extent of change needed.

Mainstream commentators focus on technical fixes and market-friendly mechanisms. Critics, radical scholars, activists and civil society organizations argue for a more substantive socioeconomic transformation process. It could be a good approach to take a look at some academic papers recently published by the Transnational Institute in order to capturing the popular desire for more substantive environmental change in the concept of 'energy democracy', which has emerged out of activist and community struggles.

The case for energy democracy demand more decentralized and socially controlled energy systems, which may be realized as smaller-scale local initiatives provided by cooperatives and community associations or as larger-scale initiatives provided by municipal and state-owned providers. The lynchpin remains the substantive democratization of energy generation and distribution based on renewables.

For many, energy democracy is necessary. But alone it is also insufficient. Any green transformation requires funding. And if the financing social does not share the same societal or public interest orientation, then the struggles for green transformation are likely to be stillborn. Money may trump even the best of intentions. Public and 'public-like' cooperative banks may therefore hold the key to the future of a just global green transformation and energy democracy.

The current global context is favourable to raise the potential for public banks to support a green energy transition because the 2015 UN Sustainable Development Goals (SDGs) and Paris Agreement on climate change (COP21) both stress the need for investment in sustainable infrastructure. 'Sustainable' in this context is intended to align new infrastructure with the requirement of keeping climate change 'well below' 2 °C (while also delivering on 'development', which will be a major challenge).

An estimated US$5–7 trillion per year is needed to realize the SDGs.[5] To date, the international financial institutions (IFIs), such as the World Bank, have done relatively little financing in this direction.

Today, the energy transformation debate goes hand in hand with global demands for new infrastructure, estimated to be in the range of US$90 trillion. Ideally for mainstream authorities like the World Bank, this

[5] UNEP (2015).

new infrastructure should be low-carbon and climate-resilient. Their first problem, however, is how to actually finance this new infrastructure, be it green or otherwise. The hoped-for private sources of capital have simply not materialized. This is not for lack of resources but because financiers prefer shorter term, lower risk and more conventional investments.[6]

Rather than absorbing the investment risks themselves, private investors want public banks to invest with them in new infrastructural projects. That is, the private sector wants public banks and public finance to 'wrap' green infrastructure projects in public guarantees so as to socialize the risks while allowing the privatization of the returns.[7]

The IFIs appear all too eager to comply. Public banks, once the bugbears of most international development institutions, now seem to offer the financial panacea.[8] Instead of investing themselves, according to this narrative, public banks should help leverage private capital investment. The idea has become popular. As stated in the 2015 **UN Addis Ababa Financing for Development Report**: '*We note the role that well-functioning national and regional development banks can play in financing sustainable development*'.[9]

Yet mainstream understandings of a 'well-functioning' public bank share little with the needs of energy democracy—focused, as they are, on securing higher and more stable returns on investment for private investors. This trajectory will mean further subordination of the environment to corporate financial ends. Alternative, progressive and collective efforts are needed to stem the private capture of public banks. The payoff of such a campaign could be substantial for energy democracy. There is context to this public bank resurgence. Despite 40 years of neoliberal privatization efforts, public banks remain major actors at the global, regional, national and provincial levels. There are today 586 'public' banks across the globe, and their combined resources are massive. Public banks account for a quarter of all banking assets, worth some $35 trillion—an amount equal to 46% of global GDP.[10]

[6] EPSC (2017) and Financial Times (2016).

[7] Levy (2017).

[8] OECD (2016).

[9] UN Assis Ababa Financing for Development Report (2015).

[10] Orbis (2017) and World Bank (2012).

Public banks often embody important cultural and historical legacies. Governments and communities have long relied on public banks to channel financial and non-financial support to development initiatives.[11] This is not to say that public banks are without problems and challenges, but often the negative charges levelled against public banks are more ideologically driven than evidence-based.[12] There is real potential for public banks to lead and support popular struggles for green transformation and energy democracy.

This paper will describe and analyse ICO's role over Spanish economy as sustainable public bank.

ICO is a Madrid-based Spanish state-owned bank attached to the Ministry of Economy Affairs and Digital Transformation, via the State Secretariat for Economy and Enterprise Support.

ICO's main purpose is to promote economic activities that contribute to the growth and development of the country while improving the distribution of wealth, in particular activities of a social, cultural, environmental or innovative significance, which are deemed to be a priority. The active promotion of sustainable development that preserves and respects the environment is particularly important for the institution (Fig. 1).

As a *state-owned bank*, ICO provides loans to Spanish companies' investment funds and liquidity needs for their domestic and international operations through ICO's direct funding and second-floor facilities (Fig. 2).

As *Instrument of Economic and Financial Policy*, ICO has a long track record of collaboration with all levels of the Kingdom of Spain government and its ministerial departments, as well as with European institutions. Those collaborations include:

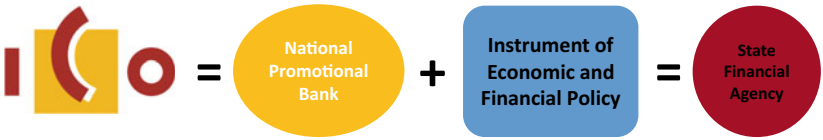

Fig. 1 ICO's framework structure (*Source* ICO Green Bond Framework. June 2021)

[11] Schmit et al. (2011).

[12] Marois (2013).

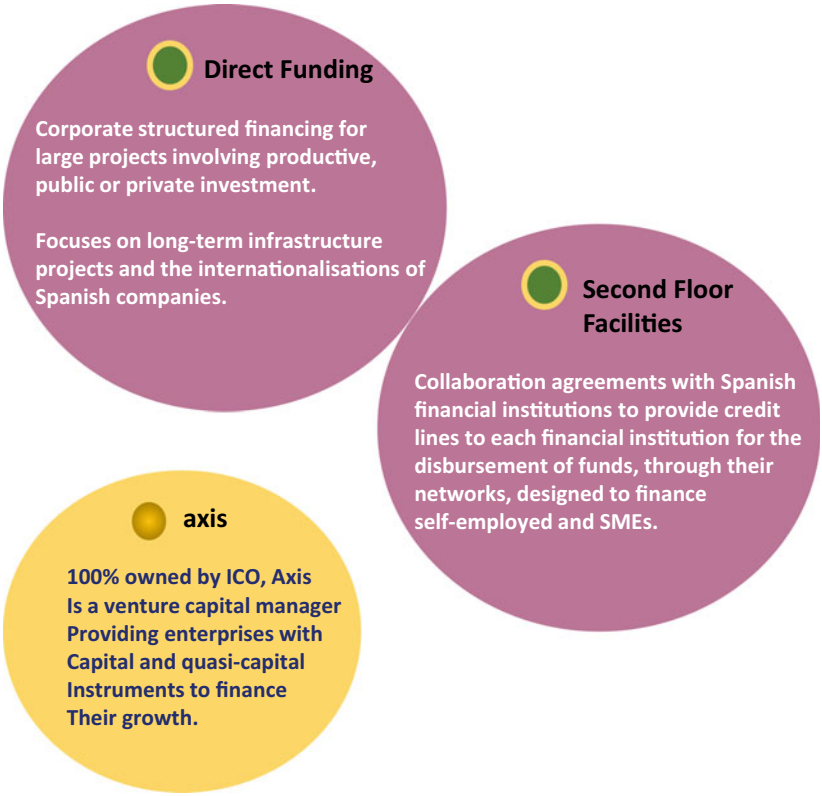

Fig. 2 ICO's Direct Funding and Second-floor Facilities (*Source* ICO Green Bond Framework. June 2021)

- Joint implementation of initiatives launched by Ministries.
- Collaboration with European institutions: EIB, EIF, EFSI, etc.
- Accredited European Commission's Implementing Partner to manage European funds under the Invest EU Programme and other EU Programmes.
- Public-Private Association in projects and initiatives by public and private institutions.

As a *State Financial Agency* (off-balance sheet) of the Spanish State, ICO manages the official financing instruments for the promotion of exports and development.

- Internationalization: Fondo para la Internacionalización de la Empresa (FIEM, Corporate Internationalisation Fund) & Contrato de Ajuste Recíproco de Intereses (CARI, Reciprocal Interest Adjustment Contract) on behalf of MINCOTUR (Ministry of Industry, Trade and Tourism).
- Corporate Financing: Fondo de Promoción del Desarrollo (FONPRODE, Development Promotion Fund) and the Water Fund on behalf of the Spanish Agency for International Development Cooperation (AECID).
- Territorial Funds: For regions and local authorities on behalf of MINHAP (Ministry of Finance).

In its triple function as a national promotional bank, instrument of economic and financial policy and financial agency of the State, in 2020 ICO focused all its efforts mobilizing finance for the business network to mitigate the economic impact after COVID-19.

ICO has performed an important role during the COVID-19 pandemic crisis. During this exceptional period, ICO has managed the financial instruments approved by the Spanish Government, primarily the Guarantee Lines, in an unprecedented public-private collaboration scheme. It has simultaneously maintained and increased its usual activity to make all its financing instruments available to the self-employed, SMEs and companies, and has also worked to develop new programmes and equip itself with new capacities.

This support has been provided through the following instruments:

a. COVID-19 Liquidity Guarantee Line
b. Tourism Sector specific second-floor facility
c. COVID-19 Investment Guarantee Line
d. COVID-19 Direct Loans
e. Corporate Short-Term Debt Purchase and Guarantee Programme for Mid Caps
f. COVID-19 Leasing Guarantee Line.

In the last 50 years of history, ICO has raised resources in the markets to finance its activity. Since 1996, this fundraising has taken place in international markets and it was in 2015 that it reached a new milestone when the ICO entered the sustainable bond market, with the launch of the first social bond issued in Spain for €1,000 million.

Subsequently, in 2019, the ICO entered the green bond market with the launch of the first bond amounting to €500 million. The funds raised with this issue have contributed to mobilizing more than €4,000 million in financing for projects that have generated an estimated saving of 315 tons of CO_2 emissions.

Since then, ICO has established itself as a fundamental player in this market at a European level, with nine issues of sustainable bonds (7 social and 2 green) for €4,550 million. This prominent role of the ICO in the sustainable bond market has allowed it to recently join the Nasdaq Sustainable Bond Network (NSBN), a platform that centralizes relevant information on sustainable bond issuers and operations around the world with the aim of promoting transparency in this market.

These issues are being used to finance operations that generate a positive social or environmental impact. In the case of social bonds, the ICO allocated the funds from the first issuances to finance projects of micro-enterprises and self-employed individuals located in Autonomous Communities with an income below the Spanish average, with the aim of promoting inclusive economic growth and improvement in the distribution of income. The last issuance of social bonds launched by the ICO in May 2020 was used to finance operations of the self-employed, SMEs and companies that contribute to mitigating the social and economic impact of the COVID-19 pandemic.

In the case of green bonds, the funds raised are used to finance projects in the fields of renewable energy, energy efficiency, clean transportation, pollution prevention and control and sustainable management of natural resources.

2 ICO's Sustainability Police

2.1 Objective

For ICO Group, sustainability is a basic guideline pillar of its activities, in line with article 2 of ICO's statutes, both in its assets and liabilities operations, as well as its internal management of the organization, and

from the perspective of governance and Corporate Social Responsibility (ESG CSR). Therefore, it involves all areas of the organization and its activity, acting as a foundation of management that allows it to fulfil its mission as a public and promotional bank.

With this policy, ICO conveys the coherence that exists between the management of its operations and the needs of society and the environment, and socializes its commitment to sustainability.

In this sense, this Sustainability Policy determines a general framework for action complemented by the rest of the internal policies that govern ICO's activity, and in particular:

- Environmental Policy
- Direct Financing Policy
- CSR Policy
- Equality Plan
- Code of Ethics and Conduct
- Internal Code of Conduct in the Stock Market.

2.2 ICO's Mission

ICO is a bank and corporate state-owned entity whose purpose, as expressed by its statutes is 'sustaining and promoting economic activities that contribute to growth and to **improving the distribution of national wealth** and, in particular, promoting those activities that merit promotion because of their **social**, cultural, innovative or **ecological importance**'.

In this context, ICO Group considers that sustainability in its environmental, social or governance aspects is a basic guiding pillar of its actions, due to the growing interrelationship with its mission and objectives.

Firstly, this mission is reflected in its lending activity as a bank for financing and promoting business activities that foster a solid, competitive and sustainable business fabric. ICO plays a key role and is a reference point in the financing of all Spanish companies, particularly SMEs, the self-employed and entrepreneurs, promoting their growth in Spain, internationalization in third markets and contributing to the generation of employment and social welfare.

Moreover, because of its public nature and its vocation to cover social needs, ICO considers those financing operations that have a positive impact on people, the climate and the environment to be a priority.

Secondly, as an instrument for financing economic policy, ICO will act following the fundamental lines established by the competent Government bodies and subject to the rules and decisions adopted by its General Board.

Within these two functions, the role that ICO will have to play as an instrument of support for Spanish and European energy and climate policy is particularly relevant. As is happening in the rest of the financial sector, especially by other promotional banks, progress will be made in aligning ICO's balance sheet, operations and activity with its climate action, thus taking advantage of the opportunities it offers both for the Spanish economy and for the financial sector itself.

As a consequence, ICO will actively contribute to the decarbonization of the Spanish economy through the decarbonization of its own portfolio. Furthermore, this will enable it to limit the risks and fully exploit the opportunities arising from the ecological transition process, and contributing to the rest of the financial sector and society.

Thirdly, as a State Financial Agency, ICO also contributes to social, economic and environmental development by managing various official financing instruments on behalf of the State which are dependent on various Ministries. In this sense, with the instrumentation and management of a variety of funds and instruments, ICO promotes the internationalization of the company in third countries by managing funds dependent on the Secretariat of State for Trade (FIEM, CARI), promotes cooperation for development by managing funds dependent on the Spanish Agency for Cooperation for Development (FONPRODE, FCAS) and contributes to the financial sustainability of the Autonomous Communities and local entities by managing funds dependent on the Ministry of Finance (Territorial Funds of the Autonomous Communities and Local Governments).

2.3 Commitment to Sustainability

ICO promotes growth by financing business activities that contribute to the generation of employment and economic development, both in Spain and in third countries, aligning itself with the 17 Sustainable Development Goals of the United Nations' Agenda 2030, with the Paris Climate

Agreement (COP 21), and with the United Nations' Guiding Principles on Business and Human Rights, all of which have been signed by Spain and implemented at European and national level.

In line with these guidelines, ICO expresses its commitment to:

- The promotion of a sustainable business fabric that generates employment, social welfare and positive environmental impact.
- The integration of Corporate Social Responsibility into ICO, as the backbone of the whole organization, as well as transparency and good governance, and the promotion of sustainability in all business activities within its reach and over which it can exert an influence.
- Respect for Human Rights and the preservation of the surroundings, the environment and biodiversity, in the framework of its activity as financier and along its value chain.
- The fight against climate change, the promotion of a low-carbon economy model and the mobilization of resources, financing and investment towards sustainable activities, aiming to play a particularly active role in the field of renewable energies and energy efficiency and saving projects.
- The promotion of proper management of financial risks arising from climate change, and the social and environmental impacts associated with its activity.

To carry out these commitments, ICO works in partnership and collaboration with other multilateral and regional investment and development banks and counterpart promotional banks in third countries and at EU level, sharing good practices and management models with the private credit institutions that it supports and complements in its work to make business financing more dynamic.

For ICO Group, *sustainability* is a basic guiding pillar of its actions, and involves all areas of the organization and its activity, acting as a foundation that allows the company to fulfil its mission as a public and promotional bank.

Sustainability is also the core of ICO's strategic reorientation,[13] and constitutes a multidimensional challenge, summarized through the Sustainable Development Goals, the Agenda for Change and the European Green Deal.

As a concrete step of its strategy, ICO, with the structural assistance of the European Commission, defined a *Sustainable Finance Action Plan* in July 2020.[14] This plan concluded the need to provide the institution with a *Sustainability Task Force* with representation from all the General Directorates of ICO and all the entities of ICO Group (Axis and Fundación ICO) to promote, coordinate and contribute to the development of the different actions of the group in terms of sustainability. Additionally, a Sustainability Area has been created to evaluate and promote the different actions carried out in terms of sustainability and in charge of the coordination of the Task Force.

Through public-private partnerships, ICO will seek to maximize the positive impacts generated in its activity and to work in harmony with the financial sector, capital markets, civil society and the third sector for a more sustainable economic model and compliance with global sustainability agendas.

For these purposes, ICO has signed the Spanish Collective Commitment to Climate Action,[15] under which the signatories commit to:

- Reduce the carbon footprint of their portfolios by prioritizing the necessary actions with special attention to the sectors with the greatest impact.
- Engage their customers in the transition to a low-carbon economy.
- Join efforts and work together to develop the capacities and methodologies needed to measure climate impact and align with global and national climate objectives.

[13] https://www.ico.es/documents/15125/1926935/ICO+Strategic+Realignment+2019-2021/5c6f5e34-5b66-48c8-9202-aad4aff71d94.

[14] UE: Sustainable Finance Action Plan. July 2020.

[15] Signed by ICO on 9 December 2019 within the framework of COP25 in Madrid, along with the Asociación Española de Banca (AEB), CECA and a score of Spanish financial institutions. https://s1.aebanca.es/wp-content/uploads/2019/12/spanish-collective-commitment-to-climate-action.pdf.

- Develop, together with governments, scenario experts and stakeholders, specific road maps by sector and geography that are clear, feasible and contribute to the objective of keeping the temperature increase well below 2 °C with respect to pre-industrial levels, aiming for 1.5 °C.
- Establish and publish portfolio alignment goals and objectives, specific to each sector and scenario-based, before December 2022.
- Publish and implement, together with its customers and from December 2020, measures to support and accelerate the transition of society and business models towards low-carbon economy and technology adapted to climate change.

2.3.1 Responsible Lending Statement

The activity of the financial sector and ICO's role as stated-owned bank must contribute to and encourage the successful transition to a low-carbon economy and the achievement of the Paris Agreements and Agenda 2030.

ICO is aligned with the European guidelines on sustainable finance and considers all those operations that contribute most to sustainable economic development to be a priority. In this sense, ICO identifies the business activities and projects that have the greatest positive social and environmental impact both in Spain and in third countries.

For this purpose, ICO defines the Group's activity and financing objectives, giving priority to:

- **Sustainability**: Climate Change and the environment (reducing emissions, renewable energy, energy efficiency and transition, waste treatment and reduction, water management…); sustainable infrastructures and circular economy.
- **Competitiveness**: Digital transformation, innovation and technological development.
- **Supplementary funding for SMEs**, for entrepreneurship and start-ups, and for the growth and internationalization of Spanish companies.
- **Social welfare and development** by financing employment-generating activities and participating in public and private initiatives that promote social inclusion and the reduction of inequalities.

ICO will align its lending with the SDGs and develop metrics and indicators to report on its contribution to Agenda 2030, highlighting the SDGs especially related to its activity. In addition, in order to provide information to its stakeholders and contribute to the implementation of a common language on sustainability that promotes the reorientation of capital flows towards these activities, ICO will identify the green projects it finances in accordance with the **European Union Taxonomy** or internationally recognized standards. It will also ensure adequate management of the risks and impacts of the projects it finances by applying recommendations, international performance rules or standards, such as the **Equator Principles**.

Taking into account the values and mission which underpin ICO, in October 2016, it voluntarily adhered to the Equator Principles with the aim of improving its social and environmental risk management system on large financing projects and identifying and mitigating any potential negative impacts which these projects could cause on the environment, on people and on the climate.

ICO's public nature and mission require it to promote and encourage best management practices which contribute to a sustainable business fabric and the fight against climate change. By adhering to these Principles, ICO positions itself among the leading banks in the drive towards sustainable and responsible financing.

Since Equator Principles were implemented in ICO in 2017, including new obligations in its regular operations approval and management processes, social and environmental risks of operations falling under the 'scope' of the Equator Principles are being rigorously analysed, and the Principles are applied to new financing projects in all countries and economic sectors (Fig. 3).

In this regard, ICO undertakes to publicly disclose all the projects financed which fall under the 'scope' of the Equator Principles annually, following the reporting guidelines indicated in the Principles themselves.

Furthermore, insofar as ICO wishes to be a relevant actor in the implementation of the various instruments and policies within the Multiannual Financial Framework of the European Union, it undertakes to adopt the necessary measures to develop a methodology to identify, quantify and measure the impact of its activity on sustainability in a coordinated manner and in line with the regulations established in the framework of the EU.

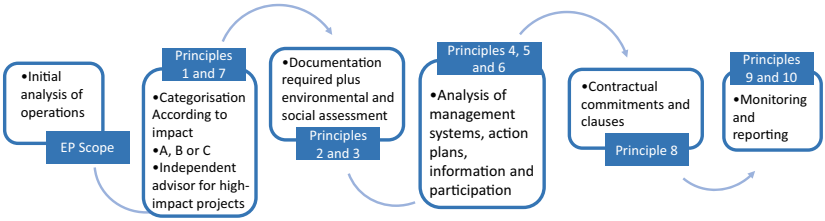

Fig. 3 ICO's Equator Principles (*Source* ICO Green Bond Framework. June 2021)

ICO considers it essential that the management of risks associated with projects consider the assessment of environmental and social impacts as well as those related to climate change and human rights. This allows for improved financial results, minimizing costs to people and the environment, and contributing to the achievement of global sustainability commitments.

As a financier, ICO will work together with the project promoters, and with the other banks participating in each operation, to identify, assess and manage environmental, social and climate risks, as well as their monitoring, throughout the project's life cycle.

In this regard, ICO is committed to maintaining and reviewing its financing and risk policies to ensure the improvement of due diligence processes and guarantee that best practices are applied.

ICO will assess the recommendations of the **Task Force on Climate-related Financial Disclosure (TCFD)** in the financing of projects and with particular regard to the transition and physical risks that could be related.

In this regard, and within the framework of the agreements signed with other financial institutions on sustainability, ICO is committed to measuring and reducing its portfolio's carbon footprint.

2.3.2 Exclusion of Activities

Based on the principles of action, detailed in its policy, and in order to lead the transition towards a sustainable economic model in partnership with other financial institutions or promotional banks, ICO will not finance the following activities:

- Illegal activities according to the legislation applicable to the operation in question or according to international agreements and conventions.
- Projects that could result in the violation of human rights or the limitation of individual rights and freedoms. Nor will it finance those projects that do not comply with national, European or local environmental legislation, or IFC standards or OECD guidelines where this is a better reference.
- Projects that do not respect labour rights in general and in particular rights on child labour, discrimination and forced labour, on the basis of the fundamental conventions of the International Labour Organization (ILO).
- Activities linked to pornography and/or prostitution.
- Lethal weapons, munitions and dual-use goods, except for the financing of the manufacture and marketing by an EU or NATO country of parts, components and subsystems intended for non-lethal defence equipment. Exceptionally, when it is considered to be in the national interest, and after consultation with the Ministry concerned and after justification and approval by ICO's General Board, dual-use goods may be financed with third countries.
- Companies on the relevant sanctions lists, in accordance with the Policy on Prevention of Money Laundering and Terrorist Financing.
- Projects that may generate negative social, environmental or climate impacts, where the promoter does not adopt the necessary measures for their adequate management and mitigation.
- Projects that do not comply with the social and environmental standards that ICO has established in its internal procedures or do not meet the criteria and limitations established in ICO's direct financing policy.
- ICO's direct financing policy may establish additional conditions to those provided for in this section with regard to sustainability, whether based on European commitments, the application of international standards or other specific conditions that may be agreed.

2.3.3 ICO and Its Commitment to SMEs: Financing, Awareness and Alignment

The objectives set at global level require the commitment of small and medium-sized enterprises in order to be achieved. The **Agenda 2030** and

the **Paris Climate Agreement** require the active participation of SMEs, which in Europe represent more than 98% of the total business fabric.

Disinformation and limited economic and human resources represent a barrier to the alignment of these small and medium enterprises with the SDGs and Agenda 2030. In order to meet these challenges, companies will have to incorporate changes in their management systems to enable the transformation to a low-carbon and sustainable economic model in the long term.

ICO is aware of this situation and has a key role to play as a reference in the financing of all Spanish companies, and particularly of SMEs, the self-employed and entrepreneurs. On the basis of this relationship, ICO, with the necessary collaboration and coordination with the financial entities collaborating in the credit lines and with other *collaborating agents in matters of sustainability*, is committed to promoting actions of information, dissemination, guidance and support that smooth this transition towards the new economic paradigms represented by the SDGs and the Paris Climate Agreements.[16]

2.3.4 Commitment to Sustainable Development of Financial Markets

To finance its activity, ICO issues bonds on the capital markets. Over the years, ICO's vocation of public service and its commitment to the long-term and sustainable development of the economy has generated confidence in the financial markets which has enabled it to finance its activity successfully.

ICO has been a pioneer in Spain in issuing **social bonds**, in which it is already a reference point, and with which it has obtained funds to promote business activity in the most disadvantaged areas nationally, and to influence the creation and maintenance of employment.

In 2019, ICO was also recognized for its first **green bond** issue to finance projects related to renewable energy, energy efficiency, clean transport, pollution prevention and control and sustainable management of natural resources.

[16] In this line, ICO has already created a web space together with the Spanish Global Compact Network to involve Spanish SMEs in the achievement of the Agenda 2030 https://icopymeods.ico.es/.

ICO is involved in the sustainable evolution of capital markets, working alongside the main associations, such as the ***International Capital Market Association*** **(ICMA)**, in its implementation of standards and principles that contribute to directing capital flows efficiently and transparently towards sustainable development.

In this regard, it should be noted that the ICO has been the only national promotional bank in Europe and the only Spanish entity that is part of the ICMA's Advisory Committee for social and green bond principles, which accredit the prestige and recognition that its work as a responsible bond issuer has generated.

ICO is committed to following this line of action that aims to provide value through the development of sustainable financial instruments, to exerting influence so that all the actors in the markets are united in responsible investment and to promoting partnerships and synergies that allow the redirection of capital flows to sustainable and low-carbon investments.

Finally, it should be noted that for ICO, transparency and communication with its investors is the key to building confidence that the funds obtained through ICO issues will be used to promote and finance business projects and public-private partnership initiatives that contribute to sustainability, both in Spain and abroad.

2.4 ICO's Commitment to Its Employees

ICO's most important asset is its human and intellectual capital, committed professionals who drive the organization every day towards achieving its mission in an environment of collaboration and trust.

As regards the relationship with the professionals who make up its organization, ICO expressly commits to:

- The Universal Declaration of Human Rights and the International Labour Organization Declaration on Fundamental Principles and Rights at Work.
- Freedom of association and effective recognition of the right to collective bargaining.
- Equal treatment and opportunities between men and women and the fight against all forms of discrimination.
- The conciliation of work, family and personal life.
- Professional development and training.

- Workplace health and safety.
- Balancing professional activity with respect for the environment.
- The inclusion of groups with functional diversity in social and work contexts.
- Corporate volunteering to be developed through collaboration agreements with social entities.

ICO has the **'EFR' family-responsible company seal**, which certifies that it has an effective model for managing its balancing processes. This certification is based on evaluation and continuous improvement and promotes the application of conditions of flexibility, harmony between family and professional life, equal opportunities, communication channels with employees and quality at work.

ICO undertakes to expressly inform and train its employees on the sustainable management of its activity, in all its facets; environmental, social, human rights and climate.

ICO has established a **Management by Objectives System** in which the variable remuneration of all its staff and senior management is directly linked to specific sustainability objectives. This facilitates the express alignment of the organization with the commitments made in this area and guarantees progress in the established lines of action.

2.5 Good Governance and Transparency

2.5.1 Corporate Governance and Compliance

The bases of corporate governance in the ICO Group, and in particular the functions, responsibilities and powers of the governing bodies and decision-making committees, as well as their appointment and functioning, are set out in the internal regulations, decision-making procedures or the corresponding by-laws of ICO or its subsidiaries.

In the development of its activity, ICO complies with the provisions of its by-laws, internal regulations, procedures and the applicable legislation. Where convenient and appropriate, it adheres to standards or good practices that go beyond those required by the applicable regulations.

The **General Board** provides the guidelines for sustainability. As the highest decision-making body, it is committed to independence and impartiality in its decision-making. It has four **independent directors** among its ten members, who do not belong to the public sector but

are not linked to the financial sector either. In addition, these directors have double voting rights for decisions relating to financial transactions involving the assets and liabilities of ICO's business.

All members of the board must meet requirements of commercial and professional integrity and must always act in the interest of the institution and in accordance with a set of referred principles of impartiality and confidentiality, avoiding actual and potential conflicts of interest, both direct and indirect.

The internal control systems address and ensure the prevention of money laundering and the financing of terrorism, corruption and fraud and the protection of personal data, and regulate the use of privileged information through the Code of Ethics and Conduct and the Internal Regulations of Conduct in the Securities Market. ICO is a signatory to the 10 Principles of the Global Compact and is committed to fighting corruption in all its forms, including extortion and bribery.

ICO has a **Code of Ethics and Conduct** which defines and develops the basic foundations of ethical behaviour and the necessary action guidelines expected from its directors, managers and employees in the relations established with ICO staff, customers, suppliers and third parties. These guidelines include mandatory rules on the acceptance of gifts, invitations or benefits.

ICO is committed to the OECD recommendation on public integrity to promote accountability and the general interest, through the proper management of conflicts of interest, the introduction of transparency measures in lobbying activities, ensuring in all cases, transparency and the participation of all interested parties. The Direct Funding Policy will establish the conditions and limitations in this respect.

2.5.2 Responsible Public Procurement

ICO, as a public entity, is subject to the law on public sector contracts. By virtue of these regulations and in application of the principles that govern its activity, the contracting of ICO, in addition to being a purchasing procedure, serves as an instrument to implement both European and national policies in social, environmental, innovation and development matters, as well as the promotion of SMEs and the protection of competition.

ICO is committed in its tendering processes to efficiency in public spending and respect for the principles of equal treatment, non-discrimination, transparency, proportionality and integrity.

Social responsibility criteria are incorporated into its contracting, in which for the awarding of the contract, the socially responsible practices of its suppliers are evaluated, especially those oriented towards the creation of long-term employment, the establishment of equality and conciliation policies among its staff, the contracting of people at risk of social and labour exclusion and respect for the environment.

ICO attaches particular importance to suppliers' compliance with human rights, labour and environmental regulations. ICO has appropriate measures in place to combat corruption, fraud and favouritism, as well as to prevent, detect and effectively resolve conflicts of interest that may arise in tendering procedures.

ICO requires from its suppliers quality certifications, environmental and social labels and seals to accredit the sustainability of the products and services they offer, which is an effective instrument to evaluate and guarantee these aspects.

As a public business entity, part of its contracting is subject to centralized purchasing processes, according to Order EHA/1049/2008, of 10 April, which makes it compulsory to contract through the Directorate General for Rationalisation and Centralisation of Public Procurement. This contracting complies with the standards and principles outlined above.

In addition, the ICO Group promotes the social and labour integration of groups at risk of exclusion by contracting goods or services through Special Employment Centres.

2.5.3 Internal Management

ICO has at its facilities the necessary means to segregate and recycle the waste generated in the development of its activity and seeks to use ecological and recycled materials.

It also carries out periodic awareness campaigns on the consumption of light, water and paper in order to ensure the responsible use of these resources by employees in the workplace and to transfer these habits to the personal sphere. In this process, employees are invited to suggest improvements that allow for a more efficient use of resources.

A relevant objective for ICO is to avoid and reduce greenhouse gas emissions as much as possible. This is achieved through the implementation of energy-saving measures, and the use of energy from renewable sources in the heating and air conditioning of its offices. In addition, in order to reduce its carbon footprint per employee, it promotes the use of alternative means to travel, such as video conferencing, and seeks to minimize travel as much as possible.

2.5.4 Communication and Transparency

For ICO, dialogue with its stakeholders in relation to sustainability is a fundamental key for its business and activity. ICO informs its stakeholders of its activities and its financing in a transparent manner and maintains open channels of communication to obtain comments and contributions, which enable it to continue improving its sustainability management, identify business opportunities and avoid or identify risks.

ICO provides its stakeholders with all relevant information regarding its organizational structure and activity, and it prepares its reports in accordance with internationally recognized standards, such as the Global Reporting Initiative (GRI), under which it prepares its sustainability report. In addition, and in accordance with the provisions of the Transparency Law, it provides direct access to the Transparency Portal of the Government of Spain so that interested parties can consult the information and data available.

Finally, ICO reiterates its commitment to continue incorporating the best practices in good governance, transparency and internal management, as well as in improving its information, indicators and reporting, especially those related to sustainability and its contribution to the achievement of the SDGs, the Paris Climate Agreements and the impact of its activity.

2.6 Scope, Coverage and Revision

ICO's General Council approved this Sustainability Policy at its meeting of 27 February 2020 in order to make known the commitments of ICO in this matter. It will be published on ICO's website and will be available to all interested parties.

This policy has been prepared by ICO, and is applicable to its activity and management practices, and it's the main reference for the rest of the

entities of the ICO Group, Axis and ICO Foundation, given the different activities they develop and the rules that regulate them.

ICO's Management assumes the commitment of keeping the Sustainability Policy updated, reviewing it when there are modifications in the management of ICO's activities, or facts that force its adaptation to the current reality. In any case, the update will be made at least every three years.

2.7 Axis Sustainability Approach

Sustainability criteria have been implemented throughout ICO Group, including Axis, the **ICO's Venture Capital Manager**, through these three financial instruments:

Fond-ICO Global Investments in funds that invest in companies of all sectors that incorporate a component of innovation. Sustainability and digitalization have been included as evaluation criteria in this 4.5 billion € fund of funds.

Fond-ICO Infrastructures II Endowed with 400 million €, and managed by Axis, this fund will invest in sustainable infrastructures (transport, social infrastructure and energy and environment) directly or as fund of funds, in Spain and abroad when there is any Spanish interest involved.

Fond-ICO Pyme This fund, worth 250 million €, has five activities: (1) Business Angels, (2) COVID-19 Entrepreneur Ecosystem, (3) Sustainable and Social Impact Initiative, (4) Diversified Debt Funds and (5) Direct Investment and Fund of Funds (until 2013).

This fund is focused on promoting innovative sources of funding for SMEs and a new ecosystem activity. In 2019, Axis launched a new initiative for sustainability and social impact through Fond-ICO PYME worth 50 million €.

This initiative promoted the creation of funds devoted to invest in companies developing projects with a significant social and/or environmental and circular economy impact. The remuneration of the fund manager (carry interest) is linked to the performance of impact indicators for each company in its portfolio.

Since this initiative was launched, Fond-ICO Pyme has invested in CREAS IMPACTO (5 million €), Q-IMPACT (5 million €) and B-SOCIAL (5 million €) with an expected mobilization of 125 million

€ for Spanish impact SMEs focused on health and well-being, environmental sustainability, education and social innovation, whose activity has a measurable social impact.

In addition, AXIS collaborates with Spain NAB, National Advisory Board on Impact Investment, related to the *Global Steering Group for Impact Investment—GSG*.[17] The GSG was established in August 2015 to continue the work of the Social Impact Investment Taskforce established under the UK's presidency of the G8. It currently covers 33 countries and brings together impact leaders from finance, business, government and philanthropy. AXIS also belongs to the Impact Committee of the Spanish Association for Private Equity and Venture Capital (ASCRI).

3 ICO's Participation in National and International Sustainable Initiatives

1. National initiatives
2. International initiatives

ICO analyses, promotes and integrates main market trends in sustainability and CSR fields, including global agreements and development guidelines for which the international community is committed to, as illustrated below:

ESG principles on responsible investment govern ICO's external corporate social responsibility policy, through joint work with other institutions and initiatives, as well as its compliance with various national and international commitments of the financial industry and the public sector related to sustainability.

In relation to sustainability, ICO acts in a coordinated manner at the European Community level with other National Promotional and Development Banks. In 2019, the ICO has committed to the following two initiatives:

[17] GSG (2021).

3.1 National Initiatives

3.1.1 ICO's Foundation

Foundation ICO, together with UNED carried out a *Study on Circular Economy and SMEs*[18] with the aim of being a practical tool capable of providing solutions to real problems faced by Spanish SMEs when launching initiatives and practices of this nature. The result of this study has been the document 'The transition to the Circular Economy. Guide for SMEs'.

a. **Spanish Network of the UN Global Compact:** ICO is a member of the Red Española del Pacto Mundial (REPM) and a signatory of its 10 Principles since 2005, and has been part of its executive committee since 2010.

The mission of the Spanish Network of the Global Compact is to:

- Promote business sustainability through the establishment of 10 universal principles of conduct and action in the field of Human Rights and Business, labour standards, the environment and the fight against corruption.
- Strategize and promote daily actions of all types of entities and thus favour the achievement of Sustainable Development Goals (SDGs). Currently, the United Nations Global Compact (UN Global Compact) is the largest voluntary initiative of corporate social responsibility and sustainable development in the world, aimed at the generation of shared value.

ICO has been a partner since 2005 and part of its Executive Committee since 2010.

b. **Collective Commitment to Climate Action.** This reflects the *commitment of the Spanish banking sector* to reduce its carbon footprint in the credit portfolios of the signatory entities.

[18] ICO and UNED (2020): Study on Circular Economy and SMEs.

c. **FINRESP (Spanish Centre for Responsible and Sustainable Finance)**: ICO maintains a close collaboration with this Centre, driven by various associations of the financial sector. It aims to address the difficulties and needs of the business fabric, particularly in relation to Spanish SMEs, to positively contribute to the commitments of the 2030 Agenda.
d. **SPAINSIF:** Spainsif is the reference platform on sustainable and responsible investment in Spain, encouraging the integration of environmental, social and good governance criteria in investment policies. Spainsif is a member of the pan-European Forum of sustainable and responsible investment. ICO is one of the 73 partners of this platform incorporated as a non-profit association whose mission is to promote the integration of ESG criteria in investment policies through dialogue between the investment community, public administrations and various social groups, contributing to sustainable development. It also aims to raise awareness and promote changes in companies' and citizens' investment processes.
e. **Working Group on the Strategic Plan for Internationalizing the Spanish Economy**. ICO participates in the development of the National Action Plan for Businesses and Human Rights, which aims to establish a guide for examining the consistency of policies that support the internationalization of companies and their alignment with the UN's Guiding Principles on Human Rights.

3.2 International Initiatives

3.2.1 Invest EU's Sustainability Proofing Expert Group

ICO participates in the expert working group at the European level for defining the methodology and criteria that will be used to ensure sustainability in projects financed through Invest EU linked to the *2021–2027 EU Multiannual Financial Framework*.

a. **Joint Initiative on Circular Economy (JICE)**

Initiative from the five largest national promotional banks (KFW—Germany, CDP—Italy, CDC—France, BGK—Poland and ICO) along with the EIB to support the development and implementation of projects and programmes of the circular economy in the European Union worth 10,000 million euros until 2023.

b. **Clean Ocean Initiative**

ICO's commitment to this initiative, worth 2,000 million euros, aims to help to mitigate the effects of climate change and to contribute to the fight against pollution in the oceans through the provision of funding for projects for the efficient management of production processes and for the recycling of plastic waste in order to preserve our oceans, along with sustainable fishing and shipping.

Within the framework of COP25 in Madrid, along with the Asociación Española de Banca (AEB), CECA and a group of Spanish financial institutions, ICO signed the *Spanish Collective Commitment to Climate Action*,[19] under which the signatories commit to:

- Reduce the carbon footprint of their portfolios by prioritizing the necessary actions with special attention to the sectors with the greatest impact.
- Engage their customers in the transition to a low-carbon economy.
- Join efforts and work together to develop the capacities and methodologies needed to measure climate impact and align with global and national climate objectives.
- Develop, together with governments, scenario experts and stakeholders, specific roadmaps by sector and geography that are clear, feasible, and contribute to the objective of keeping the temperature increase well below 2 °C with respect to pre-industrial levels, aiming for 1.5 °C.

[19] AEB (2019).

- Establish and publish portfolio alignment goals and objectives, specific to each sector and scenario-based, before December 2022.
- Publish and implement from December 2020, together with its customers, measures to support and accelerate the transition of society and business models towards low-carbon economy and technology adapted to climate change.

c. **Collaboration with the High Commissioner for the 2030 Agenda.**

The #ICOpymeODS platform, developed by ICO, the Spanish Network of the UN Global Compact and the High Commissioner for the 2030 Agenda, must be mentioned. It aims to develop a sustainable business fabric through raising awareness of the opportunities offered by the achievement of the SDGs among SMES and the importance of aligning their strategies with these.

d. **Forética**

Forética is the leading association of companies and professionals in corporate social responsibility and sustainability in Spain and Latin America with more than 200 partners. With the aim of being a key player in promoting the integration of social, environmental and good governance in the strategy and management of companies and organizations, ICO participates in the following working groups:

- Cluster of climate change
- Social Impact Cluster
- Cluster of transparency, good governance and integrity

ICO has been a partner of Forética since 2005. In 2018, ICO, in collaboration with Forética, implemented a CSR Action Group in the Public Company to share knowledge and integrate the SDGs into public enterprises' strategies so that they could promote change and be a reference point for other economic and social actors. The Group currently has over 28 associated public entities and, in 2018, it published the '*Practical*

guide to public companies' contribution to the 2030 Agenda'.[20] In terms of transparency and good governance, ICO is fourth in Transparency International Spain's ranking of 45 entities and public enterprises, only ranking underneath CDTI, Adif and Ingeniera y Economía de transporte.

e. **ICMA—Green Bond Principles**

ICO is a partner of the International Capital Markets Association (ICMA), one of the most active institutions internationally in the definition of certification for green bond issues. ICO participated in the Working Group that prepared the "Social Bond Principles" guide and has been a member of the Advisory Council of the Green Bond Principles and Social Bond Principles Executive Committee since 2019, being the only Spanish public entity and the only National European Promotional Bank that participates in this category of the Advisory Council.

f. **LMA—Green and Sustainable Green Loan Principles**

Established in 2018 by the Loan Market Association (LMA) to rate green loan operations based on four basic ideas: ensuring the use of funds; undergoing a rigorous project evaluation and selection process; controlling the management of funds; and monitoring until its completion and implementation. ICO uses this standard to rate their green loans.

g. **Equator Principles Association**

ICO has been committed to the Equator Principles since 2016, having incorporated them into its internal processes to assess the impact of projects. This set of internationally recognized principles in the financial sector aims to define a risk management framework for identifying, assessing and managing social and environmental risks linked to projects.

h. **Sustainable Bond Forum**

[20] CSR Action Group in the Public Companies, 2018.

Organized annually by ICO, having celebrated its 5th edition in June 2019 in Madrid, coinciding with *World Environment Day*. In addition, ICO actively promotes and participates in numerous international forums related to sustainable finance and investments. During 2019, the ICO's role at COP25 as an organizer of a panel on sustainable finance and its participation in over 10 sessions and meetings within the framework of the summit should be highlighted. In addition, the organization undertook *ALIDE's Annual Assembly*[21] in Madrid, which includes national banks of promotion in Latin America, Europe and other relevant countries.

i. **Invest EU's Sustainability Proofing Expert Group**

Participation in the expert working group at the European level for defining the methodology and criteria that will be used to ensure sustainability in projects financed through InvestEU linked to the 2021–2027 EU Multiannual Financial Framework.

4 ICO's Green Bonds

1. Rationale for ICO's Green Bond Framework
2. Use of Proceeds
3. Alignment of the use of proceeds
4. Process for project evaluation and selection
5. Management of proceeds
6. Reporting
7. Allocation reporting
8. Impact reporting
9. External review

In 2019, ICO made its début in the Green Bond market, a category of sustainable debt that reflects the Institute's commitment to the environment and the fight against climate change through the financing of projects aimed at these ends.

[21] Sustainable Bond Forum. June 2019.

ICO's green bond issuance framework was updated in June last year and, like the social bond issuance framework, has received an independent opinion from Sustainalytics, which determines that the framework is aligned with **ICMA**'s Green Bond Principles, the industry's leading international standard.

The framework includes different categories, aligned with the SDGs (Sustainable Development Goals) towards which to direct funds raised from emissions: **renewable energy, clean transport, energy efficiency, sustainable management of natural resources or pollution control**, among others.

So far, ICO has launched 4 Green Bond issues worth 2 billion € and has published information on the destination of the funds and the estimated impact of the first three. The proceeds of these first three green bonds, issued between 2019 and 2021, have been used to finance **30 projects with an estimated saving of more than 692,000 tons of CO2 and mobilizing funds in excess of 12 billion €** (Fig. 4).

Public-Private Partnership

The funds raised through sustainable debt are used to finance public-private partnership projects through the various instruments available to ICO, such as the ICO Lines, direct financing programmes and the funds managed by AXIS, ICO's venture capital subsidiary.

Furthermore, with ICO's issuance of social and green bonds and its consequent promotion of projects that generate a positive social and environmental impact, ICO's commitment extends to working in line with the objectives set out in the Recovery, Transformation and Resilience Plan.

4.1 Rationale for ICO Green Bond Framework

ICO's public nature and mission require it to promote and encourage best management practices, which contribute to a sustainable business fabric in line with the SDGs. By adhering to these standards, ICO positions itself among the leading banks in the drive towards sustainable and responsible financing.

ICO is fully committed with Sustainability Finance and has played a key role in the Social Bond Market by issuing a series of Social Bonds in different currencies thus far, and has the intention to go further on the contribution to the development of a sustainable financial market.

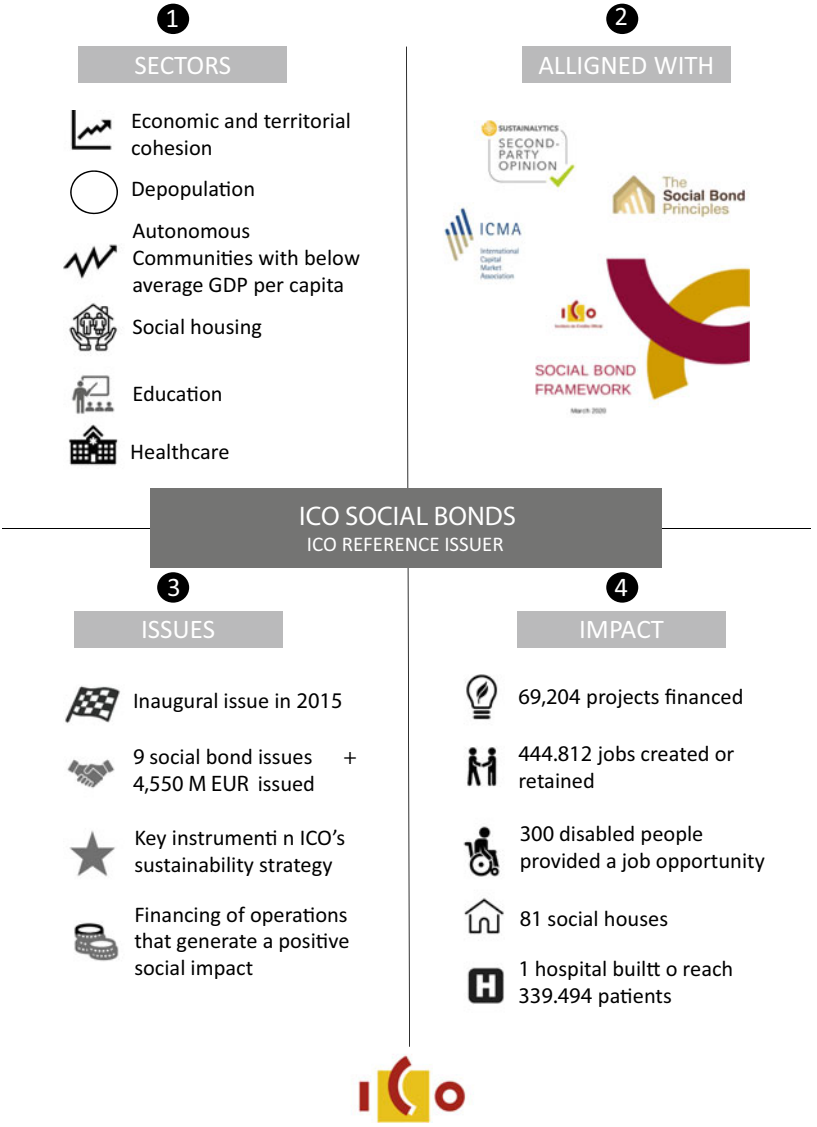

Fig. 4 ICO's Green Bonds. ICO's Benchmark Issuer (*Source* ICO [2019])

ICO has updated its *Green Bond Framework* ('the Framework') to be aligned with what is expected to become *EU Green Standard*[22] (based on available documentation). In addition, the Framework is aligned with *ICMA's Green Bond Principles 2018*[23] and its four core components.

1. Use of Proceeds
2. Process for Project Evaluation and Selection
3. Management of Proceeds
4. Reporting

ICO also intends to progressively examine all projects in line with EU Taxonomy for sustainable economic activities as it becomes available, final and relevant for the projects comprised in ICO Eligible Green Loan Portfolio. Such analysis will be included in the reporting as the case may be.

4.2 Use of Proceeds

ICO's Green Bonds proceeds will be allocated to a portfolio of Green Eligible Loans (the 'Green Eligible Loan Portfolio') meeting the following Project Categories according to its Eligibility Criteria, Environmental Objectives and Environmental Benefits (climate change mitigation) (Table 1).

Table 1 ICO's Project categories and eligibility criteria

	Project categories
1	Renewable energy
2	Hydrogen production
3	Energy efficiency
4	Green buildings
5	Clean transportation
6	Pollution, prevention and control
7	Sustainable water and waste water management

Source ICO Green Bond Framework, June 2021

[22] EU Green Standard (2019).

[23] ICMA's Green Bond Principles (2018).

Certain activities will be excluded as eligible due to their environmental non-friendly nature, such as:

- Nuclear power generation
- Fossil fuel based energy
- Carbon related activities
- Oil and gas
- Armament sector
- Tobacco
- Any other activities that are not considered environmental-friendly

4.3 Alignment of the Use of Proceeds with the UN SDGs

All of ICO's Eligible Green projects contribute to the environmental objective of climate change mitigation and the achievement of UN Sustainable Development Goals, specifically the following ones (Table 2).

Table 2 ICO's goals in Renewable Energy projects

Renewable Energy	
	
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix
7.a	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy
7.b	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and land-locked developing countries, in accordance with their respective programmes of support
13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

Source ICO Green Bond Framework. June 2021

Table 3 ICO's goals in Hydrogen production projects

Hydrogen production	
	
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix
7.a	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
7.b	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and land-locked developing countries, in accordance with their respective programmes of support
13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

Source ICO Green Bond Framework. June 2021

Table 4 ICO's goals in Energy efficiency projects

Energy efficiency	
	
7.3	By 2030, double the global rate of improvement in energy efficiency
8.4	Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead
9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in

Source ICO Green Bond Framework. June 2021

Table 5 ICO's goals in Green Buildings projects

Green Buildings	
	
9.1	Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in

Source ICO Green Bond Framework. June 2021

Table 6 ICO's goals in Clean Transportation projects

Clean Transportation	
	
11.2	By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons
11.a	Support positive economic, social and environmental links between urban, per-urban and rural areas by strengthening national and regional development planning
3.9	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination

Source ICO Green Bond Framework. June 2021

4.4 Process for Project Evaluation and Selection

ICO commits to ensure that all eligible projects comply with the sustainability policies ICO has adopted, including the Sustainability Policy, Corporate Social Responsibility (CSR) Policy, the Environmental Policy,

Table 7 ICO's Goals in Environmentally sustainable management of living natural resources and land use projects

Environmentally sustainable management of living natural resources and land use	
	
11.4	Strengthen efforts to protect and safeguard the world's cultural and natural heritage
11.5	By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations
12.2	By 2030, achieve the sustainable management and efficient use of natural resources
14.4	By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics
15.1	By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements
15.2	By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally
15.3	By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods and strive to achieve a land degradation-neutral world
15.4	By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development
15.a	Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems

Source ICO Green Bond Framework. June 2021

Table 8 ICO's goals in sustainable water and wastewater management projects

Sustainable water and wastewater management	
	
6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4	By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
6.a	Countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
6.b	Support and strengthen the participation of local communities in improving water and sanitation management
12.2	By 2030, achieve the sustainable management and efficient use of natural resources

as well as other standards ICO adheres to (i.e. Equator Principles, UN Global compact), and that are not subject to any major controversy.

The process for Project Evaluation and Selection will be elaborated by ICO's Sustainability Department on a regular basis, and implies the participation of the different units involved in the projects, considering the sustainable commitment across the organization, according to this procedure:

- The Loan Portfolio Management Area will make a list including the Projects susceptible of being classified as Green.
- Further information about each specific Project is collected from the Sustainability Department as well as from other areas directly involved in the financing of the particular Project.
- Finally, the Sustainability Department will select the *Eligible Projects* that meet the eligibility criteria and fit with the Green Project Categories identified in the ICO's framework.

In the event that a loan does not meet the eligibility criteria, in the case that there are any early loan repayments, or when a loan matures, ICO will replace such loans in the Green Eligible Loan Portfolio with new loans selected according to the Eligibility Criteria as defined in this framework.

ICO commits to updating the *Green Bond Framework* with the goal of adhering to the most recent best market practices.

4.5 Management of Proceeds

Net proceeds from ICO's Green Bonds will be placed in ICO's treasury and managed by the treasury department using existing internal tracking systems. ICO commits to invest the net proceeds yet to be invested in cash, cash equivalent or money market products.

The team in charge of Sustainable Finance will periodically review loans funded through its administrative loan programme to identify those that meet the eligibility criteria and allocate them to the Green Eligible Loan Portfolio.

ICO, on a best-efforts basis, will allocate all of the Green Bonds proceeds to eligible projects and loans within a year of issuing a bond.

4.6 Reporting

ICO commits to providing the following reporting information with regard to green bonds on a dedicated report publicly available on ICO's website.

4.7 Allocation Reporting

ICO will provide to investors information on the allocation of the Green Bonds proceeds annually until all proceeds have been allocated. The allocation reporting will include:

- Total amount allocated with a breakdown per project category, and per geographies
- Share of new financings and of refinancing through the Green Bonds
- Total amount of the unallocated proceeds

4.8 Impact Reporting

Until full allocation, ICO will also provide an annual impact reporting on the environmental benefits of the projects resulting from the Green Bond issuance. This reporting may include (Table 9).

Table 9 ICO's annual impact reporting

Project category	*Output metrics*	*Impact metrics*
Renewable energy	Expected renewable energy capacity installed (MW) Expected renewable energy production distributed in MWh	Estimated annual GHG emissions reduced/avoided (in tCO2e/year)
Energy efficiency	Annual energy savings in MWh	Estimated annual GHG emissions reduced/avoided (in tCO2e/year)
Hydrogen production	Annual Hydrogen production (tH2 or m3)	Estimated annual GHG emissions reduced/avoided (in tCO2e/year)
Green Buildings	Annual energy savings in MWh Reduction in annual energy consumption after renovation (%)	Estimated annual GHG emissions reduced/avoided (in tCO2e/year)
Clean transportation	Modal shift: Number of passenger-Km. and/or tons-Km Size of the Group's fleet	Estimated annual GHG emissions reduced/avoided (in tCO2e/year)
Pollution prevention and control	Annual reduction in waste to landfill/Project specific targets and results	Tons of waste managed (m3/year)
Environmentally sustainable management of living natural resources and land use	Estimated land area with biodiversity management Number of sustainable fishery loans granted	Estimated annual GHG emissions reduced/avoided (in tCO2e/year)
Sustainable water and wastewater management	Expected volume of water treated (m3/year)/Project specific targets and results	Annual reduction in water consumption (m3/year)

Source ICO Green Bond Framework. June 2021

4.9 External Review

ICO will engage *Sustainalytics* to provide an External Review in the form of a *Second Party Review* on the *ICO Green Bond Framework*, and confirm alignment with GBP 2018. The external review will be made available on ICO website.

5 ICO's Social Bonds

In 2015, ICO began its journey as a sustainable issuer, and it was then that **the first ICO Social Bond was launched**. At a time when there were still no specific guidelines for sustainable bonds on the market, the Institute focused its objective on the letter 'S' of the so-called ESG criteria (Environmental, Social and Corporate Governance) and opted for attracting funds to act in regions of Spain with a per capita income below the national average by financing projects carried out by the self-employed and SMEs (Fig. 5).

This first Social Bond issue has been followed by seven more to date, and **ICO has not only been a pioneer but has also remained from the outset one of the key issuers in the sustainable finance sector**, launching at least one social bond issue every year to finance operations that generate a positive social impact. The latest ICO Social Bond was issued in September 2022, maturing in January 2028 and worth 500 million € which, added to the total social debt issued, amounts to 4,050 million € euros placed with investors from all over the world.

Taking stock of the first Social Bonds issued by ICO, of which the reporting of 7 has been published, the funds raised have financed 64,200 projects with an estimated impact of 406,600 jobs.

In April 2020, ICO updated its Social Bonds Framework. As in the previous 2015 report, Sustainalytics (a global leader in ESG research and data) certified that the framework was aligned with ICMA (International Capital Markets Association) Social Bond Principles, the leading industry standard. This update enabled it to launch the first public issue in Spain of a COVID-19 Social Bond. With this new framework, ICO can allocate the funds it raises through the issuance of Social Bonds to projects with a positive impact on employment, that promote economic and territorial cohesion, the construction of social housing or that are developed in the field of education and health, among others.

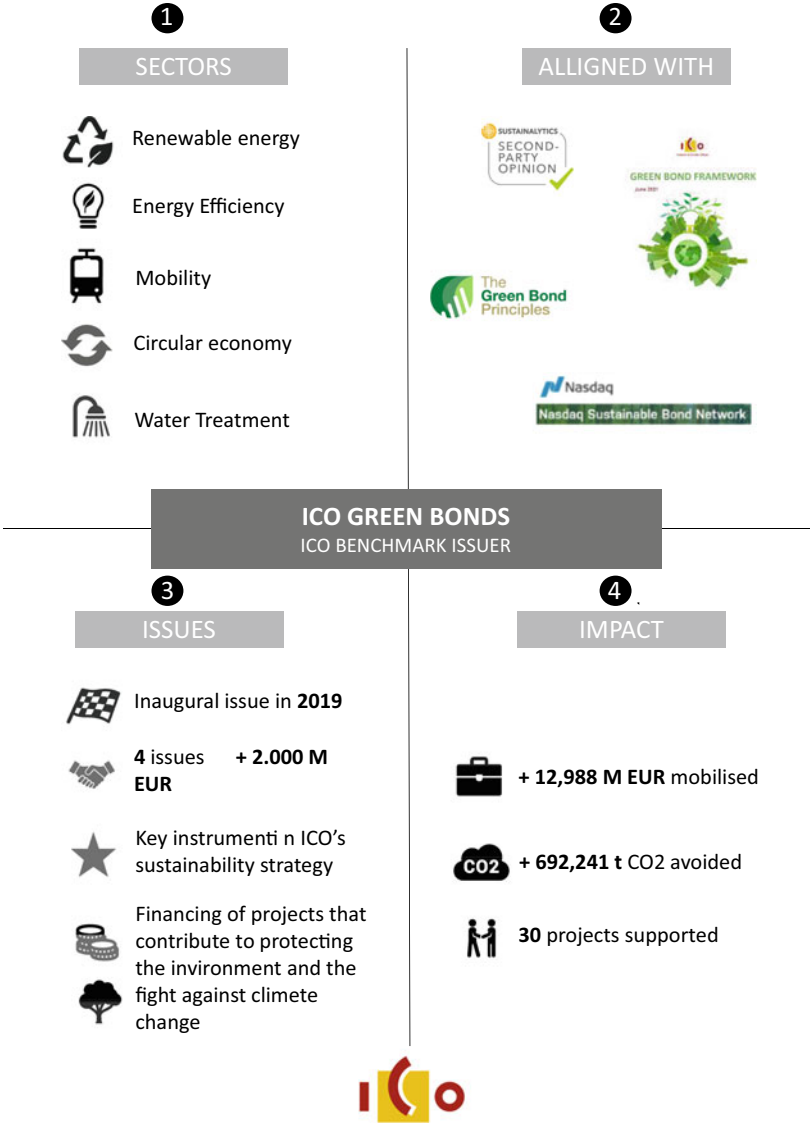

Fig. 5 ICO's Social Bonds. ICO's Reference Issuer (*Source* Ico.es—ICO: Benchmark issuer in the market for sustainable bonds)

Last 26th September 2022 ICO launched a new social bond issue amounting to 500 million €.

- The issue has been very well received by international investors, who have acquired 84% of the bonds.
- With the funds raised, ICO will finance projects in public-private partnerships that promote social and territorial cohesion and generate a positive impact on employment.
- ICO strengthens its role as a benchmark issuer in the sustainable bond market with thirteen transactions (9 social and 4 green) amounting to 6.55 billion €.
- These operations have promoted more than 69,000 projects for the self-employed, SMEs and Spanish companies, which have contributed to maintaining more than 440,000 jobs, and prevented the emission of more than 692,000 tons of CO_2 per year.
- With the issuance of social and green bonds, ICO is committed to promoting investments that generate a positive social and environmental impact, in line with the objectives established in the Recovery, Transformation and Resilience Plan.

ICO (with rating A/Baa1/A-/A de S&P/Moody's/Fitch/DBRS) has launched a new social bonds issue amounting to 500 million €, maturing on the 31st January 2028, which will be used to finance projects for the self-employed, SMEs and Spanish companies which generate a positive social impact and boost job creation.

With this new issue, ICO strengthens its commitment to the development of the sustainable bond market and consolidates its role as a benchmark issuer, with nine social bond issues and four green bond issues, with an issued amount of 6.55 billion €.

This operation has been well received by international investors, demonstrating the investor base's confidence in the role of ICO. 84% of the operation has been placed between international accounts, highlighting the demand registered in Germany, Austria and France.

The issue has registered a demand of more than 1.1 billion €. This oversubscription has allowed the operation to close with a spread of 14 basis points over the Treasury reference for the same maturity (5.4 years), narrowing the starting price that had been set at 16 basis points, with a return of 2.66%.

The quality of the order book in the distribution by investor type stands out. Fund managers have acquired 35% of the total volume of the issue, followed by banks with 31%, central banks and official institutions with 25% and insurance companies and pension funds with 9%.

The transaction, led by BNPP, Citi (B&D), HSBC and Santander Bank, is listed on BME's AIAF fixed income market.

5.1 Issues with a Positive Social and Environmental Impact

With the issuance of social and green bonds, ICO commits to investors to promote projects that generate a positive social and environmental impact, in line with the objectives established in the Recovery, Transformation and Resilience Plan.

To do this, ICO channels the funds it raises with these operations towards the business fabric through its direct financing programmes, ICO Mediation Lines, and funds managed by AXIS, its venture capital subsidiary.

With the social bonds, ICO has financed more than 69,000 projects for the self-employed, SMEs and companies, which have contributed to generating or maintaining more than 444,000 jobs.

The issuance of green bonds has promoted 30 renewable energy and clean transport projects by Spanish companies, which have mobilized an investment of approximately 13 billion euros, preventing the emission of more than 692,000 tons of CO_2 per year.

6 Conclusions

To achieve the SDGs and the ambitions of the Paris Agreement, an estimated US$90 trillion worth of infrastructure need to be financed. To date, the International Financial Institutions (IFIs) have done relatively little.

Commentators also lament that public and private investors see a lack of investment-ready, 'bankable' projects as a major constraint to future green investment as the culprit for such dismal results. This has given rise to questions of whether the private sector is willing or able to deliver.

It remains the case that public spending by governments on infrastructure constitutes the largest proportion of investments, by far, estimated at about US$1.5 trillion annually.[24]

Public-Private Partnerships (PPPs) generated an additional $112 billion in 2015, with a financing leverage ratio of about 1:1 (for every dollar invested publicly, another private dollar would follow).

In 2015 the **Multilateral Development Banks** contributed about $80 billion. Given the estimated US$90 trillion in investments required in the near future, the burning questions are how to increase investment, and how to green it. The fact is that public sources of funding are doing much, and that there is also potential for public banks to do more in the current context. This is a point of agreement by the 'Right' and advocates of market-oriented approaches and by the 'Left' and advocates of solutions driven by the public interest.

It can be clearly said that there is a whole world of potential public bank catalysers for a green and just energy transformation.

That said, public banks must not be taken as a panacea in and of themselves, for the mere fact that they are public. Their potential depends on the actual policies and practices of the public banks and the extent to which these practices are defined democratically and in the public interest.

The big issue of financial sustainability must also be raised. Disagreements continue to rage over the financial viability and desirability of public banks. Conventional economists and neoliberal market advocates remain firmly against public ownership, arguing that it leads to corruption and economic inefficiencies. Heterodox economists contest such claims, arguing that the economic evidence against public bank ownership is not as strong as suggested and that public banks can be as efficient as private banks.[25]

Others, too, would argue that profitability is secondary to the public banks' capacity to drive innovation, address society's grand challenges, and to their capacity to rebuilding and reclaiming a progressive public ethos.[26] In the end, there is no compelling evidence that public banks cannot be financially sustainable for the simple reason that they are publicly owned (as ICO suggests). Most studies claiming private banking

[24] Levy (2017).

[25] Levick (2007).

[26] Marois (2015), Mazzucato and Penna (2015), and Pavel (2015).

superiority, moreover, are methodologically flawed. Their approach is typically to assess whether public banks are as efficient as private banks at making money. One might as well ask if oranges are better at making apple juice than apples. Many public banks either do not have a profit mandate or profitability stands alongside other social and development goals, as with the ICO, BPDC and the KfW.

Private corporate banks seek profits alone, and are essentially oriented in this sole direction. This, in turn, is what has prevented more substantial private investments in a global green transformation. It is also why private investors are unlikely to support social goals like energy democracy. That being said, public banks can perform their mandated duties in financially sustainable ways in at least two different ways: on a not-for-profit basis, which implies that returns are re-invested by the bank in society; and via explicit loss-making operations, which implies that the government or another part of the bank subsidizes such losses to ensure the bank's overall long-term sustainability. It needs emphasizing that, as for any public or public-like entity, financial sustainability needs to be accounted for across the full spectrum of the public bank's activities and impacts.

Accordingly, appropriate incentives and training need to be put in place to incentivize bank management and staff to approve projects according to this long-term practice of financial sustainability in the public good. In any case, the issue of financial sustainability needs to be democratically decided in line with a public bank's mandate and mission—as opposed to the ideologically driven profitability imperatives of conventional economics—and this should be made fully understood by the public.

Finally, financial sustainability should be considered beyond 'lending' to also include forms of 'ownership and equity'. Public banks can fund public infrastructure and other venture projects, and in return take a stake in the new institution.

Over time, the equity stake can pay dividends back to the bank, which in turn benefits the public purse.[27]

[27] Mazzucato (2015).

This is nowhere without risks, but the payoffs can be financially and developmentally astounding. Cooperative banks such as the BPDC can also consider taking a stake in new coop investments as a way of promoting cooperativism in society.

Building strong coop–coop collaborations helps to solidify a future of social solidarity development, which in turn helps to provide for the political and economic will required to maintain truly cooperative and public operations working in the public interest.

There are real concrete benefits in having public banks involved in the green transformation of society. A look at ICO's activities helps to illustrate their potential, but also shortcomings.

Banks can be public and serve the public good, and do so democratically. Public banks can raise the needed capital for personal and infrastructural investments, and channel this towards low-carbon and climate-resilient programmes. Profitability need not be the primary measure of a bank's success, and the bank's stability need not be threatened by such an approach. As public banks take on greater roles in green transformation, they can help build the needed public ethos and necessary technical expertise. These are important possibilities.

That said, there are a number of barriers to realizing the potential of public banks to finance a green and just energy transformation. Internally, public banks need to find effective ways of translating popular democratic aspirations into effective and sustainable operational strategies. Sometimes this can lead to conflicts between those who own the bank (shareholders and associated stakeholders) and those who control it (senior management and technical experts). This politicization of the banks should not be shied away from, but embraced through open, representative and transparent democratic structures. Likewise, public banks need to confront possible abuses by either governing parties or banks. No one benefits from the abuse of public banks or the wasting of collective resources via ineffective banks. Accountability and transparency must reign supreme.

Externally, public banks face the seemingly insurmountable structural context of neoliberal financial capitalism. For one, neoliberal ideology and development practices threaten the very legitimacy and existence of public banks. Mainstream neoclassical economics and liberal political economy, by definition, see public banks as suboptimal market actors, which by virtue of public ownership are inherently inefficient and corrupt entities.

While some international institutions have had to begrudgingly accept a role for public banks in addressing the global climate challenge (and

recurrent global financial crises), their hard-core belief in private sector superiority remains rock solid.

For another, the context of global financial capitalism has created an intensely competitive context for public banks. Gone are the days of a purely national developmental strategic orientation and the possibility of banks ignoring global financial markets.

Today's public banks are intertwined globally, borrowing funds from abroad, dealing in global financial markets and currencies, and mitigating global financial risks and crises nationally.

The experience of ICO in the COVID-19 crisis is instructive.

Support for and capacity in public finance is a necessary, if not sufficient, condition for any break with orthodox financial capitalism.

Likewise, a green and just energy transformation requires, among other things, financing based on solidarity and oriented in the public interest. To this end, society must hold their public banks to account and, in fact, demand their substantive democratization and 'greening'.

Such positive examples—as ICO's previously described—must not be taken for granted, but used as a basis to deepen and extend the political and economic democratic foundations of society and, in particular, to build progressive campaigns around democratizing finance for sustainable and just energy transformation. In terms of specific strategies around defending and improving public banks, we have elsewhere considered a range of actions for progressive campaigns.

These are worth revisiting, by way of closing, vis-à-vis public banks and energy democracy.

These could include:

1. **Framing public finance as a common good:** The financial sector is the nervous system of society, and it needs to be conceived of in the public interest.
2. **Democratized banking:** The struggle to defend public banks must also involve their democratization as a long-term strategy of social sustainability.
3. **Collective ownership and control:** State or public ownership is only one form of ownership. Many other progressive, collective forms of cooperative and worker-controlled banks should be pursued and not be undermined by neoliberal ideology.

4. **Radical scholarship:** Critical scholars must engage more systematically in the real problem of understanding and advocating for effective public financial alternatives.
5. **Linking the green transformation to public provisioning:** Environmental sustainability demands effective, long-term and accountable sources of finance. Public banks are uniquely capable of playing a lead, proactive role in a global green and just transition.
6. **Collective organization in the banking sector:** Bank workers need effective union representation, and unions can be powerful actors of resistance to neoliberalism and financialization as well as powerful advocates of progressive social change.
7. **Solidarity across sectors:** Too often dialogue and solidarity between traditional trade unionists, finance workers and (other) public sector workers is non-existent, and this needs to change for a green and just energy transformation.

References

#ICOPymeODS.

AEB. (2019). *Spanish collective commitment to climate action*. https://s1.aebanca.es/wp-content/uploads/2019/12/spanish-collective-commitment-to-climate-action.pdf

Badré, B. (2019). *Can finance save the world?* Berrett Koehler Publishers, Inc.

Beitel, K. (2016). *The municipal public bank: Regulatory compliance, capitalization, liquidity and risk*. Roosevelt Institute. Available online at: https://rooseveltinstitute.org

Brown, E. (2019, April 18). The public banking revolution is upon us. truthdig.

COP Madrid. (2019). *ALIDE's annual assembly.*

Dafermos, Y. et al. (2021). The wall street consensus in pandemic times: What does it mean for climate-aligned development? *Canadian Journal of Development Studies*, *42*(4), 1–14

EC. (2020, July). *Sustainable finance action plan.*

EPSC. (2017). *Financing sustainability: Triggering investments for the clean economy*. European Policy Strategy Centre. European Union.

EU. (2021a). *2021–2027 EU multiannual financial framework.*

EU. (2021b). *Invest EU's sustainability proofing expert group: Green bond European framework.*

EU. (2022). *EU Green bond standard.*

Foretica. (2018). *Practical guide to public companies' contribution to the 2030 Agenda*.
Fundación ICO. (2020). *Transicion hacia la economía circular. Guía para pymes.* UNED, 14 de mayo de 2020.
Griffith-Jones, S., & Ocampo, J. A. (2018). *The future of national development banks*. The Iniciative for Public Dialogue (IPD).
GSG. (2019). *Global Impact Summit*. Global Steering Group for Impact Investment. https://www.ico.es/documents/15125/1926935/ICO+Strategic+Realignment+2019-2021/5c6f5e34-5b66-48c8-9202-aad4aff71d94
GSG. (2021). *Financing sustainability*. Global Steering Group for Impact Investment.
ICMA. (2018a). *ICMA's green bond principles 2018*.
ICO. (2018b). *CSR in the public companies'*. https://www.ico.es/documents/19/0/ICO+SUSTAINABILITY+POLICY.pdf/af535e65-d30c-4ff7-847c-7bf833efc12b
ICO. (2019a). *ICO strategic realignment (2019–21)*.
ICO. (2019b). *ICO's sustainability policy*.
ICO. (2019c, June 2019). *Sustainable bond forum*.
ICO. (2021, June). *Green bond ICO's framework*.
ICO and UNED. (2020, May 14). Transicion hacia una economía circular. *Guía para pymes*.
IMF and World Bank. (2015). The world bank support for the 2020 agenda for sustainable development. *Development committe discussion paper*. Annual Meeting.
La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2002). Government ownership of banks. *The Journal of Finance, 57*(1), 265–301.
Levick, K. (2007). *Accelerating green finance*. A Report to Goverment by the Green Taskforce Group.
Levy, J. (2017, February 24). *Building climate smart infrastructure systems in emerging markets, managing director and chief financial officer of the World Bank Group, and former finance minister of Brazil, presentation to OMFIF*. London, UK.
Levy Yeyati, E., Micco, A., & Panizza, U. (2007). A reappraisal of state-owned banks. *Economia, 7*(2), 209–247.
Marois, T. (2013). *State-owned banks and development: Dispelling mainstream myths* (Occasional Paper 21). Municipal Services Project. http://www.municipalservicesproject.org/sites/municipalservicesproject.org/files/publications/OccasionalPaper21_Marois_State-owned_Banks_and_Development_Dec2013_0.pdf
Marois, T. (2015). Banking on alternatives to neoliberal development. In L. Pradellaand & T. Marois (Eds.), *Polarizing development: Alternatives to neoliberalism and the crisis*. Pluto Press.

Marois, T. (2021). *Public banks decarbonisation definancialisation and democratisation*. Ed. Cambridge University Press.
Marshall, W. C., & Rochon, L.-P. (2019, January). Public banking and post-keynesian ecomomic theory. *International Journal of Political Economic Theory*.
Mazzucatto, M. (2018, October). *Mission-oriented innovation policies: Challenges and opportunities*.
Mazzucato, M. (2015). *The entrepreneurial state: Debunking public vs. private sector myths* (2nd ed.). Anthem Press.
Mazzucato, M., & Penna, C. C. R. (2015). *The rise of mission-oriented state investment banks: The cases of Germany's KfW and Brazil's BNDES* (SPRU Working Paper Series) (ISSN 2057–6668), University of Sussex.
Mazzucato, M., & McPherson, M. (2018). *What the green revolution can learn from the IT revolution*. Institute for Innovation and Public Purpose.
OECD. (2016). *Green Investment Banks: Scaling up private investment in low-carbon, climate-resilient infrastructure*. OECD.
Orbis. (2017). *Orbis*. Bureau van Dijk.
Pavel, M.P. (2015). A climate justice compass for transforming self and world. *The Journal of New Paradigm Research*.
Schmit, M., Gheeraert, L., Denuit, T., & Warny, C. (2011). *Public financial institutions in Europe*. European Association of Public Banks.
Sustainalytics. (2019, marzo 12). *Second party review* on the *ICO Green Bond Framework*.
UN. (2015a). *Paris agreement*. https://www.un.org/en/climatechange/paris-agreement
UN. (2015b). *SDGs of the United Nations 2030 agenda*.
UN. (2019). *United Nations Guiding Principles on Business and Human Rights (UNGPs)*.
UN Assis Ababa Financing for Development Report. (2015). *The raison d´etre of public development banks and recommendations for succesful development banking*. UN AAF for Development Report.
UNCTAD. (2019). *UNCTAD public banking drive will strength for momentum*. Oxford Analytica.
UNEP. (2015). *The financial system we need. Aligning the financial system with sustainable development*. Inquiry: design of a sustainable development system.
UN IATF. (2019). *Finance for sustainable development report*.
United Nations. (2015, July). *The raison d'être of public development banks and recommendations for successful development banking*. Paper presented at KfW FfD panel on Development Banks, Addis Ababa. http://www.un.org/esa/ffd/ffd3/wp-content/uploads/sites/2/2015/07/Raison-detre-of-DBs-non paper-Addis.pdf

von Mettenheim, K. (2012). Public banks: Competitive advantages and policy alternatives. *Public Banking Institute Journal, 1*(1), 2–34.

World Bank. (2001). *Finance for growth: Policy choices in a volatile world*. World Bank.

World Bank. (2012). *Global financial development report 2013: Rethinking the role of state in finance*. World Bank .

World Bank. (2013, April). *Rethinking the State's Role in Finance: The world bank development research group*. Policy Research Working Paper 6400.

Xu, et al. (2019). *Bank profitability and financial stability*. IMF library.

PART II

ESG Instruments and Sectors

CHAPTER 5

A Bibliometric Analysis of Sustainable Finance

Fatima Dahbi, *Inmaculada Carrasco*, *and Barbara Petracci*

1 Introduction

Nowadays, the world is facing great challenges in social, environmental, and economic areas. Massive financial resources and investments are needed in order to eradicate poverty, combat climate change,

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reduce economic inequalities, and, most recently, mitigate the threat of pandemics (Levy, 2020; Pizzi et al., 2021; United Nations, 2018). For instance, sustainable finance instruments have become popular across the global market to financially support the green transition, combatting climate change and boosting clean energy while recovering from the ongoing COVID-19 pandemic negative impact.

Green, social impact, and sustainable bonds are these innovative financial tools. The first aims to improve environmental impacts (Tang & Zhang, 2020). However, despite the recent "green bond boom" (Stanley, 2017), there is still no universal definition of this financial security. Green bonds are fixed-income securities issued by capital-raising entities to fund environmental-friendly projects such as renewable energy, sustainable water management, climate change adaptation, and so on (Tang & Zang, 2020). Social impact bonds are a new financial mechanism for delivering pre-defined public services such as food security, affordable housing, access to essential services, and employment generation (OECD, 2016). Finally, sustainable bonds are fixed-income securities that are used to fund projects that have a positive impact on both the environment and society.

Moreover, the literature on sustainable finance has been prolific since issuing the first green bond in 2007 and excessively fragmented. As a result, identifying what and why these instruments differ from traditional finance and investing can be challenging.

In this context, the main objective of this paper is to analyse the literature's state-of-art and make some order on the ongoing academic works on green, social impact, and sustainable bonds. Furthermore, this study is motivated by the study of Kumar et al. (2022), who suggested enriching the proper understanding of sustainable finance tools. Our study accepts this challenge by studying the entire spectrum of articles on green, social impact, and sustainable bonds. We apply a case study of bibliometric analysis on sustainable finance instruments to explore the evolution of the literature over time, to identify the main authors and journals in the field, the most important papers, and the most studied countries, by doing a keyword analysis, which allows us to detect trending research topics and summarise the paper's content with just a few words.

Bibliometric analysis is a commonly used and rigorous technique for studying and evaluating large amounts of scientific evidence as it focuses on emerging fields and analyses the nuances of a specific field (Donthu et al., 2021; Goodell et al., 2023; Paul et al., 2020). According to Paul

et al. (2020), a bibliometric analysis of themes, theories, or methods synthesises prior studies to strengthen the foundation of knowledge. Mukherjee et al. (2022) posit that bibliometric research provides opportunities to contribute to theory and practice. For instance, our chapter aims to contribute to sustainable finance literature alongside other recent bibliometric studies.

The rest of the paper proceeds as follows: in Sect. 2, we will explore the techniques and methods used to develop our search. More precisely, we will develop a protocol following the PRISMA method (Page et al., 2021) and the subsequent steps to produce the base with which we develop our bibliometric analysis. Then, in Sect. 3, we will show the most important results and discuss them. Finally, in the last section of our study, Sect. 4, we will conclude the research with some final comments.

2 Materials and Methods

The research methodology combines a systematic literature review (SLR) and a bibliometric analysis to understand academic studies clearly. According to the PRISMA Statement, "systematic review is a review of a formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyse data from the studies that are included in the review" (Moher et al., 2010). This approach is widely used due to the "organised, transparent, and replicable procedures at each step in the process" that ensures quality and replicability of the review (Stechemesser & Guenther, 2012).

The following subsection describes the protocol performed according to the PRISMA Statement.

2.1 The Protocol

The systematic methodology allows for carefully identifying and synthesising the current literature on the topic with reproducible criteria and limits biases and random errors (Delle Foglie & Keshminder, 2022).

The first methodological step is defining the research questions the literature review is based on. These are:

Q1: *How far did the economic literature on green, social impact, and sustainable bonds investigate these new financial instruments?*
Q2: *What are the major research trends* in academia about them?

Q3: What are the future research directions on green, social impact, and sustainable bonds?

Following the PRISMA procedure, the next step is to select the bibliographic database. Between the two databases most used, Scopus and Web of Science, we selected the latter as it provides a list of high-quality peer-reviewed articles and is widely used (Araclil et al., 2021; Khan et al., 2020; Liu et al., 2015; Waltman, 2016). Therefore, this database suits the requirements of our bibliographic analysis (Paltrinieri et al., 2019; Khan et al., 2020; Khan et al., 2022). The research is limited to English-, French-, Italian-, and Spanish-written articles published in peer-reviewed journals. The choice to include only scientific works guarantees the reproducibility and completeness of the literature sample (Cortellini & Panetta, 2021). We consider papers published between 01/01/2007 and 31/12/2022. The starting period is chosen according to the European Investments Bank's (EIB) first-world green bond issuance (2007), while 2022 is the last complete year available. In 2022, we also included early-access articles published at the beginning of 2023.

The data query is based on a combination of the following authors' keywords (AK): AK = (green bond*) AND/OR (social bond*)[1] AND/OR (sustainable bond*). To exclude any articles that are not referred to economics, we focus on papers about the following subject areas: "Business", "Business finance", "Economics", "Environmental studies", "Ethics", and "Management".

The academic records identified through database interrogations resulted in a total of 502. To obtain a refined sample, after reading the title and abstract of each article, we excluded not relevant and off-topic papers (185 documents) and duplication (4 documents). To establish the "no relevance", we included only papers that: (1) debate on the development and use of green, social impact, or sustainable bonds, (2) case studies (real or proposal) on green, social impact, and sustainable bonds, and (3) qualitative, quantitative, or comparative studies. Finally, we double-checked the sample verifying the full-text availability via academic databases and removed ten papers, leaving 303 articles in

[1] We selected a wider category to include studies related to social bonds and social impact bonds.

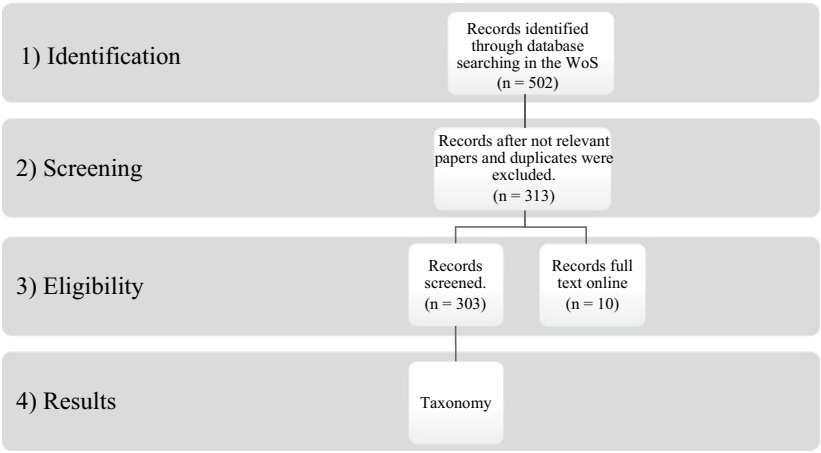

Fig. 1 Systematic literature review research design (*Source* Author's elaboration)

the final sample. The steps conducted during the sample construction are provided in Fig. 1.

In addition, the bibliometric analysis is conducted through Bibliometrix, an R-tool for comprehensive science mapping analysis (Aria & Cuccurullo, 2017). This second approach is complementary to PRISMA in order to organise the performance analysis better. In the next section, we will show some results.

3 Results and Discussion

Bibliometric reviews analyse literature using statistical methods, software, or graphical interfaces that is, in our case, via Biblioshiny of Bibliometrix package of R (Aria & Cuccurullo, 2017; Delle Foglie & Keshminder, 2022).

Green, social impact, and sustainable bonds are new and rising topics in the economic and financial literature. Nevertheless, the interest of scholars is noticeable (Fig. 2).

As we can observe, our final sample of 303 documents was published between 2013 and 2023 from 119 different journals with an annual

Fig. 2 Overview of the final sample (*Source* Authors' elaboration through Bibliometrix)

growth rate of almost 26%. The latest data shows the academic community's interest in investigating these new sustainable finance instruments. This trend is also detectable in the significant number of authors (660) who worked on the publications under review.

According to the aims of this paper, after completing the analysis of all the documents included in the sample through Bibliometrix, we can develop a "taxonomy of green, social impact, and sustainable bonds' research" starting from the thematic map reported in Fig. 3.

After reading all article's abstracts, introductions, results and discussion, and conclusion sections, the selected academic works are grouped into different categories related to the subject the authors analysed, as shown in Table 1.

Concerning our sample, green bonds are a major topic in academia (colour red in Fig. 3), followed by social impact bonds (colour green) and sustainable bonds (colour brown). This trend is also confirmed by the evolution of the sustainable finance worldwide market, where the issuance of green bonds prevails, as Fig. 4 shows.

3.1 Publication Years

Until 2013, our database interrogation did not detect sustainable finance-related research (grey line). However, the first green bonds (green line) and social impact bonds (yellow line) were already issued (green bonds in 2007 and social impact bonds in 2010).

The following years registered a considerable increase in publication and scholars' interest (Fig. 5 and Table 2), particularly after the Paris Agreement in 2015, with which world leaders pledged to be socially responsible and set the 17 Sustainable Development Goals (SDGs) to be

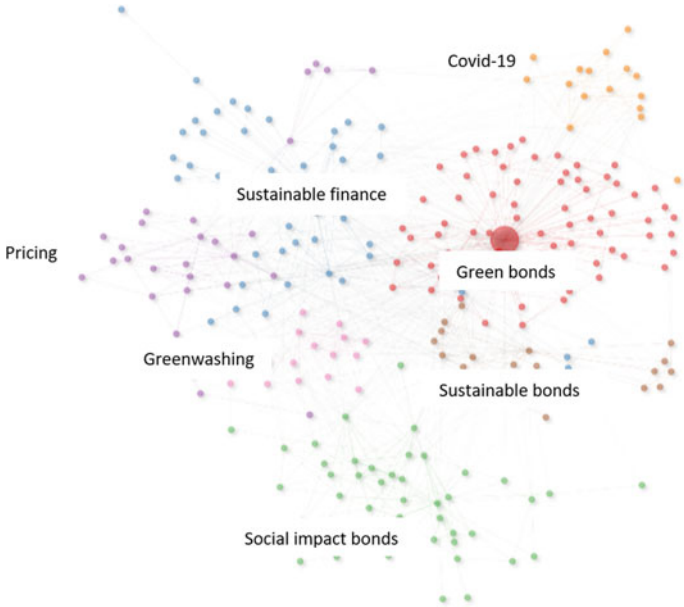

Fig. 3 Thematic map (*Source* Authors' elaboration through Bibliometrix)

achieved by 2030. Further, around 2018, Greta Thunberg, a young girl from Sweden, started a school strike for climate, asking for urgent actions on the climate crisis.

The number of papers grew significantly for both green and social impact bonds starting in 2019, with the emergence of the global pandemic, increased climate awareness, and growing demand for social services. Publications related to sustainable bonds (blue line) are identified starting from 2020.

With the beginning of the post-pandemic era and the issuance of the first recovery funds, the number of papers published related to green, social impact, and sustainable bonds reached its peak. However, in 2022 there was a turnaround for social impact bonds article production that began to decrease considerably, while the articles related to green bonds continued to grow.

Overall, the annual growth rate of production is 25.89%.

Table 1 Taxonomy of green, social impact, and sustainable bonds' research (*Source* Authors' elaboration)

	Group	*Number of articles*
Green bonds	1. Green bond market development and performance analysis	93
	2. Green bonds connected with other financial instruments	78
	3. Green bonds' premium	40
	4. Municipal bond	30
	Total	*241*
Social impact bonds	1. Single country—Single sector studies	30
	2. Cross-country studies—Cross-sector studies	21
	Total	*51*
Sustainable bonds	1. Sustainable bonds market analysis	1
	Total	*1*
Literature review	1. Sustainable finance	3
	2. Green bonds	6
	3. Social impact bonds	1
	Total	*10*
Total		**303**

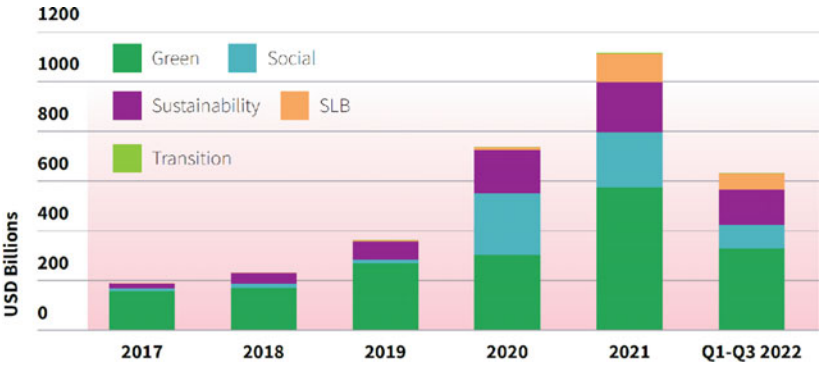

Fig. 4 Sustainable debt annual issuance (*Source* Climate Bonds Initiative [November 2022])

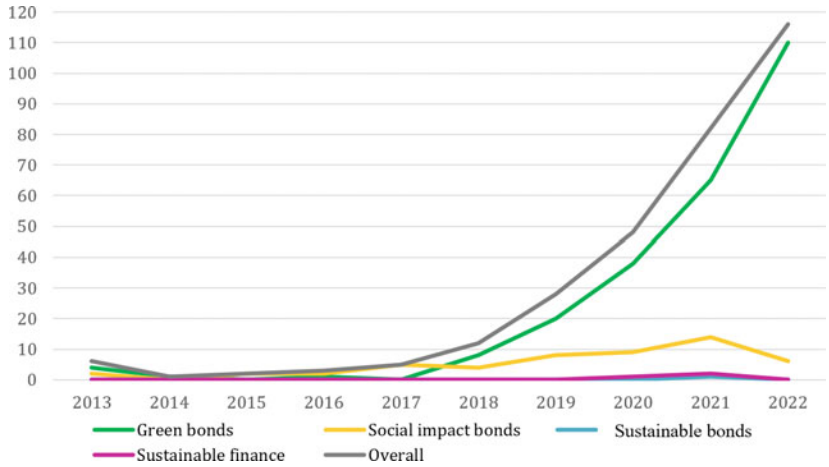

Fig. 5 Annual production (*Source* Authors' data elaboration)

Table 2 Annual production (*Source* Authors' data elaboration)

Annual production topic					
Year	*Green bonds*	*Social impact bonds*	*Sustainable bonds*	*Sustainable finance*	*Overall*
2013	4	2	0	0	6
2014	1	0	0	0	1
2015	0	2	0	0	2
2016	1	2	0	0	3
2017	0	5	0	0	5
2018	8	4	0	0	12
2019	20	8	0	0	28
2020	38	9	0	1	48
2021	65	14	1	2	82
2022	110	6	0	0	116
Total	247	52	1	3	303

3.2 Author(s)' Analysis

Table 3 collects the ten most productive authors. M.A. Naeem is the author with the highest number of papers published on sustainable

Table 3 Top 10- most productive authors (*Source* Authors' data elaboration)

Rank	*Authors*	*Articles*	*h-index*	*Topic*
1	Naeem, M. A	**7**	42	Green bonds
2	Li, Y	**6**	21	Green bonds
3	Park, D	**5**	**51**	Green bonds
4	Tiwari, A. K	5	**49**	Green bonds
5	Abakah, E. J. A	4	12	Green bonds
6	Agliardi, R	4	10	Green bonds
7	Lee, C. C	4	22	Green bonds
8	Lin, B	4	**83**	Green bonds
9	Pham, L	4	11	Green bonds
10	Reboredo, J. C	4	35	Green bonds

finance-related instruments (n.7), followed by Y. Li (n.6) and D. Park (n.5).

In general, as we can observe from Table 3, the number of papers published per author is not high, even if the literature on sustainable finance is vast. This evidence can be explained by the high number of authors that keeps investigating sustainable finance. Furthermore, the green and social impact bond markets are still in their infancy. Most of the authors analysed have commonly expressed that the major limitation in investigating these innovative financial instruments is the absence of a standard definition and the difficulty in the data collection. Related to this last point, social impact bonds are less reviewed than green bonds due to the difficulty of collecting data. In fact, among the ten most productive authors, no one has studied social impact bonds.

In the end, we focus on some metrics, more precisely on an author-level metric, the h-index that measures both the productivity and citation impact of the publications (Bornmann & Daniel, 2007). B. Lin is the author with the highest h-index value, followed by D. Park and A. K. Tiwari.

3.3 The Most Important Articles

We identify the most trending ten articles based on the number of citations reported in Table 4. O. D. Zerbib (2019) has been cited 268 times during the period analysed, followed by J. C. Reboredo (2018) and D. Y. Tang (2020). These ten influential papers are a great start to have an

Table 4 Top 10- most cited papers (*Source* Authors' data elaboration)

Rank	*Paper*	*Journal*	*Total Citations (TC)*	*TC per Year*	*Topic*
1	Zerbib, O. D. (2019)	*Journal of Banking & Finance*	268	53.6	Green bonds
2	Reboredo, J.C. (2018)	*Energy Economics*	205	34.17	Green bonds
3	Tang, D. Y. (2020)	*Journal of Corporate Finance*	181	45.25	Green bonds
4	Flammer, C. (2021)	*Journal of Financial Economics*	173	57.67	Green bonds
5	Reboredo, J. C. (2020)	*Economic Modelling*	133	33.25	Green bonds
6	Warner, M. E. (2013)	*Journal of Economic Policy Reform*	127	11.55	Green bonds
7	Hachenberg, B. (2018)	*Journal of Asset Management*	126	21	Green bonds
8	Saeed, T. (2021)	*Energy Economics*	110	36.67	Green bonds
9	Bachelet, M. J. (2019)	*Sustainability*	108	21.6	Green bonds
10	Thi Thu Ha, N. (2021)	*Finance Research Letters*	107	35.67	Green bonds

overview of green bonds since the authors are the most prominent in the research field. The ten papers are cited on average 35 times per year, with the highest rate of 57.67 and the lowest of 11.55 times. The lowest value is slightly under the all-document average citation per document, which is 19.79 times.

3.4 Keywords Analysis

The total number of authors' keywords is 957. Table 5 and Fig. 6 illustrates the results of the 50 keywords most used and their frequency. This kind of analysis allows us to detect trending research topics and summarise the paper's content with just a few words.

Table 5 50 Authors' keywords most used and their frequency (*Source* Authors' elaboration)

Words	*Frequency*	*Words*	*Frequency*
Green bond(s)	214	Greenwashing	5
Social impact bond(s)	39	Hedging	5
Sustainable finance	28	Sustainable investment	5
Green finance	22	Bond yield	4
Green	16	Causality	4
Covid-19 pandemic	20	Clean energy	4
Sustainability	15	credit spread	4
Climate change	14	Crisis	4
Impact investing	14	Financial markets	4
Climate finance	13	Governance	4
ESG	13	Innovation	4
Sustainable development	12	Liquidity	4
Green bond Premium/ greenium	15	Portfolio Diversification	4
Investment	7	Sukuk	4
China	6	Volatility	4
Connectedness	6	Yield spread	4
Corporate social responsibility	6	Bitcoin	3
Energy efficiency	6	Central banks	3
Payment by results	6	Clean energy stocks	3
Renewable energy	6	Credit rating	3
Climate	5	Cross-quantilogram	3
Conventional bonds	5	Equity and other prices	3
Event study	5	Diversification	3
Financial innovation	5	Risk-management	3
Green bond market	5	Services	3

Many terms are related to green bonds and climate change. This result is not surprising because most papers under analysis have examined this innovative instrument.

The other most frequent words are related to social impact bonds, such as "impact investing", "payment by results", "public–private partnership", and "social investment".

Other prominent terms refer to "corporate social responsibility", "ESG factors", "sustainable development goals", "COVID-19 pandemic", and "financial markets". In fact, concerning the market analysis, we find several keywords such as "financial analysis", "yield spread", "bond yield",

Fig. 6 Word cloud—Authors' keyword (*Source* Authors' data elaboration)

"liquidity", "credit rating", "portfolio diversification", "greenwashing", and "equity and other prices". All these terms are referred to the analysis of green bonds.

This analysis highlights how scholars and practitioners investigate green and social impact bonds. Concerning the former, the authors investigate their financial performance. Concerning the latter, the authors examine the issuance methodology of social impact bonds and their application sector.

3.4.1 Source Analysis

We identified top ten prominent journals based on the (1) number of papers, (2) number of citations, and (3) number of citations per year. The top journals are listed in Table 6.

Sustainability is the journal most chosen by the authors interested in sustainable finance and its instruments, followed by the *Finance Research Letters*.

Following a fundamental premise and motivation of bibliometric studies according to which citations reflect the impact, we agree with Goodell et al. (2023) that impact measures quality. For this reason, it is interesting to observe that seven out of ten journals are ranked

Table 6 Top 10 sources (*Source* Authors' elaboration)

Sources	*Articles*	*JIF Rank*
Sustainability	27	Q2
Finance Research Letters	12	Q1
Energy Economics	18	Q1
Journal of Sustainable Finance & Investment	13	Q2
International Review of Financial Analysis	10	Q1
Journal of Risk and Financial Management	10	Q2
Business Strategy and The Environment	9	Q1
Energy Policy	7	Q1
Technological Forecasting and Social Change	6	Q1
Research in International Business and Finance	5	Q1

Q1 following the Journal Impact Factor (JIF)[2] quartile performed by Clarivate. It means that sustainable finance, green, social impact, and sustainable bonds are not only prominent research topics for scholars but also that the scientific community and journals are concerned about these novel themes.

3.4.2 Country Analysis

Table 7 illustrates the ten countries most and least cited in the papers. China and the USA are the most cited, Qatar, Sri Lanka, and Norway the least.

This data can be explained because these countries issue most green and social impact bonds. Furthermore, China's market analysis is gaining much interest because it represents a developing country's green bond explosion.

However, if we put together the number of times European countries (Spain, Italy, Netherlands, France, Sweden, Romania, Denmark, and Norway) have been mentioned (1,628 times), we would far outnumber the USA (763 times) and China (1,024 times). This is because Europe

[2] A journal's quartile ranking is determined by comparing a journal to others in its JCR category based on Impact Factor score. If a journal falls in Q1, it means that the journal performs better than at least 75% of journals in that category, based on its Impact Factor score (Clarivate, 2023. Available https://clarivate.libguides.com/jcr#:~:text=JIF%20Percentile%3A,granular%20view%20than%20quartiles%20do.).

Table 7 Most and least studied countries (*Source* Authors' elaboration)

The most studied countries		*The least studied countries*	
Country	*No of citations*	*Country*	*No of citations*
China	1,024	U Arab Emiratis	7
USA	763	Turkey	5
Spain	540	Pakistan	4
United Kingdom	410	Romania	3
Italy	364	Uganda	3
Netherlands	285	Ghana	3
Japan	253	Danmark	3
France	226	Qatar	3
Australia	224	Sri Lanka	2.5
Sweden	205	Norway	2

still dominates the market even if the green, social impact, and sustainable bond market is spreading and the number of actors and liquidity is increasing worldwide.

4 Conclusion

This study reviewed the sustainable finance-related literature. Using a bibliometric approach, we analysed 303 articles published in 2007–2022 from Web of Science databases. Through our analysis, we noted that the extant literature deeply focused on the green bond market, whereas only limited studies have investigated social impact or sustainable bonds.

We show that the peak in article production for both green and social impact bonds was reached in 2021, although in 2022 the number of papers related to social impact bonds significantly decreased. This can be explained by the difficulty in collecting data for this last type of bonds. In addition, we highlighted that the top 10 contributions are unsurprisingly related to green bonds. However, they can be a great starting point for an overview of the green bonds market since the authors are the most prominent in the research field. Moreover, we demonstrate that seven out of 10 of the most productive journals are ranked Q1. As for the top three countries most mentioned, we find China, the USA, and Spain.

Our chapter can be used as a guide for future scholars and practitioners in advancing theory and having a general overview of sustainable finance related to literature evolution.

Overall, while we highlight the specific findings of this particular bibliometric study, our focus is to reiterate the need for future studies related to social impact and sustainable bonds.

AuthorContribution *Author Statement*

The authors assert that this paper is a product of genuine collaboration and is not published or under consideration elsewhere.

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References

Aracil, E., Nájera-Sánchez, J., & Forcadell, F. J. (2021). Sustainable banking: A literature review and integrative framework. *Finance Research Letters, 42*, no 101932. https://doi.org/10.1016/j.frl.2021.101932

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics, 11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Bornmann, L., & Daniel, H. D. (2007). What do we know about the *h* index? *Journal of the American Society for Information Science and Technology, 58*(9), 1381–1385. https://doi.org/10.1002/asi.20609

Clarivate Analytics (2023, April 7). *Journal Citation Reports: Learn the Basics*. Clarivate Analytics. https://clarivate.libguides.com/jcr#:~:text=JIF%20Percentile%3A,granular%20view%20than%20quartiles%20do

Cortellini, G., & Panetta, I. C. (2021). Green bond: A systematic literature review for future research agendas. *Journal of Risk and Financial Management,* 14(12), no. 589, https://doi.org/10.3390/jrfm14120589

Delle Foglie, A., & Keshminder, J. S. (2022). Challenges and opportunities of SRI sukuk toward financial system sustainability: A bibliometric and systematic literature review. *International Journal of Emerging Markets*. EarlyCite. https://doi.org/10.1108/IJOEM-04-2022-0601

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research, 133*, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Goodell, J. W., Oriani, M. E., Paltrinieri, A., & Patel, R. (2023). The importance of ABS 2 journals in finance scholarship: Evidence from a bibliometric case study. *Finance Research Letters*, article in press, 103828. https://doi.org/10.1016/j.frl.2023.103828

Khan, A., Hassan, M. K., Paltrinieri, A., Dreassi, A., & Bahoo, S. (2020). A bibliometric review of takaful literature. *International Review of Economics & Finance, 69*, 389–405. https://doi.org/10.1016/j.iref.2020.05.013

Khan, A., Goodell, J. W., Hassan, M. K., & Paltrinieri, A. (2022). A bibliometric review of finance bibliometric papers. *Finance Research Letters, 47*, n[a] 102520. https://doi.org/10.1016/j.frl.2021.102520

Kumar, S., Sharma, D., Rao, S., Lim, W. M., & Mangla, S. K. (2022). Past, present, and future of sustainable finance: Insights from big data analytics through machine learning of scholarly research. *Annals of Operations Research*: 1–44. https://doi.org/10.1007/s10479-021-04410-8

Levy, D. L. (2020). COVID-19 and global governance. *Journal of Management Studies, 58*(2), 562–566. https://doi.org/10.1111/joms.12654

Liu, Z., Yin, Y., Liu, W., & Dunford, M. (2015). Visualizing the intellectual structure and evolution of innovation systems research: A bibliometric analysis. *Scientometrics, 103*(1), 135–158. https://doi.org/10.1007/s11192-014-1517-y

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *International Journal of Surgery, 8*(5), 336–341. https://doi.org/10.1016/j.ijsu.2010.02.007

Mukherjee, D., Lim, J. W., Kumar, S., & Donthu, N. (2022). Guidelines for advancing theory and practice through bibliometric research. *Journal of Business Research, 148*, 101–115. https://doi.org/10.1016/j.jbusres.2022.04.042

Organisation for Economic Co-operation and Development (OECD). (2016). *Social impact investment: Building the evidence base*. OECD.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Bourtron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E. & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *International of Clinical Epidemology, 134*, 178–189. https://doi.org/10.1016/j.jclinepi.2021.03.001

Paltrinieri, A., Hassan, M. K., Bahoo, S., & Khan, A. (2019). A bibliometric review of sukuk literature. *International Review of Economics & Finance*, In press. https://doi.org/10.1016/j.iref.2019.04.004

Paul, J., & Criado, A. R. (2020). The art of writing literature review: What do we know and what do we need to know? *International Business Review, 29*(4), nº 101717. https://doi.org/10.1016/j.ibusrev.2020.101717

Pizzi, S., Rosati, F., & Venturelli, A. (2021). The determinants of business contribution to the 2030 agenda: Introducing the SDG reporting score. *Business Strategy and the Environment, 30*(1), 404–421. https://doi.org/10.1002/bse.2628

Stanley M. (2017). *Behind the green bond boom*. Retrieved Jun 19, 2022, from https://www.morganstanley.com/ideas/green-bond-boom

Stechemesser, K., & Guenther, E. (2012). Carbon accounting: A systematic literature review. *Journal of Cleaner Production, 36*, 17–38. https://doi.org/10.1016/j.jclepro.2012.02.021

Tang, D. Y., & Zhang, Y. P. (2020). Do shareholders benefit from green bonds? *Journal of Corporate Finance, 61*,. https://doi.org/10.1016/j.jcorpfin.2018.12.001

United Nations. (2018). *The sustainable development goals report 2018*. Nova York.

Waltman, L. (2016). A review of the literature on citation impact indicators. *Journal of Informetrics, 10*(2), 365–391. https://doi.org/10.1016/j.joi.2016.02.007

CHAPTER 6

Exploring the Shades of Green Premium: A Matching Approach

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1 Introduction

The need to undertake corrective actions to counterbalance the vicious circle which is damaging our environment has been the object of the most recent institutional interventions. A clear example of such a commitment should be traced back in the COP26 (Conference of Parties held in

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Glasgow (UK) from 31 October 2021)[1] and in the most recent COP27 (held in Sharm-el-Sheik from 6 November 2022)[2] conferences, organised to enhance cooperation among institutional parties and to achieve effective actions in line with the objectives of the Paris Agreement. In this debate, the European Union acts as a protagonist, orientating the European post-pandemic recovery towards the green transition with "*the biggest green stimulus in history*".[3]

In this broader framework, firms are called to stand actively to reduce their carbon footprint. A key step in this path is represented by the need to collect financial resources for projects which radically modify the operational structure of firms living the transition process. As a corollary, in the last few years green bonds market has grown more and more in complexity and dimensionality, representing a channel to link investors' green appetite and firms debt capital collection. To make the environmental transition process easier, it is required a strong regulatory support to promote the supply of green bonds, facilitating issuance process, conveying clearer information and ex-post monitoring activities, making green bonds more and more attractive as an alternative for resource collection upon markets.

In the light of what has been said until now, this chapter refers to a sample of 1707 issuances from January 2020 to August 2022. The timeframe includes several turmoil moments on markets, from the COVID-19 pandemic storm that hit the whole world in 2020, to the increasing inflation affecting interest rates in 2021 and the outbreak of the war between Ukraine and Russia in 2022. In addition, the analysis takes advantage of a well-established technique, namely the propensity scores matching analysis, by the nearest neighbour matching approach

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[1] https://ukcop26.org/.

[2] https://cop27.eg/.

[3] https://www.bloomberg.com/news/articles/2020-07-21/eu-approves-biggest-green-stimulus-in-history-with-572-billion-plan.

to observe if differently labelled green bonds, compared to their nearest non-green peers, result in lower expected returns for investors, underlying their higher proneness towards green instruments. The pairing mechanism is based on similar financial and issuance-specific characteristics of the paired issuances, to isolate, if any, the treatment effect represented by the greenness of the issuance and its facets. By testing different labels applied to green bonds issuances, namely self-green declarations by the issuers, ESG disclosure performed activities, external guarantees to the issuance and self-documented greenness of the bond, the analysis shows how, benefits still exist in terms of lower cost of debt capital for those issuers engaging in more concrete environmentally oriented activities.

This chapter contributes to the existing debate on green premium by exploring its persistence despite higher economic downturn, in line with the majority of literature which has pointed out such feature in a pre-pandemic sample, as well as by highlighting how a stronger and more effective disclosure on projects underlying green bonds issuances implies better financing conditions for firms and higher investors willingness to accept lower expected returns compared to conventional bonds with similar characteristics.

The remainder of this chapter continues as follows: Sect. 2 Literature Review observes the main antecedents in literature in the field of green bonds; Sect. 3 Data and Methodology presents the data used for the analysis, the sampling strategy, the variables construction process and the methodology development; Sect. 4 highlights the main results of the analysis drawing the main implications of each result; and Sect. 5 concludes highlighting the main implications of the analysis.

2 Literature Review

Great attention has been paid overtime to the benefits deriving from engaging in high socially responsible activities for firms. The role of environmental performance of firms has been the fil rouge of several studies focusing on the possible impact of higher corporate non-financial performance on corporate financial performance, providing evidence of a positive association (Perrini et al., 2011; Porter & Van der Linde, 1995; Russo & Fouts, 1997). In this general framework, the so-called stream of research of the "*does it pay to be green*" literature, since Hart and Ahuja in 1996, investigates the role of emissions reduction and environmental

commitment in improving firms performances under different perspectives. In depth, Hart and Ahuja (1996) argue the positive and beneficial impact of environmental depletive emissions reduction on firms financial measures, as the Return on Assets (ROA), the Return on Sales (ROS) and the Return on Equity (ROE).

In this sense, both companies and investors, moved by institutional pressures, are driven by a sort of moral obligation and by the growing legislative engagement to reduce their environmental depletive footprint, undertaking several changes in their organisational structure and adopting sustainable strategies. Firms are changing their traditional habits, directing their choices to the reduction of emissions and waste or, as another example, to the use of renewable energies. As part of that complex of processes and actions that everyday firms must face, the process of financial resources collection is influenced by such dominating trend too. The green bonds market, which initially broke out in 2013 when there was a widespread growth of green bonds (Gianfrate & Peri, 2019), has nowadays reached new peaks, foreseeing an expected growth to 5 trillion dollars in 2025.[4]

Green bonds are defined by the International Capital Markets Association (ICMA) as a category of debt instruments that allows raising capital to be invested in new projects bringing environmental benefits. The Green Bond Principles (GBP) support issuers during the financing phase of environmentally friendly and sustainable projects by promoting a sustainable, emission-free and environmentally friendly economy. In fact, green bonds might be generally traced out as plain vanilla fixed income instruments characterised by a peculiar use of proceeds. For this reason, since the first emissions, green bonds have had a strong impact on firms choices, directing their financing decisions and reaching a substantial growth, up to a peak in 2021 of half a trillion dollars issued amount. In other words, green bonds are nothing more than instruments capable of raising resources on the capital markets that aim at undertaking investments and eco-proactive interventions for the real economy (Russo et al., 2021).

As stated by Tang and Zhang (2020) green bonds are a useful source for issuers as they allow to raise financial resources reducing the cost of raising capital. The authors have identified three main sources of benefits

[4] https://www.climatebonds.net/2022/01/500bn-green-issuance-2021-social-and-sustainable-acceleration-annual-green-1tn-sight-market.

ranging from the announcement phase, to the issuance of green bonds, seeking to reduce funding costs while jointly encouraging investors to pay attention to sustainability, as their demand for green investments appears to be growing day by day. Thus, paying attention to sustainability implies benefits simultaneously for both companies and investors concerned about the environmental impact of their choices (Mariani et al., 2019).

In this sense, Maltais and Nykvist (2020) develop in-depth interviews with 9 green bonds investors, including for example investment funds, banks and governments with respect to Swedish public and private green bonds issuers. As a main result, the authors highlight how green bonds are perceived as a more sustainable oriented investment choice, as a response to the mainstreaming of sustainability consideration into investors interaction with issuers. In a similar way, Macaskill et al. (2021) claim that one of the drivers in investors strategy are the future climate and environmental implications arising from their investment choices.

Focusing on investors willingness towards green investments, in the last few years the academic literature has focused on the implications deriving from their increased appetite on sustainable oriented investments, as in the case of green bonds, for example, by accepting lower yields. The yield to maturity represents "*the single discount rate that allows to obtain a present value equal to the purchase price of the security*" (Forbes et al., 2008).

In this framework, Zerbib (2019) introduces the so-called Greenium, as the difference in yields between green bonds and conventional peers, which allows to lower the cost of capital for green issuers, highlighting that environmental preferences have an impact on bond market pricing, lowering the yield to maturity and implying a lower cost of the related debt capital for firms. Indeed, by observing 110 pairs of bonds, Zerbib (2019) highlights that green bonds exactly matched to their peers in terms of underlying financial characteristics, register a difference in yields to maturity equal to -2 basis points.

Literature has long debated on the green bond premium from investors and issuers perspectives with mixed results. Hachenberg and Schiereck (2018) demonstrate a yield difference, equal to 1 basis point in case of issuing green or conventional bonds. Intriguingly, Fatica et al. (2021), by matching green premium in a peculiar sample of bonds issued by supranational institutions, corporate and financial issuers, highlight a significant premium in pricing when it comes to green bonds only when issued by supranational institutions. Gianfrate and Peri (2019), adopting

a propensity score matching approach, investigate the differences between conventional and green bond yields within both primary and secondary markets. The authors develop an analysis comparing corporate and non-corporate issuers, confirming the benefits deriving from the greenness of the instrument, in particular when dealing with corporate issuance.

In a similar way, Nanayakkara and Colombage (2019), by an analysis based on an Option-Adjusted spread methodology on panel data regression from 2016 to 2017, show that green bonds are marked by a premium of -63 basis points, implying reduced cost of capital for green issuers. Next to this, the last few years have been characterised by some turmoil events driving choices on capital markets. Firstly, COVID-19 has shaken more and more the global economy, in the same direction of the outbreak of the Russian-Ukrainian war and consequent rise in the cost of energy and raw materials. In the same line, the rising inflation has enlarged the growing shadow of a recession. All these events have had a major impact on markets and they must be combined with the institutional attempt to drive the recovery towards a green path, trying to shift more and more the attention of investors towards a definitive ecological transition.

In this context, Hacïomeroğlu et al. (2022) study how after an initial decrease in yields in the primary market; green bonds on secondary market seem to have represented a safe-haven for investors during periods of turmoil such as COVID-19. Yi et al. (2021), using an event study methodology on green bond yields, show a significant cumulative abnormal return (CAR) during the COVID-19 pandemic period, significantly reduced in the post-pandemic period.

To sum up, this chapter aims at observing if the occurrence of disruptive events as the COVID-19 pandemic, the huge increase of inflation in the post-pandemic period, as well as the Russian-Ukrainian war has shifted the attention towards the financial sustainability of environmental transition. In this sense, despite a consensus on the existence of a green premium, the analysis is driven by the desire to assess if the need for a financial recovery after the outburst of the series of downturns we are experiencing has changed the tendency to accept lower yields in return of a green-oriented financial instrument. Thus, this chapter is aimed at testing if the greenium resists even in such conditions, by comparing green and traditional bonds in a timeframe simultaneously characterised by high environmentally-related investors' attention and higher uncertainty and potential transition costs for firms. In this sense, the first hypothesis can be summarised as follows:

HP1: Green Premium endures in period of turmoil on markets.

Furthermore, other aspects are analysed by literature. In this regard, the presence of a label testifying the reliability of the issuance drives investors' decision when it comes to green bonds. Russo et al. (2021) analyse a sample of 306 corporate issues, taking as a time frame the period from 2013 to 2016 and the authors highlight the impact of project characteristics, issuer green orientation and third party opinion assessing the reliability of the issuance on green bond yields. The authors claim the investors' tendency to accept a lower yield for green bonds when supported by the reliability of the label tied with the issuance.

Dorfleitner et al. (2022) stress the relevance of the presence of a more consistent green bond premium if the issuance is certified. The authors compare green and conventional bonds by an analysis on a sample of 250 green bonds combined with 500 conventional issues in the period from 2011 to 2020. The results show the existence of a difference in yield referring to bonds with a second-party opinion or certified green bonds. In the same vein, Hyun et al. (2021) find evidence of a range oscillating from 24 to 36 basis points (from 0.24% to 0.36%) between green and conventional bonds pricing, due to the impact of green labels on bond prices. The green label appears as a strongly considered feature by sustainable investors, willing to accept a reduced yield in case of investment green-labelled green bonds, given the reduction of the information asymmetries. Even within the Chinese primary bond market, it has emerged that the risk premium on green bonds is positively assessed if it is a green certification from third parties able to prove their authenticity (Wang et al., 2019).

This chapter also aims at observing the impact of different green facets on investors return expectations. Given the high environmentally-related attention increased overtime, the second hypothesis is focused on investigating the conditions which drive a further reduction in investors' returns expectation when dealing with green bonds. In other words, this hypothesis deepens the differences in investors demand when dealing with different disclaim of greenness of the scope underlying green bond issuance. In this sense, an in-depth analysis of the green yield premium is conducted between green and traditional bonds, to observe the persistence of the so-called greenium. Thus, the second hypothesis can be summarised as follows:

HP2: Green Premium intensifies according to the facet of green engagement applied by the issuer.

3 Data and Methodology

Data is collected through the Bloomberg database. The sample includes the latest bond issuances, starting from January 2020 to August 2022, to capture issuances referring to the pandemic period, the outbreak of the Russian-Ukrainian war as well as the Energy Crisis outburst. To test the persistence of the greenium even during economic turmoil, data concerning 5000 globally issued bonds are retrieved. After the data cleaning process, the final sample consists of bonds specifically referring to European countries, the United States and the United Kingdom, excluding developing and emerging countries, and issuances for which data was unavailable. The final resulting sample contains 1707 issuances.

Concerning the sample distribution, Fig. 1 shows the S&P rating of the issuances in the sample. A skewed distribution of credit risk can be identified, with higher absolute frequency of BBB+ and BBB bonds.

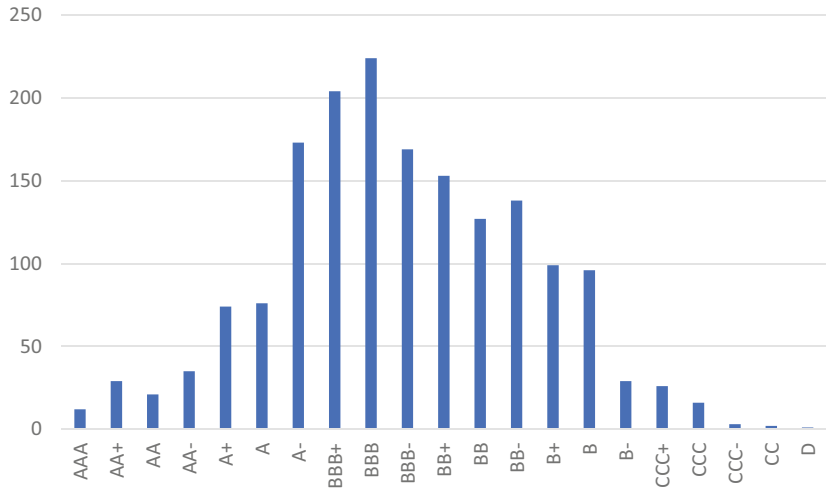

Fig. 1 Rating distribution of the issuances

Considering the industry distribution of the sample, Fig. 2 highlights the weight of industrial entities issuing debt instruments on capital markets, followed by the financial sector. Utility sector issuances are highlighted due to their sensitivity to the topic of environmental engagement, representing a stand-alone category in such logic.

The analysis adopts a matching approach in line with the literature to actively compare the yield of green and traditional bonds and to assess the specific impact of green labels on investors' expected return. The approach is highly diffused as a tool to pair treated versus non-treated observations. The analysis of the treatment effect on a treated group is based on the comparison with respect to a non-treated group to isolate the effect of the treatment with a propensity score matching (Rosenbaum & Rubin, 1983, 1984).

The methodology is based on a two-step procedure, firstly estimating propensity scores by a logit function as the probability of being treated given the underneath conditions. In the analysis we adopt the following formula:

$$\begin{aligned} Label_{i,t} =& \alpha_{i,t} + \beta_1 Rating_{i,t} + \beta_2 Leverage_{i,t} + \beta_3 Size_{i,t} \\ &+ \beta_4 Volume_{i,t} + \beta_5 Sector_{i,t} + \beta_6 Maturity_{i,t} \\ &+ \beta_7\ Country_{i,t} + \varepsilon_{it}; \end{aligned}$$

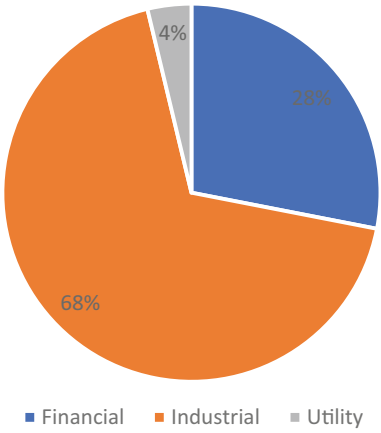

Fig. 2 Industry distribution

More specifically, the variables included in the equation to robustly carrying out the matching procedure are the following:

- **S&P Rating**: as the Standard & Poor's rating for each issuance;
- **Leverage**: as the ratio between total debt and the value of equity capital of the issuer;
- **Sector**: identifying if the issuer is an Industrial, Financial or Utility firm. Utility firms are highlighted due to their higher probability to engage in green bonds issuance (Gianfrate & Peri, 2019);
- **Size**: computed as the logarithm of Total Assets;
- **Volume**: computing the volume of the issuance as the logarithm of the value of the issued amount of bonds;
- **Maturity**: as the difference between the expiring date and the issuance date;
- **Country**: as the country of origin of the issuer.

Size, Leverage and Volume are treated by a statistical process, to exclude 1% outliers.

Then, considering the propensity scores individuated, a matching methodology is adopted to combine similar units. Each green bond is paired with an immediately referable counterpart with similar underneath financial characteristics differing only for the *"green"* identification. In this sense, the analysis takes advantage of the nearest neighbour matching technique, combining similar units in terms of observed propensity score with a calliper, namely a limitation in the standard deviation between paired observations equal to 0.2.

To measure the greenium the following four variables are adopted:

- **Bid Yield to Maturity (YTM)**: reflecting the yield to maturity from the best bid price of current market prices for the bond;
- **Ask Yield to Maturity (YTM)**: reflecting the yield to maturity from the best ask price of current market prices for the bond;
- **Liquidity**: the difference between the Bid yield to maturity and the Ask yield to maturity;
- **Yield to Maturity at Issuance**: as the yield to maturity at the bonds issuances.

Taking advantage on the formerly presented variables, the impact of the green label in terms of expected returns is assessed through different measures, following the greenium analysis approach. Firstly, we observe the impact of green features at issuance, namely focusing on Yield to Maturity at issuance variable. In this sense, it has been possible to assess the benefits of green bond issuances directly for firms. Secondly, the same consideration refers to the hypothesis that bonds can be traded on secondary markets, implying a gap between bid price and ask price in green bonds over time. Thirdly, the effect of greenness is tested on a specific measure of liquidity, namely the difference between bid and ask yields. In this sense, each hypothesis is tested for each observed outcome, to assess the impact on primary and secondary yields as well as on a measure of market liquidity.

Given that, once the observations have been paired and the balancing property of the matching procedure has been successfully assessed, and the difference in terms of expected returns is retrieved with a t-test, looking for a green premium, testing for the average effect and checking the robustness of the results with a regression model to confirm the association between lower expected returns and green features.

To address the second hypothesis, alternatively Self-Green, Self-documented Green, Guaranteed-Green and ESG Disclosure are adopted as possible labels retrieved from the Bloomberg database and on the prospectus of each issuance:

- **Self-Green**: a dummy variable counting 1 in case of an issuance defined "Green" by the issuer and 0 otherwise. There are 54 bonds with such definition in the sample;
- **Self-documented Green**: a dummy variable counting 1 in case of an issuance with self-documented green oriented use of proceeds, 0 otherwise. There are 55 bonds with such definition in the sample;
- **Guaranteed-Green**: a dummy variable counting 1 in case of an issuance with external green orientation guarantees by a second-party opinion or rating and 0 otherwise. There are 73 bonds with such definition in the sample;
- **ESG Disclosure**: a dummy variable counting 1 in case of an issuance whose issuer is engaged in non-financial disclosure activities and 0 otherwise. There are 71 bonds with such definition in the sample.

The matching procedure, based on a one-to-one nearest neighbour matching approach with calliper equal to 0.2 and an Average Treatment on the Treated (ATT) method, is based on the computation of propensity scores to observe the probability of each bond to be treated by each of the 4 analysed treatments. In this sense, each kind of green facet is passed alternatively to the same binomial model, pairing the samples based on the model estimation for each facet, capturing results in two main contexts, namely primary market with the yield at issuance as well as secondary market with the best bid yield. The same attempt is conducted also regarding the liquidity of the instrument by the difference between best bid and best ask yields.

The matching procedure results in 48 out of 54 Self-Green paired green bonds, 47 out of 55 Self-documented Green paired green bonds, 68 out of 73 Guaranteed-Green paired green bonds and 66 out of 71 ESG Disclosure-related paired green bonds.

4 Results and Discussion

Concerning the balancing property after the matching procedure, with reference to each treatment, the main descriptive statistics for the financial characteristics of the issuer as well as bond-related characteristics are compared in the sample, with and without treatment to assess the balancing properties of the matching procedure (Tables 1, 2, 3, and 4).

The balance in the standardised differences of the average values of the firms key financials, namely leverage and size and issuance-related variables, namely the volume of issuance, between the treated and untreated units testifies the reliability of the procedure.

Moving on to the main results of the analysis, considering the Yield to Maturity at issuance as a proxy for primary market consideration of

Table 1 Balancing descriptive statistics for Self-Green Treatment matches

Variable	*Mean with treatment = 1*	*Mean with treatment = 0*	*Standardized Mean Differences*
Leverage	61.03	66.17	−0.26
Size	11.002	10.01	−0.01
Volume	20.40	20.52	−0.23

Table 2 Balancing descriptive statistics for Documented-Green Treatment matches

Variable	*Mean with treatment = 1*	*Mean with treatment = 0*	*Standardized Mean Differences*
Leverage	60.84	66.18	−0.27
Size	11.09	11.01	0.04
Volume	20.38	20.52	−0.25

Table 3 Balancing descriptive statistics for Guaranteed-Green Treatment matches

Variable	*Mean with treatment = 1*	*Mean with treatment = 0*	*Standardized Mean Differences*
Leverage	60.87	66.24	−0.25
Size	11.23	11.01	0.12
Volume	20.45	20.51	−0.12

Table 4 Balancing descriptive statistics for ESG Disclosure Treatment matches

Variable	*Mean with treatment = 1*	*Mean with treatment = 0*	*Standardized Mean Differences*
Leverage	60.42	66.25	−0.26
Size	11.40	10.99	0.21
Volume	20.44	20.52	−0.14

different shades of green labelling, the effect of different treatments on the issuance yield to maturity is observed.

Table 5 shows the value of the yield as well as the difference in the yields with and without the treatment. In this sense, the Yield to Maturity at issuance represents the required yield by primary market investors for green bonds and thus the expected cost of debt for firms. First of all, it emerges how the yield for a green bond, independently from the nature of "green" treatment, is lower in comparison to the yield for conventional bonds. This leads to the conclusion that the first hypothesis is strongly supported, and firms can issue green instruments still taking advantage of the long debated green premium, despite the period marked by financial

Table 5 Yield to maturity results

Treatment	*Mean YTM treatment = 1*	*Mean YTM treatment = 0*	*Difference*
Self-Green	3.15	4.39	−1.24***
Documented-Green	3.17	4.39	−1.22***
Guaranteed-Green	3.16	4.40	−1.24***
ESG Disclosure	3.12	4.40	−1.28***

Note *** p < 0.01; ** p < 0.05; * p < 0.10

markets downturns and attention rising on the financial sustainability of the recovery.

In fact, the significance in the difference between the yields to maturity at issuance in the two categories of instruments highlights how the uncertainty towards the recovery path after pandemic and the debate about the relevance of corporate green engagement when dealing with the whole economy recovery, do not alter the willingness of investors to accept lower expected returns in case of green bonds.

With reference to the second hypothesis, it appears clear how, despite the growth between self-reported green bonds and self-documented ones, the more issuers strive to guarantee their commitment, the more markets seem to reward them by a lower expected yield to maturity at issuance, thus lower cost for firms to collect debt capital. More specifically, the more the issuer is engaged in ESG disclosure, the lower is the expected returns for investors and simultaneously the gap with expected returns of bonds with similar characteristics (−128 bps). The green facet with the worst result is the "Self-documented *Green*" treatment (−122 bps), implying that firms which claim to use their proceeds in green activities without a third party assurance, as well as without ex-post ESG disclosure activities are rewarded to a less extent by the market.

Similar results have emerged when considering the effect of the treatment analysis to a linear regression model, with a negative coefficient in line with the t-test analysis. Adopting clustered robust standard errors for each subclass in the sample of paired observations, we assess that each different shade of green labelling lowers the yield to maturity at issuance.

The two hypotheses are re-estimated with reference to secondary market tendencies and real time investors' bids. Table 6 shows the main results dealing with the best bid yield to maturity.

Table 6 Best bid yield to maturity results

Treatment	*Mean YTM treatment = 1*	*Mean YTM treatment = 0*	*Difference*
Self-Green	4.55	5.87	−1.32***
Documented-Green	3.17	4.38	−1.21***
Guaranteed-Green	3.16	4.40	−1.24***
ESG Disclosure	3.12	4.40	−1.28***

Note *** p < 0.01; ** p < 0.05; * p < 0.10

When shifting to the secondary market analysis, observing the difference in yields involving the best bid yield to maturity by investors, it stands clear how the stronger the commitment by firms, the higher the willingness to accept a lower yield. In this sense, the tendency is even clearer considering how from a mean value of 4.55% (Self-Green) the yield decreases to 3.12% (ESG Disclosure). Even in this case, the two hypotheses are strongly supported, implying the enduring persistence of greenium (HP1) and the decreasing yield to maturity when it comes to a more concrete engagement by the issuer. Conversely, the greenium intensifies in case of "Self-Green" treatment, followed by "ESG Disclosure treatment" (HP2). The negative difference can even be motivated by the hype on markets and the appetite for green bonds considering their "green" appearance.

Also in this case, a similar result is obtained when shifting the treatment analysis to a linear regression model for each subclass. In fact, a negative coefficient emerges, perfectly in line with the *t*-test analysis.

Moving on to the last stage of analysis, when dealing with market liquidity for similar pairs of bonds, in terms of difference between best bid and ask spreads, Table 7 shows the main results of the *t*-test analysis.

In this sense, the more the difference decreases, the better the liquidity of the bond on secondary market. However, no significance is found concerning the results in the sample between treated and untreated paired observations. This conveys a message of no average effect in terms of difference between the liquidity of treated and untreated bonds, independently on the shades of greenness which are referred to the single issuance and/or the issuer.

Such results reinforce the idea that there is no beneficial effect on the liquidity on secondary markets in the sample of analysis, maybe due to

Table 7 Liquidity results

Treatment	*Mean YTM treatment = 1*	*Mean YTM treatment = 0*	*Difference*
Self-Green	0.1	0.09	0.01
Documented-Green	0.1	0.09	0.01
Guaranteed-Green	0.12	0.09	0.03
ESG Disclosure	0.1	0.09	0.01

different market macro conditions lowering the magnitude of any possible effects of green labelling activities. No evidence of a different association is found even adopting a linear regression model. It implies that the two hypotheses are not supported when dealing with typical market liquidity.

Considering the analysis main implications, this proves investors' enduring consciousness about the importance of green investing with a renewed willingness to accept lower yields both on secondary and primary markets. In the same vein, the lower return expectation by investors reflects in a lower cost of debt for firms.

This evidence highlights how the increasing attention to the environment as well as the unstopping growth of the green bonds market have not altered the concrete commitment perceived by investors in such tool and how the stronger the commitment testified by a different label and more concrete commitment, and the more investors are prone to accept a lower yield, given the reduced information asymmetries. Such truth must be read together with the recent turmoil events. In this renewed context, it appears even more crucial to reduce the information asymmetries for investors, who are surrounded by green claims and green investment alternatives referring to projects in which a real virtuous commitment mixes with greenwashing intentions, hiding real outcomes behind the mask of the "new normal", represented by green.

5 Conclusions

In the broader framework of the path towards green transition, the importance of corporate choices which are always more oriented towards a concrete engagement in reducing their environmental damaging practices is becoming increasingly relevant. One possible pitfall of such tendency is undoubtedly represented by the need for new financing sources by firms

to finance the needed projects to undertake the route for new sustainable habits.

In this vein, in the last few years the green bonds market has kept growing in relevance, complexity, standing and, clearly, dimensionality. Nowadays green bonds constitute one established and accessible tool which permits firms to collect debt capital with choices oriented to greener alternatives.

Thus, this chapter, observing the most recent evolution of green bonds market, is oriented at testing if such instrument still represents a possibility to orientate their portfolios to green activities and a still useful tool for firms to collect debt capital at a lower costs, as pointed out by literature. In particular, the main contribution of the analysis stands in highlighting how the engagement to convey a message of real commitment by more solid labels and stronger commitment in disclosure of future activities, makes the issuance of a green bond even more desirable for investors, testifying the engagement of the issuer and reducing the unavoidable information asymmetries.

By a propensity score matching analysis, after matching in a sample of 1707 issuances by January 2020 to August 2022 different labelled green bonds with their immediately comparable non-green peers, this chapter permits to observe the enduring persistence of a green premium lowering the yield to maturity, both in terms of mean value t-test and regression association. What emerges is that looking at both primary and secondary market yields, certifying the greenness of the instrument by a label or engaging in disclosure activities makes the issuance more trustworthy. In this sense, what stands clear is that a green engagement during time with green disclosure activities translates into better capital collection conditions for issuers. In this sense, the contribution of this chapter is twofold, testing the persistence of the yield in period of turmoil on market in which such tools might lower green bonds disruptive impact, as well as testing a well-established effect under different shades to assess when the green premium resists and when it amplifies.

Considering the analysis main implication, this would ideally represent a message for issuers pushing them to a more concrete commitment avoiding greenwashing practices, claiming how investors are more prone to accept lower yields the more their information asymmetries are reduced. The analysis could clearly be enlarged in terms of dimensionality of the green bonds to be paired, as well as enlarged to the entire world to observe such phenomena in different countries. In terms of

future research, the difference between differently labelled green bonds can be studied, to assess if the difference in yields exists also when comparing green bonds whose only difference is the different facet of green engagement by the issuer.

References

Dorfleitner, G., Utz, S., & Zhang, R. (2022). The pricing of green bonds: External reviews and the shades of green. *Review of Managerial Science, 16*(3), 797–834.

Fatica, S., Panzica, R., & Rancan, M. (2021). The pricing of green bonds: Are financial institutions special? *Journal of Financial Stability, 54*, 100873.

Forbes, S. M., Hatem, J. J., & Paul, C. (2008). Yield-to-maturity and the reinvestment of coupon payments. *Journal of Economics and Finance Education, 7*(1), 48–51.

Gianfrate, G., & Peri, M. (2019). The green advantage: Exploring the convenience of issuing green bonds. *Journal of Cleaner Production, 219*, 127–135.

Hachenberg, B., & Schiereck, D. (2018). Are green bonds priced differently from conventional bonds? *Journal of Asset Management, 19*(6), 371–383.

Hacıömeroğlu, H. A., Danışoğlu, S., & Güner, Z. N. (2022). For the love of the environment: An analysis of green versus brown bonds during the COVID-19 pandemic. *Finance Research Letters, 47*, 102576.

Hart, S. L., & Ahuja, G. (1996). Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance. *Business Strategy and the Environment, 5*(1), 30–37.

Hyun, S., Park, D., & Tian, S. (2021). Pricing of green labeling: A comparison of labeled and unlabeled green bonds. *Finance Research Letters, 41*, 101816.

MacAskill, S., Roca, E., Liu, B., Stewart, R. A., & Sahin, O. (2021). Is there a green premium in the green bond market? Systematic literature review revealing premium determinants. *Journal of Cleaner Production, 280*, 124491.

Maltais, A., & Nykvist, B. (2020). Understanding the role of green bonds in advancing sustainability. *Journal of Sustainable Finance & Investment*, 1–20.

Mariani, M., Grimaldi, F., & Caragnano, A. (2019). A new tool to gather debt capital: Green bond. Risks and opportunities for firms and investors. *Journal of Governance and Regulation, 8*(4).

Nanayakkara, M., & Colombage, S. (2019). Do investors in green bond market pay a premium? Global Evidence. *Applied Economics, 51*(40), 4425–4437.

Perrini, F., Russo, A., Tencati, A., & Vurro, C. (2011). Deconstructing the relationship between corporate social and financial performance. *Journal of Business Ethics, 102*(1), 59–76.

Porter, M. E., & Van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives, 9*(4), 97–118.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70*(1), 41–55.

Rosenbaum, P. R., & Rubin, D. B. (1984). Reducing bias in observational studies using subclassification on the propensity score. *Journal of the American Statistical Association, 79*(387), 516–524.

Russo, A., Mariani, M., & Caragnano, A. (2021). Exploring the determinants of green bond issuance: Going beyond the long-lasting debate on performance consequences. *Business Strategy and the Environment, 30*(1), 38–59.

Russo, M. V., & Fouts, P. A. (1997). A resource-based perspective on corporate environmental performance and profitability. *Academy of Management Journal, 40*(3), 534–559.

Tang, D. Y., & Zhang, Y. (2020). Do shareholders benefit from green bonds? *Journal of Corporate Finance, 61*, 101427.

Wang, Q., Zhou, Y., Luo, L., & Ji, J. (2019). Research on the factors affecting the risk premium of China's green bond issuance. *Sustainability, 11*(22), 6394.

Yi, X., Bai, C., Lyu, S., & Dai, L. (2021). The impacts of the COVID-19 pandemic on China's green bond market. *Finance Research Letters, 42*, 101948.

Zerbib, O. D. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds. *Journal of Banking & Finance, 98*, 39–60.

CHAPTER 7

Sustainable Finance for Maritime Development: A Critical Analysis of Green Bonds in the National Recovery and Resilience Plan

Massimo Arnone and Tiziana Crovella

1 Introduction

This chapter started from an observation by Awaworyi (2017) according to which: "*the achievement of a green economy requires a stable and growing financial system*". Particularly, it focuses on green bonds which, within the European Union, from the very early stages of drafting the

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post-COVID-19 recovery plan, has been attributed to a crucial role in achieving the objectives of the ecological transition.

The research objective is twofold:

(1) From the scientific point of view, in the context of sustainable finance, it provided an analysis of the literature on the main characteristics of green bonds highlighting the differences respect to conventional bonds and the effects of this new approach to finance on the decision-making and strategic process of individual investors and the business models of bank intermediaries,
(2) For providing an application useful for all stakeholders involved in the maritime supply chain, it proposed an empirical reflection on the implementation of green finance to cold ironing technology in the maritime transport sector.

The new EU Sustainable Finance Disclosure Regulation (SFDR) 2019/2088 (EU, 2019) policy entered into force on March 10, 2021, emphasized social and environmental compliance reporting and reporting obligations for financial services participants in order to define their strategic positioning on sustainability. The greater stability of the financial sector can be achieved through greater integration between the typical procedures of conventional finance and the more recent ones of green finance (Migliorelli & Dessertine, 2019). For example, Meo and Abd Karim (2021) established that green finance is the best financial approach to reduce CO_2 emissions in the top ten economies, including UK, US, Canada, Denmark, Hong Kong, and Japan.

It is not an easy achieve this goal because there are many challenges that this new approach to finance will have to face in the years to come, involving players both on the supply side (public sector, foundations, multinationals, high net wealth individuals, retail investors, asset managers, green fund wholesalers, family offices, institutional investors, banks) and demand (environmentally oriented foundations, international non-governmental organizations, consumers and green-minded companies, non-profits, social enterprises and corporations social responsibility enterprise based on green assets) (Albino et al., 2009; Babiak & Trendafilova, 2011; Luzio & Lemke, 2013; Minn & Galle, 2001; Owen et al., 2018; Vickers & Lyon, 2014; Walley & Taylor, 2002).

Among the main innovations, first of all, the elaboration of new methods for measuring environmental risks, and more careful management of the risk of "*greenwashing*" which could produce damage both at a microeconomic level (individual investor) and at a macroeconomic level (for the entire market financial) (Caldecott, 2020; Gilchrist et al., 2021) and robust interventions aimed at creating a much more homogeneous regulatory framework on green bonds (Dikau & Volz, 2021; Park, 2018). Moreover, comparing several areas, the European continent has distinguished itself in recent years for a more intense effort of regulatory initiatives and policy indications, first of all with the Strategy for Sustainable Development of 2001 (later merged into Europe 2020), the launch of the Green Deal aimed at achieving carbon neutrality by 2050 and more recently the definition of a more detailed framework on the different types of green finance instruments and finally all the emergency interventions for the recovery from the pandemic financed by the next generation program.

The focus on this problem has grown, above all following the international financial crisis and the more recent pandemic crisis which have led the main local players (politicians, sector operators, academics) to ask themselves how green finance can facilitate a more connected approach to environmental issues which in various studies have been defined as low-carbon economy, circular economy, and green economy (Bonsu, 2020; Bridge et al., 2013; Gooaverts & Verbeek, 2018; Loiseau et al., 2016; Stahel, 2016; Zadek & Flynn, 2013). With the aim to achieve this goal, an amount of financial resources equal to 1.5 trillion dollars per year up to 2030 has been estimated (Doumbia & Lauridsen, 2019). The main areas of application of green finance primarily for carbon neutrality and the fight against pollution, renewable energy, and energy efficiency, climate change (Blose & Shieh, 1997; Flaherty et al., 2017; Fragiacomo & Genovese, 2020; Ghosh, 2018; Monasterolo & Raberto, 2018; Rosenthal et al., 2018; Thomson et al., 2017). For this reason, the authors proposed an application of green finance in maritime sector, considering that this activity is responsible for high rates of pollution and energy consumption. Besides, as highlighted by Cotugno et al. (2022), green bonds can be considered a subset of ESG (Environmental, Social, Governance) risks. The outbreak of the pandemic had the benefit of reinvigorating attention to the issue of environmental sustainability and leading investors to make more responsible choices aimed at obtaining maximum returns while also reducing ESG risks (Campiglio et al., 2018; Semieniuk et al., 2021).

The inclusion of these risk factors complementary to those financial allows investors to broaden the parameters for assessing their performance and not limit themselves only to the financial dimension (Van Duuren et al., 2016). Both companies and individual investors share the need to "*green*" their portfolios. In this regard, Rizzello (2022) identified five possible ways of conducting investors in the green finance market ("*exclusionary screening*", "*Best-in-class*", "*Thematic selection*", "*ESG Integration*", and "*Environmental Impact Investing*"). The first approach eliminated those companies that conduct unethical investments; the second approach selected the companies with the best performance based on ESG indices; the third approach selected sustainable investments (i.e., all those that have objectives primarily related to climate change, biodiversity, and renewable energy); the fourth approach includes ESG factors in evaluating investment returns; the last, the fifth, looks simultaneously at achieving financial returns on investments and at measuring their environmental impacts. Observing recent market trends, territorial differences have consolidated with the USA as the country with the largest issue of green bonds (51.1 billion dollars), followed by Germany (40.2 billion dollars), France (32.1 billion dollars), China, and the Netherlands (17.2 and 17 billion dollars, respectively). In terms of market share, green bonds currently account for 50% of the total sustainable bond market and 5% of the global bond market.

Recently, green finance market has experienced significant development thanks to the support of various green bond subsidy programs (Day et al., 2016; Martinez & Ebenhack, 2008). Moreover, different forms of green loans have developed especially in the banking business (e.g., green mortgages, commercial building loans, home equity loans, fleet loans, green funds, green insurance, public–private partnerships, and green equity trading) (Umar et al., 2021). Among the countries most characterized by this growth, it emerged Asian countries (Waddams et al., 2012) and China. The latter country had a key role of a growth that has known no setbacks since 2015, the year in which a regulatory regulation on the issue of green bonds was issued. Particularly, in 2016, 77% of green bond issues were carried out by the Chinese banking system (62% and 68% in the following two years). This growth was mainly caused by a significant domestic demand for green investments that can benefit from adequate financial support exclusively through green bonds. Another factor that may explain China's near-world-leading position in the green bond market is fewer regulatory constraints across green bonds

facing commercial banks with weak ratings and a lack of liquid assets. The shadow banking system building has been favored above all since 2018, with the new regulations issued to the CBRC (China Banking Regulatory Commission) for stricter supervision against off-balance sheet financial transactions that can fuel systemic banking risks. In this context, the use of green bonds can represent a form of alternative finance solution for obtaining the liquidity necessary to finance one's assets. Asia and Europe represent the second largest market for green bond issuance (representing about 80% of the entire market in 2020) (Rizzello, 2022). With the reflections and analyzes proposed in this study, the authors highlighted the important role that green finance, and in particular the product of green bonds, can play in achieving a more environmentally economy (Fig. 1). The size reached by global sustainable investments equals 35.3 trillion dollars of which more than 80% are located in the USA and Europe (GSIA, 2020), highlighting the centrality of the topic investigated in this chapter. The sector of application of green finance in this study is that maritime transport. This is because, as can be seen from the figure below, the transport sector can help by green finance to meet objectives related to four of the four main natural elements (fire, air, water, and earth).

Specifically, maritime sector and, mainly, maritime transport industry accounts for over 80% of the volume of international trade and the percentage is even higher for most developing countries (UNCTAD, 2021). Although this sector generates a considerable impact on the economy, it also generates many impacts on the environment such as waste, carbon emissions, pollution, depletion of natural resources (Paiano et al., 2020). At EU level, maritime transport is a substantial CO2 emitter, representing 3 to 4% of the EU's total CO_2 emissions, or over 144 million tons of CO_2 in 2019 (European Commission, 2022). At EU level, among ten most polluting ports: Rotterdam in Netherlands emits 13.7 Million tons (Mt) of CO_2, Antwerp in Belgium 7.4 Mt, Hamburg and Bremerhaven in Germany emit, respectively, 4.7 and 2.3 Mt of CO_2, in Spain Algericas 3.3 Mt, Barcelona 2.8 Mt and Valencia 2.7 like Piraeus in Greece, Marseille emits 2.3 Mt and lastly Amsterdam 2.1 Mt (Transport & Environment, 2018). Hence, these values show the urgent need to reduce supply chain emissions related to ports, especially in European ones. Particularly, maritime transport stands out as a strategic sector; the trend toward an increase in maritime traffic makes it essential to reduce energy consumption and emissions through investments in energy

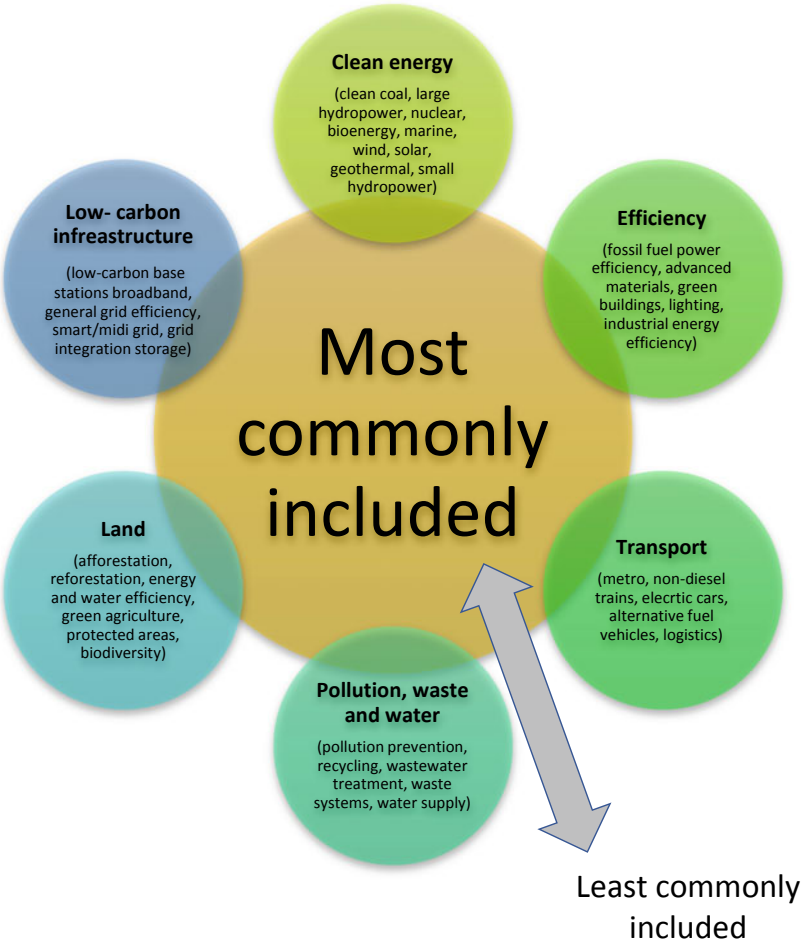

Fig. 1 The topics of green finance (*Source* UNEP, 2016)

efficiency (Longarela-Ares et al., 2020). In fact, maritime transport represents one of the most polluting sectors, with greenhouse gas emissions of over one billion tons of CO_2, equal to about 3% of global emissions. Furthermore, with the growth of ship traffic and in the absence of rapid measures to mitigate emissions these are set to increase to over 15% by

2050. Thus, considering shipping industry contributes to global CO_2 emissions, for reducing this impact, Yang et al. (2022) focussed on electric power as alternative fuel useful to decarbonize this industry. Electrifying maritime transport to achieve "cleaner ocean" and decarbonization is attracting increasing attention (Horvath et al., 2018). Driven by the need to decarbonize the energy sector, renewable capacity has reached a total of 161 GW (GW) in 2016 (REN21, 2017).

This pollution is mainly due to the ships docked in the port that have their propulsion engines turned off during the stop on the quay, but to ensure the provision of services on board they use auxiliary diesel engines. These plants use high fuel consumption and exhaust gas emissions. An example could be a cruise ship parked for 10 hours that generates CO_2 emissions equal to those generated by 25 cars in a year. Therefore, considering that 90% of European ports, for example, are located in urban areas and that pollutants can reach hundreds of kilometers from the coast, the impact extends to the hinterland, causing enormous inconvenience to citizens, at the of noise, air pollution, and traffic, mainly linked to heavy vehicles. Such situations create serious criticalities of acceptance by the community. Therefore, the sustainability of port areas must therefore become a priority for port authorities and local administrations. Unfortunately, in 2020, the COVID-19 pandemic disrupted shipping, causing maritime trade to contract by 3.8 % in 2020, recording a nascent, albeit asymmetrical, recovery in the second half of the year (UNCTAD, 2021). Particularly, the lockdown imposed by the countries, travel restrictions and production cuts have reduced the demand for fuel in 2020. Consequently, transportation and trade in crude oil, refined oil, derivatives, and gas decreased by 7.7% (UNCTAD, 2021).

The results included in this chapter can stimulate a reflection for local actors (financial authorities, banks, practitioners, social entrepreneurs, etc. and all stakeholders involved the maritime supply chain) about the nature of green bonds as a tool for completing the financial market. Regarding the effects on practitioners/investors, many studies following a microeconomic perspective show that the issuance of green bonds leads to a change in their behavior (Baker et al., 2018; Flammer, 2021; Lebelle et al., 2020; Zerbib, 2019). Analyzing the literature, Zerbib (2019) and Baker et al. (2018) underlined that investors could sacrifice a portion of their financial return by preferring green bonds to conventional ones, however obtaining in exchange greater results in terms of financial sustainability of

environmental investments. Particularly, green bonds differ from conventional bonds in the presence of a higher premium (greenium) which makes this source of funding cheaper for the issuer. Cotugno et al. (2022) shown that, during high economic uncertainty such as those following the COVID-19 pandemic, for which liquidity crises and the risk of being insolvent are always the problems most felt by companies, green bonds have a dynamic as high Beta, i.e., they offer higher risk premiums. According to the latter authors, the scholars have been identified at least four stages of the dynamics of credit spreads of green and conventional bonds during COVID-19. When the virus led to the first crisis in China (the Wuhan lockdown on January 2020), corporate credit spreads remained stable. Only after 24 February, when 11 municipalities in Northern Italy went into lockdown, did green bond credit spreads start to rise, outperforming conventional bonds and peaking in mid-March 2020. Green bond credit spreads fell to below conventional ones in October and retreated significantly after November 9th, when US-based Pfizer and Germany's BioNTech revealed positive trial results of their vaccine. Green bond credit spreads narrowed further in the following month through December 31, 2020.

Accordingly, for Lebelle et al. (2020) the issuance of green bonds improves the performance of the issuer. Flammer (2021) reached the same conclusion based on the existence of a positive correlation between attention to environmental issues by the issuing company and market reactions. This author demonstrated the existence of a positive correlation between stock prices and green bond issuance news. Other studies, following a logic of market aggregation (macroeconomic perspective), concluded that the enrichment of the type of funding instruments in the financial market through green bonds could allow investors to transfer risks from a market on the other by exploiting the similarities between the different types of bonds (conventional and green) and to achieve important environmental results more easily than traditional financial markets (Arif et al., 2021; Flammer, 2021; Naeem et al., 2021; Reboredo, 2018; Reboredo & Ugolini, 2020; Pham, 2016). For example, Reboredo (2018) using a vector autoregressive (VAR) structural model proved the transmission of financial shocks across green and financial bond markets, including bond, currency, equity, energy, and high-yield corporate bond markets. This interdependence takes on greater value especially following systemic crises (the global financial crisis of 2007 and the most recent COVID-19 pandemic) which have focused attention on the difficulty of

finding liquidity for companies, many of which are interested in making investments in sectors with strong impact on environmental and social sustainability (energy, waste, climate). The pandemic has increased the already existing economic inequalities in the territories and has brought out new forms of poverty. Therefore, the results of this chapter are increasingly topical because they are part of the reflection on the issue of how to achieve sustainability in the financial sector. Moreover, this goal is necessary to look at the processes of development and economic growth from a broader perspective. This broader perspective is that of the ecological transition (OECD, 2021) aimed at placing economies within agreements, businesses, and structures with zero carbon emissions.

Methodologically, this paper has been structured into four sections. In the first section, the introductory one, the peculiarities of the maritime transport industry that is a key sector in the economy, accounting for 90% of global economic trade (Longarela-Ares et al., 2020), the relative environmental impacts, considering an increase in emissions of up to 250% by 2050 (IMO, 2014; Nuttall et al., 2021), and the centrality of this sector in the construction of sustainable development processes were included. The second step provided the theoretical framework of the contribution, through an analysis of the literature on the topic of sustainable finance, with a focus on application to the maritime transport sector through the prism model. Considering the objective of this section the scholars provided a critical analysis of this new approach to finance, capturing the main differences concerning traditional finance. A part of this section was dedicated to green bonds. The content of this section of a descriptive nature can be divided into three parts:

(1) analysis of the state of the art of the application of sustainable finance measures;
(2) effects of sustainable finance measures;
(3) estimate of the reduction of impacts with the application of cold ironing.

The third and four section, of an empirical nature, proposed an application of green bonds to the maritime sector in particular analyzes the effects of implementing the Cold Ironing Project, Green Ports' innovative PNNR measure within the EU Next Generation. The five section concludes.

2 Theoretical Framework and Systematic Literature Review

2.1 Sustainable Finance

The topic of sustainable finance is quite recent in the scientific debate (Benedikter, 2011; Carè, 2018; Fatemi & Fooladi, 2013; Hangl, 2014; Lagoarde-Segot, 2018; Rizzi et al., 2018; Shiller, 2013; Ziolo et al., 2017). Moreover, sustainable finance is one of the perspectives for analyzing the multidisciplinary concept of sustainability applied to business; it is a key condition for being able to successfully apply sustainable entrepreneurship whose decisions do not have the sole objective of achieving economic-financial returns on investments but also of producing a social impact.

Particularly, sustainable entrepreneurship, makes it possible to seize all those opportunities representative of market failures in the field of sustainability (Hall et al., 2010; Hoogendoorn et al., 2019; Wagner, 2017; York & Venkataraman, 2010). Moreover, several authors who have coined the expression "eco-entrepreneurship", investigated the business world exclusively by looking at the relationship with the environment (Isaak, 2002; Shrivastava, 1995). For these authors, the competitive capacity of a company is based on the pursuit of environmental objectives. Other authors who have dealt with "social entrepreneurship" focused on social issues and obtaining adequate financial support for them (Bull, 2008; Mair & Martı, 2006; Nicholls, 2008).

Notwithstanding, the interest in sustainable finance and, particularly, in green finance is justified by the lack of financial resources to be allocated to the 17 Sustainable Development Goals (SGDs) of the United Nations (UN) Agenda 2030 and following the assumed importance of climate change in the field of action of the public and private sector. Therefore, it appears increasingly necessary to build public–private partnerships in support of an economy increasingly attentive to environmental problems and more inclusive.

In literature, Utting (2015) provided the following definition of green finance: *"an economy that focuses economic development on the action of business organizations in which people play a crucial role. This economy that bases its multidisciplinary nature on the integration of economic approaches, typical of the traditional economy, and the social, environmental, political, and holistic ones, typical of solidarity economies*". The centrality of

personal initiative and entrepreneurial skills are key factors in the realization of successful forms of innovation following the logic of the market and environmental sustainability at the same time (Schaltegger & Wagner, 2011). The term *"creative capitalism"* has been used in the literature for indicating the hybrid form of the enterprise (Taylor, 2010). However, an unambiguous definition is still lacking, and this has led to the proliferation of different forms of sustainable finance: ethical finance, sustainable and responsible investment, microfinance, social impact investment, crowdfunding, green finance (Chiappini, 2017; Belleflamme et al., 2014; Soppe, 2009; Perez, 2007; Relano, 2008; Robinson, 2011; Warner, 2013; Weber & Duan, 2012; Weber & Remer, 2011).

Grandin and Saidane (2011) identified four main characteristics of this new approach to corporate finance: (1) innovative approaches and new individual behaviors adopted by financial intermediaries; (2) sustainable growth; (3) proximity to people; (4) inclusive logic. Moreover, Ryszawska (2016) defined sustainable finance as finance concerning development under three dimensions (economic, environmental, and social). Besides, some studies have investigated the methods adopted by investors in the selection of sustainable finance projects. For example, the GSIA (2020 and 2019) has estimated negative screening, the involvement of companies and shareholder action in Europe as the primary selection criteria in Japan, the integration of ESG factors (Environmental, Social, Governance) in decisions in the USA, Canada, and Australia.

The presence of these characteristics, according to Schoenmaker (2017), captured another important difference between traditional finance and sustainable finance: the adoption of a long-term time horizon. According to the author: sustainable finance is a means to promote sustainable development, for example by financing healthcare, green buildings, and wind farms. The starting point is a positive selection of investment projects based on their potential to generate positive social and environmental impacts. In this way, the financial system serves the medium-long term "sustainable development agenda". According to more recent sense, the same author (2018) mentioned *"Sustainable Finance 3.0"*, i.e., af form of finance that intends to maximize economic returns not only for shareholders but for all stakeholders. Regarding social impact investments, the GIIN (2019) specified the peculiarities of the intervention methods:

(1) definition of a social and financial goal;

(2) setting up qualitative and quantitative measures of the impacts;
(3) identification of potential risks associated with the target objectives and implementation of risk mitigation techniques.

Nowadays, there is no agreement on the models for measuring social and environmental impact and this make more complicated to define the perimeter of sustainable finance. A first attempt to place sustainable finance within a regulatory framework comes from the European Union in 2016 which set up a Task Force on Sustainable Finance to adopt a homogeneous treatment between investments with climate objectives and investments in the environmental sector. In March 2018, this Committee of Experts published 10 guidelines (The Action Plan) on sustainable finance. Among the main challenges, it emerged, first of all, the introduction of a taxonomy of eco-sustainable activities, greater transparency of information on sustainable investments and environmental risks, and the adoption of targets taken as a reference to evaluate the achievement of climate objectives

The application of the concept of sustainability to the banking business requires a transformation of traditional operating models (Carè, 2018) and the adoption of new financing instruments, primarily social Impact Bonds, based on a participatory logic and where financial returns are conditioned by the production of a social and environmental impact (pay-by-results scheme). For the implementation of this new approach to finance, a key role can be played by "*sustainable banks*" (Jeucken & Bouma, 2001). Particularly, that category of intermediaries who link their performance, not to the objective of achieving the highest financial return rate, rather the highest sustainable rate of return. This kind of bank offers financial products and services to customers without however neglecting attention to environmental protection (Yip & Bocken, 2018), and the role of banks in achieving sustainable development goals (SDGs) has been highlighted by various authors (Jeucken, 2010; Weber & Remer, 2011) through both direct impacts on the environment related to banking operations (Tara et al., 2014) and indirect products from customers (Bal et al., 2014).

It emerged that, the literature has found the following characteristics of the so-called green banks: digital transparency, customer inclusiveness in designing and offering financial products and services, supporting sustainable initiatives (e.g., better waste management), and creating green products (Ahuja, 2015; Amin, 2014; Bhardwaj & Malhotra, 2013; Bose

et al., 2017; Grigoryeva et al., 2007; Lalon, 2015; Nath et al., 2014; Pariag-Maraye et al., 2017; Rahman & Barua, 2016; Schub, 2015; Singh, 2015; Ullah, 2013). Moreover, the creation of a green bank can involve different types of stakeholders: employees, customers, banking operations, and strategy. In addition to green banks and sustainable banks, other financial operators that can intervene in the green finance market are "*alternative banks*" (Weber & Remer, 2011), i.e., ethical banks and social banks.

The first market initiative in support of green finance was the United Nations Environment Program Finance (UNEP-FI) signed in 1991 and replaced the following year by the UNEP Declaration of the Financial Institutions on the Environment and Sustainable Development. This initiative involved more than 200 financial institutions belonging to the banking, insurance, and investment sectors. In Italy, initiatives in support of green finance are quite recent. First of all, the National Dialogue for Sustainable Finance (2016), the National Strategy for Sustainable Development of the Ministry of the Environment (2017), and the CONSOB Regulation implementing EU Directive 95/2014, Law 232/2016.

After the topic analysis considering scientific literature production, this paper focused on green bonds were at the center of the guidelines codified in 2018 by the International Capital Market Association (ICMA) aimed at ensuring their greater diffusion in compliance with the logic of reporting transparency. Green bonds can greatly help issuers in achieving sustainability goals and offer higher returns not only in economic terms.

Particularly, the green bond market still represents less than 1% of total bonds issued worldwide (G20, 2017). Recently, the EU has seen its competitive position in the market grow, reaching a share of 50.09% in 2018 (against 33.4% in the previous year).

Private entities entered the green bond market before public actors (in 2013 and 2016, respectively) and Poland was the country where the first issuance of sovereign green bonds took place.

According to the ICMA Green Bond Principles: "*green bonds are any bond instrument whose proceeds will be used exclusively to finance or re-finance new or existing green projects and which reflect four main components i.e. how the proceeds are used, the evaluation and selection process project management, revenue management and reporting*" (ICMA Group, 2016).

The first green bond issue dates back to 2007 in Europe by the European Investment Bank "*Climate Awareness Bond*". Thanks to this issue,

8.24 billion euros were raised to be used to finance projects relating to renewable energy, and energy efficiency. Despite this, the gap is typical of Europe compared to other countries regarding the progress models for measuring returns on investments and environmental impact.

For OECD (2017) green finance is a strategy for economic growth without neglecting environmental protection. Hence, green finance does not set itself only environmental and climate change-related objectives.

To date, various definitions have been formulated on green bonds and the first contribution of this check will be to attempt a comparison between them to focus on the distinctive elements of the market perimeter of these bonds and key factors for their success.

It emerged that, complicating the possibility of reaching an all-encompassing definition of green finance is the variety of emerging problems to be solved (climate, renewable energies, sea, biodiversity, forest, desertification, water sanitation, green building, waste, etc.) and the lack of an established literature framework to support it. This often causes an incorrect use of alternative terms to green finance such as environmental finance, environmental investments, sustainable finance, sustainable investments, and ESG investments. The interchangeable use of these terms increases the confusion on the concept of green finance because it makes us understand how this topic has a multidisciplinary nature. For example, if the term environmental finance is used, it refers to financial policies in support of environmental technologies (e.g., the construction of infrastructures for the production of low-polluting "*light*" energy) while the term environmental investments emphasizes how environmental factors can affect investors' performance and consequently their strategic decisions (Dietz et al., 2016; Hafner et al., 2019; Jones, 2015; Mekonnen, 2014). These authors defined green bonds as instruments of social impact finance. Ehlers and Packer (2017) and Sean and Padraig (2014) differentiated green bonds from traditional bonds not about the issuer but the objectives for which they are issued, i.e., environmental protection, use of renewable energy, and combating climate change. The main difference between green bonds and traditional bonds is represented by the use: in the first case, it must favor green investments. Moreover, the use of green bonds is linked to the fight against climate problems. Green bonds are equated to climate risk mitigation tools. For Lyon and Maxwell (2010) the green bond act as a signal of information transparency in the relationship between the issuing company and its investors regarding its commitment to environmental protection.

The observations of Flammer (2013) and Mocanu et al. (2021) fit into this logic, reiterate how the missions of green bonds denote the company's commitment to financing projects that protect the environment and that benefits society rather than selecting projects exclusively using the criterion of economic performance. The achievement of the objective of environmental sustainability improves the reputation of the issuing company in the perception of investors in cascade generates an improvement in the economic/financial performance (higher sales, higher profits, lower production costs linked to anti- pollution initiatives, etc.). Investors who subscribe to green bonds are more interested in environmental and social returns than in economic/financial ones. Löffler et al. (2021) confirmed this observation: they demonstrated that green bonds are characterized by lower returns and risks than traditional bonds. Other authors, on the other hand, reach opposite conclusions on the risk-return relationship of green bonds due to the still limited diffusion of this financial instrument in Europe and the limited investor base (Ehlers & Packer, 2017; Preclaw & Bakshi, 2015). Other authors, on the other hand, did not find significant differences between the yields of green bonds and traditional ones (Kapraun et al., 2021; Karpf & Mandel, 2017). Other studies have shown that yields on green bonds are very volatile because they are influenced by the occurrence of unforeseen events such as political actions in response to climate change (Antoniuk & Leirvik, 2021). Other factors as underlined by Antoniuk and Leirvik (2021) are affecting the pricing of green bonds include the rating of the issuing company (expression of insolvency risk), and as Wang et al. (2013) mentioned affecting the size of the issue, and the issue period. In the long term, sustainable finance becomes more effective if it manages to guarantee greater integration between financial objectives and green-type objectives. Therefore, the authors are witnessing the consolidation of a bond of interdependence between green bonds and conventional bonds and financial instruments. The path of green bonds benefits from positive externalities from other financial markets. Zhou and Cui (2019) have demonstrated that the issuance of green bonds produces positive impacts on the performance of the company both from a financial and an environmental point of view. Banga (2019) fits in this wake, which notes how the determinants of the green bond market are the same as those of traditional bonds. Among the factors driving the development of this market, attention to the climate of investors is the commitment of policymakers toward the

Table 1 Benefits and threats of green bond issue for issuers and investors

	Advantages	*Disadvantages*
Issuers	• Presentation and implementation of the issuer's approach to the issue of ESG bonds • Using in making investment decisions • Improving the diversification of the investors • Buy-and-hold green bond investors for reducing volatility in the secondary market • Significant investor demand for bonds • Reputation improvement • Increased credibility of the sustainable development strategy • Access to the "economies of scale"	• Reputational risk • Transaction costs
Investors	• Investors can offset risk-adjusted financial returns • Meets ESG requirements • Better risk assessment in an otherwise opaque fixed income market; • Potential use of pure-play, project to actively hedge climate policy risk; • Recognized by the UN Framework Convention on Climate Change • Engagement and private dialogue with issuers on ESG • Traceability of issue proceeds and reporting leads to improved internal governance structures	• Small and emerging (and potentially less liquid) market, • Lack of harmonized standards; • Limited possibility of legal enforcement of ecological integrity; • Need for additional due diligence may not always be met

Source: Authors elaboration based onDyduch et al. (2022)

problem of climate change. The literature has highlighted both the advantages and the critical issues associated with the issuance of green bonds for both investors and issuers (Table 1).

2.2 Maritime Sector

In this section, the authors presented the result achieved troughs a Systematic Literature Review (SLR) carried out using Prisma Model (Page et al., 2021).

With the aim of obtaining a high scientific impact in the review, authors interrogated the major database, WoS, and inserting in TITLE-ABS-KEY: "maritime sector" AND "emissions" AND "cold ironing",

"maritime sector" AND "emissions" AND "sustainable finance", "maritime sector" AND "emissions" AND "Next Generation". The results shown a shortage in scientific interest: 8 papers for the first string, 3 for the second, and 7 for the third.

Moreover, the authors considered that cold ironing is known by a variety of names, e.g., "land-based power", "shore side power", "high voltage ground connection (HVSC)", "onshore" power, "shore-to- ship power", and "alternative maritime power".

For this reason, authors dealing with this topic, so to fill this gap in literature, this paper designed a sustainable balanced score sheet particularly suited to water management in the agricultural sector.

In this sub-section, authors analyzed papers that contain single-topic or into which this has been integrated. Particularly, with the aim to analyze the publications, the authors exported metadata on two digital sheets in.csv format and, through concatenate and index/compare formulas, they assessed the strings associated with publications. Firstly, they organized the string according to the authors' names, articles' titles, type of document (refining for research and review articles, excluding the other editorial type), authors' keywords, abstract, authors' affiliations, publishing journal, year of publication, DOI and research areas, and excluding others.

Having reached this point, authors operated by following the steps indicated below as a guide to conducting a meaningful review (Fig. 2):

1. Only peer-reviewed articles written in English were considered.
2. Articles published in book chapters and conference proceedings were not considered because they cannot be easily found.
3. After integrating the results of the two databases, the duplicate results were eliminated.
4. An initial screening of the articles was carried out by analyzing the abstracts, to identify correlation between topics, consistency with the objectives and methodologies used.
5. Therefore, only the documents have been selected that satisfy the criteria referred to in points (1) to (4). At this time the authors retrieved the complete texts for an in-depth analysis.
6. Finally, the scholars built the definitive sample and carried out a final search to look for additional products to consider.

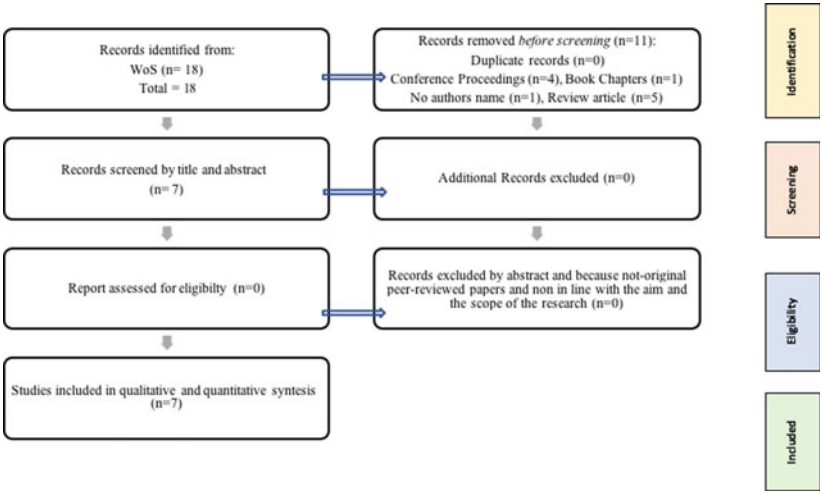

Fig. 2 Flowchart of systematic literature review according PRISMA method and performed for this paper (*Source* Authors' elaboration based on Page et al., 2021)

Therefore, the system revealed 18 products in WoS that cover as many relevant aspects as possible in terms of article title, abstract, and keywords sorted by relevance and refined according to the instructions.

According to the steps cited aforementioned and presented in the flow chart in Fig. 1 the authors presented the quantitative results of the SLR. Then, they reported these wide-ranging-meta data on Prisma Diagram elaborated according to the level on analysis entitled namely Identification, Screening, and Included which consist in studies identification via database (Fig. 2).

The authors removed the no eligible products because 4 were conference proceedings, 5 were review articles, 1 was book chapter, and 1 was without authors' name. Therefore, among 18 papers exported, the authors selected the eligible articles for Systematic Literature Review equal of 7 publications. Starting from the quantitative results and among articles published from 2013 to 2022, the authors selected the review sample respecting three criteria:

(1) consistency and adequacy with the aim of this review article;
(2) representativeness of the literature currently available on the maritime sector;
(3) creation of a general overview in the field of sustainable finance for the maritime sector replicable and useful for all stakeholder involved in this industry.

2.3 Utilities and Limitations to the Application of Cold Ironing

Analyzing the articles selected through the SLR carried out, it emerged a common line: authors highlighted utilities and limitations in the application of cold ironing system in maritime sector, an approach for reducing environmental impact associated to ships.

Currently, in terms of diffusion (Table 2) cold ironing installations in Europe are mainly collected in the northern part (e.g., Finland, Norway and Sweden) and followed by USA with seven plants (Piccoli et al., 2021).

First, there is an international regulation with the aim of limiting emissions due ships fuel: particularly, the IMO 2020 regulation was envisaged for respecting the limits of sulfur in fuels equal of 0.50% (Sun et al., 2022).

Therefore, shipowners are equipping their ships with less impacting systems by making delicate investments in a particular period with uncertainty on fuel prices in the long run (Qinghe et al., 2022). Despite this basic legislation, there are several factors that influence shipowners'investment decisions toward more sustainable approaches. Analyzing a sample of shipowners, it emerges that the main problems are associated with the distribution of incentives and the lack of information that lead companies to decide not to invest (Longarela-Ares et al., 2020).

Furthermore, as the researchers point out, energy efficiency measures are unlikely to be implemented in older ships, possibly due to the difficulty associated with recovering the investment. On the contrary, shipowners are more likely to invest in efficiency improvements in larger and newer ships and regulation encourages their adoption (Longarela-Ares et al., 2020).

For this reason and based on this evidence, investing in the efficiency of the docks like cold ironing, therefore on land, it is convenient and is to the benefit of all ships.

Table 2 Cold ironing diffusion

Year	*Country*	*Port*	*Ship type*	*Capacity*	*Frequency*	*Voltage*
2000	Sweden	Gothenburg	RoRo, RoPax	1.25–2.5	50&60	6.6&11
2000	Belgium	Zeebrugge	RoRo	1.25	50	6.6
2001	USA	Juneau	Cruise	7–9	60	6.6&11
2004	USA	Los Angeles	Container, Cruise	7.5–60	60	6.6
2005	USA	Seattle	Cruise	12.8	60	6.6&11
2006	Finland	KEMI	RoPax	n.d	50	6.6
2006	Finland	Kotkal	RoPax	n.d	50	6.6
2006	Finland	Oulu	RoPax	n.d	50	6.6
2008	Belgium	Antwerp	Container	0.8	50&60	6.6
2008	Germany	Lübeck	RoPax	2.2	50	6.6
2009	Canada	Vancouver	Cruise	16	60	6.6&11
2010	USA	San Diego	Cruise	16	60	6.6&11
2010	USA	San Francisco	Cruise	16	60	6.6&11
2010	Sweden	Karlskrona	Cruise	2.5	50	11
2011	USA	Long Beach	Cruise	16	60	6.6&11
2011	USA	Oakland	Container	7.5	60	6.6&11
2011	Norway	Oslo	Cruise	4.5	50	11
2011	Canada	Prince Rupert	Container	7.5	60	6.6
2012	Netherlands	Rotterdam	RoPax	2.8	60	11
2012	Sweden	Ystad	Cruise	6.25	50&60	11
2015	Norway	Bergen	Nd	1	50&60	0.440/0.690
2017	France	Marseille	Ferry	4	60	11

Note Ship type RoRo (i.e., Roll-on/Roll-off) and RoPax (Roll-on/roll-off Passengers). *Source* Authors' elaboration based on Piccoli et al. (2021)

Indeed, cold ironing (CI) is an electrification alternative in the maritime sector used to reduce ship emissions by switching from fuel to electricity when docked in a port (Bakar et al., 2022).

Therefore, an accurate estimate of the mooring duration is necessary to help the port operator to optimally manage the assignment of the mooring and the energy planning. Know therefore the energy consumption and departure time of the ship to use the energy management system (EMS) and the problem of berth allocation (BAP) (Bakar et al., 2022).

Considering their role in the economy, seaports play a key role in the low-carbon transition of shipping (Konstantinos et al., 2022).

Moreover, these evaluation in the scientific literature are useful for informing port authorities and policy makers in the sector, highlighting the added value of selected and inexpensive actions for energy efficiency and hybrid mobility. Furthermore, as believed by Konstantinos et al. (2022) expensive and seemingly mandatory actions under current European legislation, such as cold ironing and LNG, are robust and if the perception of non-financial risks is reduced (Konstantinos et al., 2022).

However, the technology of cold ironing (or shore-to-ship power) which can significantly reduce greenhouse gases and air pollutant emissions from ships at berth by powering ships from the shore power grid, collides with economic, legal and environmental factors still make this technology less attractive in southern Europe (Piccoli et al., 2021).

Furthermore, Piccoli et al. (2021) analyzed the main regulatory bottlenecks occurring in different European jurisdictions on the development of cold ironing, while evaluating the legal and economic consequences of implementing cold ironing considering the future inclusion of the maritime sector in the EU emissions trading.

Among the articles published, Longarela-Ares et al. (2020) presented an interesting analysis of the barriers and limitation which prevent the Energy Efficiency Investments in maritime sector (Table 3).

Particularly, Hobson et al. (2007) were the first scholars to identify the technical, economic, social, and legislative barriers that limit the adoption of low-carbon technologies in shipping. Kollamthodi et al. (2013) analyzed risks, hidden costs, information problems, technical and operational measures, and the principal-agent problem, defining the barriers as technological, institutional, and financial. Instead, Maddox Consulting (2013) distinguishes between technological, operational and physical, regulatory, economic, market failures, and administrative barriers. Jafarzadeh and Utne (2014) identified information, economic, inter-organizational, technological, political, geographical, and intra- organizational barriers, while Rehmatulla and Smith (2015a, 2015b) considered behavioral, organizational, and economic barriers (market barriers and market failures).

Other scholars examined 22 potential pathways, including conventional marine heavy fuel oil (HFO) as a reference case, alternative "*blue*" fuel produced from natural gas, and "*green*" fuels produced from biomass and solar energy. From a methodological point of view, the paths are compared in terms of quantifiable parameters: fuel mass, fuel volume, life cycle energy intensity, cost, greenhouse gas emissions (GHG), and

Table 3 Barriers and limitation for energy efficiency investments

Types	*Subtypes*	*Examples*	*Hobson et al. (2007)*	*Kollamthodi et al. (2013)*	*Maddox Consulting (2013)*	*Jafarzadeh and Utne (2014)*	*Rehmatulla and Smith (2015a, 2015b)*
Behavioral barriers							X
Organizational barriers					X	x	X
Technical barriers			X	X	X		
Social barriers			X				
Legislative barriers			X				
Institutional barriers				X			
Economic barriers	Market barriers	Capital constraints	X	X	X	x	X
	Nonmarket failures	Heterogeneity					
		Hidden costs					
		Risk and uncertainty					
	Market failures	Regulation and other		X			
		Asymmetric information					
		Split incentives					
		Adverse selection					
		Moral hazard					

Source Authors elaboration based on Longarela-Ares et al. (2020)

non-GHG emissions estimated from literature and various modeling (Law et al., 2021). The results showed that from an energy point of view, renewable electricity with battery technology is the most efficient, albeit still impractical route for long distance shipping due to the low energy density of today's batteries (Law et al., 2021). However, as evidenced by Yigit et al. (2016) the use of shore-side electricity to serve ships in port it has increasingly been considered a measure to improve their energy efficiency and environmental performance.

3 Materials and Methods

At EU level, the ports involved in the dock electrification project are include in the trans-European transport network called "Trans-European Transport Network (TEN-T)" with the aim to achieve zero carbon emissions (Fig. 3).

Analyzing the use of cold ironing is very important because the power supply on the ground side can effectively reduce dangerous emissions (e.g., SOx, NOx, VOC, PM, CO, N_2O, CH_4) in the local environment significantly as highlighted from Ballini and Bozzo (2015).

For estimating the impact of a cruise ship in order to present a snapshot, the authors started the assessment considering a general cruise traffic (Table 4).

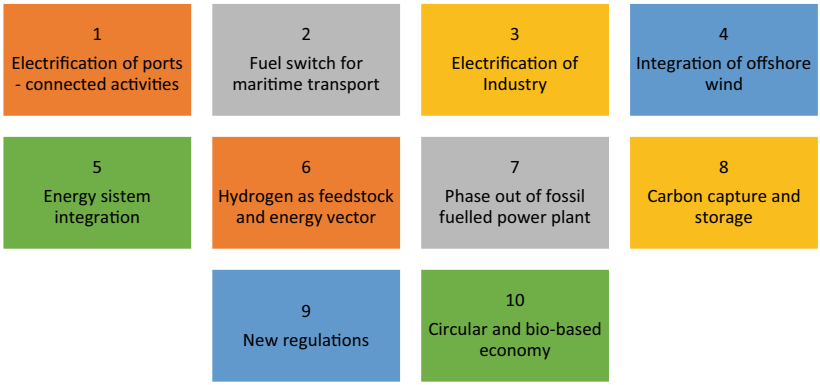

Fig. 3 The Ten-T Green Transitions towards decarbonisation (*Source* Authors' elaboration based on European Commission (2013, 2022)

Table 4 Estimation of cruise ship

Month	*Ships/month (a)*	*Ships/day/energy powered (b)*	*Starting power in MW for each ship (c)*	*Parking time in hours (d)*	*Power required in MW (e)*	*Diesel consumption in t/h per single ship (f)*	*Fuel consumption in tons / time per ship (g)*
January	7	1	12	12	12	0.63	7.56
February	5	1	12	12	12	0.63	7.56
March	12	1	12	12	12	0.63	7.56
April	24	1	12	12	12	0.63	7.56
May	52	1	12	12	12	0.63	7.56
June	41	2	12	12	24	0.63	7.56
July	54	2	12	12	24	0.63	7.56
August	43	2	12	12	24	0.63	7.56
September	42	2	12	12	24	0.63	7.56
October	63	1	12	12	12	0.63	7.56
November	28	1	12	12	12	0.63	7.56
December	8	1	12	12	12	0.63	7.56
Total	379						

Month	*Fuel consumption in barrels per ship/ day (h)*	*Cost in $/ship/ parking time (i)*	*Electricity produced from diesel in kWh / t (l)*	*Consumption in MWh during parking (m)*	*Consumption in MWh (n)*	*Depreciation Cost of cold ironing system day ($) (o)*
January	51.71	4773.87	2976	22.49856	697.46	301.37
February	51.71	4773.87	2976	22.49856	697.46	301.37
March	51.71	4773.87	2976	22.49856	697.46	301.37
April	51.71	4773.87	2976	22.49856	697.46	301.37
May	51.71	4773.87	2976	22.49856	697.46	301.37
June	103.43	9547.74	2976	44.99712	1349.91	301.37
July	103.43	9547.74	2976	44.99712	1349.91	301.37
August	103.43	9547.74	2976	44.99.712	1349.91	301.37
September	103.43	9547.74	2976	44.99712	1349.91	301.37
October	51.71	4773.87	2976	22.49856	697.46	301.37
November	51.71	4773.87	2976	22.49856	697.46	301.37
December	51.71	4773.87	2976	22.49856	697.46	301.37
Total						

Source Authors' elaboration

For this reason, the authors proposed a cost–benefit analysis starting from the hypothesis of mooring cruise ships in port. Therefore, analyzing the port calendars in Mediterranean ports, in medium 1 ship per day can moor in port every month, if low tourist season, 2 cruise ships if high tourist season.

According to the technical reports (AdSPMTS, 2021), cruise ships are stationed 12 hours a day on average and in most cases use bunker diesel to keep their engines running in port. In order to carry out an estimate, the daily quotation of the cost of bunker diesel was used (in 92.32 $/barrel, Ilsole24ore, 2022).

4 Discussion and Conclusion

Analyzing the results included in Table 3, the implantation cost is recoverable at $ 307 per day (or). Furthermore, the authors compared to the fuel consumption in tons/time per ship (g), implementing cold ironing reduces fuel consumption and associated emissions.

Better knowledge in the field of the sustainable finance for maritime sector could help businesses and governments act more sustainably, without affecting innovation and competitive sector (Longarela-Ares et al., 2020).

Investing in greater knowledge on the subject of sustainable finance is a real challenge for all the main local players (banks, financial intermediaries, issuing companies, and public and private bodies). This is because the lack of a univocal definition of sustainable finance and green finance has certainly contributed to fueling the risk of King washing, i.e., the risk of making an activity appear eco-sustainable when in reality it is not. This makes returns for the green bond investor increasingly uncertain (Bowers et al., 2020; Lyon & Maxwell, 2010).

The generating cause of this problem is the failure of communication between the investor in green finance projects and the stakeholders involved the maritime supply chain (Beder, 1998; Gatti et al., 2019,) and it can lead to fraud. It generates a misalignment or "*decoupling*" between communication and the actions of organizations and individuals. There is also talk of "*attention deflection*" (Lyon & Montgomery, 2015) because a communication, falsely green, diverts the attention of stakeholders from unethical issues and actions. It is a rapidly growing phenomenon that in recent years has increasingly entered the world of finance through various forms (Rizzello, 2022).

Following the Corporate Social Responsibility (CSR) studies, the authors underlined that information asymmetries are to be found both inside and outside the organizational structure of companies. Above all the managers of large companies receive pressure from the outside about the outcomes of their decision-making process and also from all the regulatory initiatives aimed at countering the phenomenon of greenwashing (Delmas & Burbano, 2011).

The attention to this issue by finance scholars or bank managers is justified by the fact that it has emerged that greenwashing produces wider negative effects in the financial sector than in the business world. Three types of actions need to be taken to reduce the occurrence of greenwashing. Some of them are aimed at assisting investors when they have to choose between alternative investment projects and be able to select the most performing one in terms of creating financial and above all environmental value. In this way, investors will be able to ensure perfect alignment with the environmental objectives of regulatory institutions and stakeholders. Other types of shares must allow investors and stakeholders to be able to conduct the most complete information disclosure possible on the nature of the investments by exploiting the greater availability of information assets. This information could make it possible to assess the investor company's degree of exposure to the main environmental risks (Butz et al., 2018) and not just its exposure to financial risks. A very useful tool in this sense and which has recently been the subject of analysis in various studies and which has broadened the "*modus operandi*" of the rating agencies is the so-called green rating or ESG rating (Gyo nyorova et al., 2021). It represents a measure of the compliance degree of an investment project (both insurance and green bonds) concerning environmental targets such as climate change. This tool will need future improvements aimed at making it an increasingly rigid measure to reduce the problem of the fragmentation of information disclosure on green investments. Other actions relate to the improvement of the green certifications of financial products and services, thus trying to reduce the misalignment between the intentions to produce environmental impacts loudly referred to in the investor's declarations and what is concretely manifested in his actions. The third type of action is aimed at companies (both investors and issuers of financial products) to discourage the creation of non-transparent disclosures (full of inaccurate statements and/or unclear words) which produce an overestimation of the real performance of the company.

Among the possible solutions to reduce the incidence of greenwashing risk the use of a green taxonomy, environmental indexes, and ESG ratings measure the correlation of business activity to environmental sustainability. As highlighted by the previous literature review, these tools may also have critical issues. First, the existence of numerous definitions of green investments can make it increasingly difficult to narrow down their nature and scope. Therefore, a first challenge that involves both academics and practitioners is to reduce the plurality of these definitions to be able to assess the intensity of the link more easily between the company's performance and the environment in which it is located. Furthermore, it appears increasingly necessary to improve the transparency of rating methods on environmental and sustainability objectives, perhaps by systematically using all the data available for reporting (financial and otherwise). Another challenge is related tothe promotion of greater involvement of subjects external to the company in conducting the disclosure of its green performance.

Analyzing a model based on cruise ships in a European port, this chapter showned that the total external potential benefit in terms of costs incurred by cruise ships using cold ironing compared to diesel fueling. The capital cost of the cold ironing infrastructure can be implemented in new cruise ship docks and can cover almost 100% energy demand of two hotel cruises moored vessels (22 MWh), with a cost of 110,000 dollars amortized over 30 years of investment.

Future extensions of the study are both theoretical and empirical. Regarding the first aspect, the authors intend to expand the part of the literature on the impacts of sustainable finance on the business models of banks. In particular, the scholars intend to make a comparison between green banks and traditional banks. Still, in the context of this type of extension, the authors will consider the discussion on greenwashing prevention and risk reduction policies (recalling some case studies) and on the role that green finance can play in reducing inequalities and the new forms of poverty that have arisen following the COVID-19. As regards the second type of *(empirical)* extensions, the scholars, firstly, intend to propose a brief analysis of the trend of the green bond market in Italy compared to the rest of Europe. This part will be enriched with some references to concrete cases relating to the banking and insurance sector. Subsequently, they will propose an empirical analysis aimed at estimating which are the internal (linked to the banking business and the characteristics of the functioning mechanisms of the issue) and external (context) factors that condition the value of green bonds, trying to grasp any differences compared to traditional bonds.

AuthorContribution Arnone, M.: elaboration parts on sustainable finance and green bond. **Crovella, T.**: elaboration part on maritime sector, cold ironing and final editing.

Introduction, methodology, and conclusion are elaborated in equal parts.

References

AdSPMTS. (2021). Verso la costruzione del Documento di Pianificazione Energetica e Ambientale (DEASP) dell'Autorità di Sistema Portuale del Mar Tirreno Settentrionale, https://www.portialtotirreno.it/wp-content/uploads/2021/08/ALLEGATO-2-Sistema-di-Distribuzione-Chiuso-e-Cold-Ironing-Livorno.pdf

Ahuja, N. (2015). Green banking in India: A review of literature. *International Journal for Research in Management and Pharmacy, 4*(1), 11–16.

Albino, V., Balice, A., & Dangelico, R. M. (2009). Environmental strategies and green product development: An overview on sustainability-driven companies. *Business Strategy and the Environment, 18*(2), 83–96.

Amin, S. B. (2014). Sustainable green banking: The case of Bangladesh. *Janata Bank Journal of Money, Finance and Development, 1*(1), 91–98.

Antoniuk, Y., & Leirvik, T. (2021). Climate transition risk and the impact on green bonds. *Journal of Risk and Financial Management, 14*, 597.

Arif, M., Hasan, M., Alawi, S. M., & Naeem, M. A. (2021). COVID-19 and time-frequency connectedness between green and conventional financial markets. *Global Finance Journal, 49*, 100650.

Awaworyi Churchill, S. (2017). Microfinance and ethnic diversity. *The Economic Record, 93*, 112–141.

Babiak, K., & Trendafilova, S. (2011). CSR and environmental responsibility: Motives and pressures to adopt green management practices. *Corporate Social Responsibility and Environmental Management, 18*(1), 11–24.

Bakar, N. N. A., Bazmohammadi, N., Çimen, H., Uyanik, T., Vasquez, J. C., & Guerrero, J. M. (2022). Data- driven ship berthing forecasting for cold ironing in maritime transportation. *Applied Energy, 326*, 119947. https://doi.org/10.1016/j.apenergy.2022.119947

Baker, M. P., Bergstresser, D. B., Serafeim, G., & Wurgler, J. A. (2018). *Financing the response to climate change: The pricing and ownership of U.S.* GreenBonds (Working Paper), Available online: https://www.brookings.edu/wp-content/uploads/2018/07/. Accessed on 30 June 2022.

Bal, Y., Faure, M., & Liu, J. (2014). The role of China's Banking sector in providing Green Finance. *Duke Environmental and Law Policy Forum, 24*, 89–141.

Ballini, F., & Bozzo, R. (2015). Air pollution from ships in ports: The socio-economic benefit of cold- ironing technology. *Research in Transportation Business & Management, 17*, 92–98. https://doi.org/10.1016/j.rtbm.2015.10.007

Banga, J. (2019). The green bond market: A potential source of climate finance for developing countries. *Journal of Sustainable Finance and Investment*, *9*, 17–32. Available online: https://www.researchgate.net/publication/326377509_The_green_bond_market_a_potential_source_of_climate_finance_for_developing_countries. Accessed on 30 June 2022.

Beder, S. (1998). Manipulating public knowledge. *Metascience, 7*(1), 132–139.

Benedikter, R. (2011). *Social banking and social finance*. Springer.

Belleflamme, P., Lambert, T., & Schwienbacher, A. (2014). Crowdfunding: Tapping the right crowd. *Journal of Business Venturing, 29*(5), 585–609.

Bhardwaj, B. R., & Malhotra, A. (2013). Green banking strategies: Sustainability through corporate entrepreneurship. *Greener Journal of Business and Management Studies, 3*(4), 180–193.

Blose, L. E., & Shieh, J. C. P. (1997). Tobin's q-ratio and market reaction to capital investment announcements, *Financial Review, 32*, 449–476. https://doi.org/10.1111/J.1540-6288.1997.TB00434.X

Bonsu, N. O. (2020). Towards a circular and low-carbon economy: Insights from the transitioning to electric vehicles and net zero economy. *Journal of Cleaner Production, 256*, 120659.

Bose, S., Khan, H. Z., Rashid, A., & Islam, S. (2017). What drives green banking disclosure? An institutional and corporate governance perspective. *Asia Pacific Journal of Management, 35*, 501. https://doi.org/10.1007/s10490-017-9528-x

Bowers, B., Boyd, N., & McGoun, E. (2020). Greenbacks, green banks, and greenwashing via LEED: Assessing banks' performance in sustainable construction, *Sustainability: The Journal of Record, 13*(5), 208–217.

Bridge, G., Bouzarowvski, S., Bradshaw, M., & Eyre, N. (2013). Geographies of energy transition: Space, place and the low-carbon economy. *Energy Policy, 53*, 331–340.

Bull, M. (2008). Challenging tensions: Critical, theoretical and empirical perspectives on social enterprise. *International Journal of Entrepreneurial Behavior & Research, 14*(5), 268–275.

Butz, C., Liechti, I., Bodin, J., & Cornell, S. E. (2018). Towards defining an environmental universe within planetary boundaries. *Sustainability Science, 13*(4), 1031–1044.

Carè, R. (2018). *Sustainable banking: Issues and challenges*. Palgrave Macmillan.

Caldecott, B. (2020). Post Covid-19 stimulus and bailouts need to be compatible with the Paris Agreement. *Journal of Sustainable Finance and Investment*, 1–8.

Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G., & Tanaka, M. (2018). Climate change challenges for central banks and financial regulators. *Nature Climate Change, 8*(6), 462–468.

Chiappini, H. (2017). *Social impact funds: Definition, assessment and performance*. Springer.

Cotugno, M., Cicchiello, A. F., Monferrà, S., & Perdichizzi, S. (2022). Credit spreads in the European green bond market: A daily analysis of the COVID-19 pandemic impact. *Journal of International Financial Management and Accounting, 33*, 383–411.

Day, R., Walker, G., & Simcock, N. (2016). Conceptualising energy use and energy poverty using a capabilities framework. *Energy Policy, 93*, 255–264.

Delmas, M. A., & Burbano, V. C. (2011). The drivers of greenwashing. *California Management Review, 54*(1), 64–87.

Dikau, S., & Volz, U. (2021). Central bank mandates, sustainability objectives and the promotion of green finance, *Ecological Economics*, 184 (C).

Dietz, S., Bowen, A., Dixon, C., & Gradwell, P. (2016). Climate value at risk of global financial assets. *Nature Climate Change, 6*(7), 676–679.

Dyduch, M. H., Puszer, B., Czech, M., & Cichy, J. (2022). Green bonds as an instrument for financing ecological investments in the V4 countries. *Sustainability, 2022*(14), 12188.

Doumbia, D., & Lauridsen, M. L. (2019). Closing the SDG financing gap: Trends and data. *EMCompass, 73*, 1–8.

Ehlers, T., & Packer, F. (2017). Green bond finance and certification. *The BIS Quarterly Review*, 89–104. https://www.bis.org/publ/qtrpdf/r_qt1709h.htm

European Commission. (2013). *The backbone of the Trans European Network Transport and the TEN-T Corridors*. https://transport.ec.europa.eu/transport-themes/infrastructure-and-investment/trans-european-transport-network-ten-t_en

European Commission. (2022). https://climate.ec.europa.eu/eu-action/transport-emissions/reducing-emissions-shipping-sector_en

Fatemi, A. M., & Fooladi, I. J. (2013). Sustainable finance: A new paradigm. *Global Finance Journal, 24*(2), 101–113.

EU. (2019). *New EU Sustainable Finance Disclosure Regulation (SFDR) 2019/2088*, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32019R2088

Flaherty, M., Gevorkyan, A., Radpour, S., & Semmler, W. (2017). Financing climate policies through climate bonds–A three stage model and empirics. *Research in International Business and Finance, 42*, 468–479.

Flammer, C. (2013). Corporate social responsibility and shareholder reaction: The environment al awareness of investors. *Academy of Management Journal, 56*, 758–781.

Flammer, C. (2021). Corporate green bonds. *Journal of Financial Economics, 142*(2), 499–516.

Fragiacomo, P., & Genovese, M. (2020). Numerical simulations of the energy performance of a PEM water electrolysis based high-pressure hydrogen refueling station. *International Journal of Hydrogen Energy, 45*, 27457–27470.

G20. (2017). *Green finance synthesis report*, http://g20sfwg.org/wp-content/uploads/2021/07/2016_Synthesis_Rep

Gatti, L., Seele, R., & Rademacher, L. (2019). Grey zone in-greenwash out. A review of greenwashing research and implications for the voluntary-mandatory transition of CSR. *International Journal of Corporate Social Responsibility, 4*(1), 1–15.

Ghosh, S. (2018). Bad luck, bad policy or bad banking? Understanding the financial management behavior of MENA banks. *Journal of Multinational Financial Management, 47–48*, 110–128.

Gyönyörová, L., Stachoň, M., & Stašek, D. (2021). ESG ratings: Relevant information or misleading clue? Evidence from the S&P Global 1200. *Journal of Sustainable Finance and Investment*, 1–35.

GIIN—Global Impact Investing Network. (2019). *Core characteristics of impact investing*. Retrieved April 25, 2019, from https://thegiin.org/characteristics

Gilchrist, D., Yu, J., & Zhong, R. (2021). The limits of green finance. A survey of literature in the context of green bonds and green loans. *Sustainability, 13*(2), 478, 1–20.

GSIA. (2020). *Global Sustainable Investment Review 2020*, http://www.gsi-alliance.org/wp-content/uploads/2021/08/GSIR-20201.pdf.

GSIA. (2019). *2018 Global Sustainable Investment Review*, http://www.gsi-alliance.org/wp-content/uploads/2019/03/GSIR_Review2018.3.28.pdf

Gooaverts, L., & Verbeek, A. (2018). *Sustainable banking: Finance in the circular economy, Investing in resource efficiency*. Springer.

Grandin, P., & Saidane, D. (2011). *La finance durable: une nouvelle finance pour le XXIe siècle?* Revue Banque.

Grigoryeva, E., Morrison, N., Mason, C., & Gardiner, L. (2007). *Banking on sustainability, financing environmental and social opportunities in emerging markets*. Retrieved February 28, 2018, http://documents.worldbank

Hafner, S., James, O., & Jones, A. (2019). A scoping review of barriers to investment in climate change solutions. *Sustainability, 11*(11), 3201.

Hall, J. K., Daneke, G. A., & Lenox, M. J. (2010). Sustainable development and entrepreneurship: Past contributions and future directions. *Journal of Business Venturing, 25*(5), 439–448.

Hangl, C. (2014). A literature review about the landscape of social finance. *Journal of Finance and Risk Perspectives, 3*(4), 64–98.

Hobson, M., Pell, E., Surgand, M., Kollamthodi, S., Moloney, S., Mesbahi, E., Wright, P., Cabezas, B., & Pazouki, K. (2007). *Low carbon commercial shipping; Low Carbon Transport Innovation Strategy (LCTIS)*. Department for Transport: Policy, Guidance and Research (DfT).

Hoogendoorn, B., van de Zwan, P. W., & Thurik, A. R. (2019). Sustainable entrepreneurship: The role of perceived barriers and risk. *Journal of Business Ethics, 157*(4), 1133–1154.

Horvath, S., Fasihi, M., & Breyer, C. (2018). Techno-economic analysis of a decarbonized shipping sector: Technology suggestions for a fleet in 2030 and 2040. *Energy Conversion and Management, 164*, 230–241. https://doi.org/10.1016/j.apenergy.2022.119389

ICMA GROUP. (2016). The Green Bonds Principles. https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/Green-Bonds-brochure-150616.pdf

IlSole24Ore. (2022). https://mercati.ilsole24ore.com/materie-prime/commodities/petrolio/BRNST.IPE

International Maritime Organization (IMO), Smith, T. W. P., Jalkanen, J. P., Anderson, B. A., Corbett, J. J., Faber, J., Hanayama, S., O'Keeffe, E., Parker, S., Johansson, L., et al. (2014). *ThirdIMO GHG Study 2014*. Available at: https://www.cedelft.eu/en/publicatie/third_imo_ghg_study_2014/1525

Isaak, R. (2002). The making of the ecopreneur. *Greener Management International: The Journal of Corporate Environmental Strategy and Practice, 38*, 81–92.

Jafarzadeh, S., & Utne, I. B. (2014). A framework to bridge the energy efficiency gap in shipping. *Energy, 69*, 603–612.

Jeucken, M., & Bouma, J. J. (2001). *Sustainable banking: The greening of finance*. Greenleaf Publishing.

Jeucken, M. (2010). *Sustainable finance and banking: The financial sector and the future of the planet*. Earthscan.

Jones, A. W. (2015). Perceived barriers and policy solutions in clean energy infrastructure investment. *Journal of Cleaner Production, 104*, 297–304.

Karpf, A., & Mandel, A. (2017). Does it pay to be green? (Working Paper. 2017). Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2923484. Accessed on 30 June 2022.

Kapraun, J., Latino, C., Scheins, C., & Schlag, C. (2021). *Which bonds trade at a green bond premium?* Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3347337. Accessed on 30 June 2022.

Kollamthodi, S., Pueyo, A., Gibson, G., Narkeviciute, N., Hawkes, A., Cesbron, S., Milnes, R., Harries, J., Zamparutti, T., Hernandez, G., et al. (2013). *Support for the impact assessment of a proposal to address maritime transport greenhouse gas emissions*. European Commission—DG Climate Action.

Konstantinos, K., Nikas, A., Daniil, V., Kanellou, E., & Doukas, H. (2022). A multi-criteria decision support framework for assessing seaport sustainability planning: The case of Piraeus, A multi-criteria decision support framework for assessing seaport sustainability planning: The case of Piraeus. *Maritime Policy and Management*. https://doi.org/10.1080/03088839.2022.2047815

Lagoarde-Segot, T. (2018). Financing the sustainable development goals. *Sustainability, 12*(7), 2775.

Lalon, R. M. (2015). Green banking: Going green. *International Journal of Economics, Finance and Management Sciences, 3*(1), 34–42.

Law, L. C., Foscoli, B., Mastorakos, E., & Evans, S. (2021). A comparison of alternative fuels for shipping in terms of lifecycle energy and cost. *Energies*. https://doi.org/10.3390/en14248502

Lebelle, M., Lajili Jarjir, S., & Sassi, S. (2020). Corporate green bond issuances: An international evidence. *Journal of Risk and Financial Management, 13*(2), 25.

Lindenberg, N., & Volz, U. (2016). *Green banking regulation: Setting out a framework*. Practitioners' Dialogue on Climate Investments (PDCI). Retrieved March 12, 2018, from https://www.die-gdi.de/uploads/media/WG_3_PB_LINDENBERGVOLZ.PDF

Löffler, K., Petreski, A., & Stephan, A. (2021) Drivers of green bond issuance and new evidence on the "greenium". *Eurasian Economic Review*, *11*, 1–24. Available online: https://link.springer.com/article/10.1007/s40822-020-00165-y. Accessed on 30 June 2022.

Loiseau, E., Saikku, L., Antikainen, R., Droste, N., Hansjurgens, B., Pitkanen, K., Leisken, P., Kuikman, P., & Thomsen, M. (2016). Green economy and related concepts: An overview. *Journal of Cleaner Production, 139*, 361–371.

Longarela-Ares, A., Calvo-Silvosa, A., & Pérez-López, J-B. (2020). The influence of economic barriers and drivers on energy efficiency investments in maritime shipping, from the perspective of the principal-agent problem. *Sustainability, 12*(9), 7493, 1–42, https://doi.org/10.3390/su12197943

Luzio, J. P. P., & Lemke, F. (2013). Exploring green consumers' product demands and consumption processes: The case of Portoguese green consumers. *European Business Review, 25*(3), 281–300.

Lyon, T. P., & Maxwell, J. W. (2010). Greenwash: Corporate environmental disclosure under threat of audit. *Journal of Economics and Management Strategy, 2010*(20), 3–41.

Lyon, T. P., & Montgomery, A. W. (2015). The means and end of greenwash. *Organization and Environment, 28*(2), 223–249.

Maddox Consulting. (2013). *Analysis of market barriers to cost effective GHG emission reductions in the maritime transport sector*. Available online: http://op.europa.eu/en/publication-detail/-/publication/b641a090-04c8-4459-99fe-4302bb5b9176. Accessed on 15 November 2022.

Mair, J., & Martı, I. (2006). Social entrepreneurship research: A source of explanation, prediction, and delight. *Journal of World Business, 41*, 36–44.

Martinez, D. M., & Ebenhack, B. W. (2008). Understanding the role of energy consumption in human development through the use of saturation phenomena. *Energy Policy, 36*, 1430–1435.

Mekonnen, A. (2014). Economic costs of climate change and climate finance with a focus on Africa. *Journal of African Economies, 23*(suppl_2), ii50–ii82.

Meo, M. S., & Abd Karim, M. Z. (2021). The role of green finance in reducing CO2 emissions: An empirical analysis. *Borsa Istanbul Review*, 2214–8450. https://doi.org/10.1016/j.Bir.2021.03.002

Migliorelli, M., & Dessertine, P. (2019). *The rise of green finance in Europe. Opportunities and challenges for issuers, investors and marketplaces*. Palgrave Macmillan.

Minn, H., & Galle, W. P. (2001). Green purchasing practices of US firms. *International Journal of Operations and Production Management, 21*(9), 1222–1238.

Mocanu, M., Constanyin, L. G., & Cernat-Gruici, B. (2021). Su stainability bonds an international event study. *Journal of Business Economics and Management, 22*, 1551–1576.

Monasterolo, I., & Raberto, M. (2018). The EIRIN flow-of-funds behavioural model of green fiscal policies and green sovereign bonds. *Ecological Economics, 144*, 228–243.

Naeem, M. A., Nguyen, T. T. H., Nepal, R., Ngo, Q. T., & Taghizadeh-Hesary, F. (2021). Asymmetric relationship between green bonds and commodities: Evidence from extreme quantile approach. *Finance Research Letters, 43*, 101983.

Nath, V., Nayak, N., Goel, A. (2014). Green Banking Practices – A Review. *IMPACT: International Journal of Research in Business Management (IMPACT: IJRBM), 2*, 45–62.

Nicholls, A. (2008). *Social entrepreneurship: New models of sustainable social change*. Oxford University Press.

Nuttall, P., Newell, A., Rojon, I., Milligan, B., & Irvin, A. (2021). Pacific Island domestic shipping emissions abatement measures and technology transition pathways for selected ship types. *MarinePolicy*, 132,104704. https://doi.org/10.1016/j.marpol.2021.104704

OECD. (2021). The inequalities-environment nexus: Towards a people-centered green transition (OECD Green Growth Papers, No. 2021/01).

OECD. (2017). *Investing in climate, investing in growth*. http://www.oecd.org/env/cc/g-20-climate/synthesis-investing-in-climate-investing-in-growth.pdf

Owen, R., Brennan, G., & Jyon, F. (2018). Enabling investment for the transition to a low carbon economy: Government policy to finance early stage green innovation. *Current Opinion in Environmental Sustainability, 31*, 137–145.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, 71.

Paiano, A., Crovella, T., Lagioia, G. (2020). Managing sustainable practices in cruise tourism: the assessment of carbon footprint and waste of water and beverage packaging. *Tourism Management*, *77*, 104016.

Pariag-Maraye, N., Munusami, N., & Ansaram, K. (2017). A customer's perspective of green banking: A case study of commercial banks in Mauritius. *Theoretical Economics Letters, 7*(7), 1975.

Park, S. (2018). Investors as regulators: green bonds and the governance challenges of the sustainable finance revolution. *Stanford Journal of International Law, 54*(1).

Perez, O. (2007). *The new universe of green finance: From self-regulation to multipolar governance* (Bar Ilan University Pub Law Working Paper No. 07-3).

Pham, L. (2016). *Is it risky to go green? A volatility analysis of the green bond market*.

Piccoli, T., Fermeglia, M., Bosich, D., Bevilaqua, P., & Sulligoi, G. (2021). Environmental assessment and regulatory aspects of cold ironing planning for a maritime route in the Adriatic Sea. *Energies, 14*(18), 5836. https://doi.org/10.3390/en14185836

Preclaw, R., & Bakshi, A. (2015). *The cost of being green* (Technical Report). Barclays Research. Available online: https://www.environmental-finance.com/assets/files/US_Credit_Focus_The_Cost_of_Being_Green.pdf. Accessed on 30 June 2022.

Qinghe, S., Li, C., Mabel C., & Qiang, M. (2022). Mitigating the financial risk behind emission, cap compliance: A case in maritime transportation, *Production and Operations Management*, https://doi.org/10.1111/poms.13837

Rahman, S. M. M., & Barua, S. (2016, March 1). The design and adoption of green banking framework for environment protection: Lessons from Bangladesh. *Australian Journal of Sustainable Business and Society, 2*(1), 1–19. Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2854072

Reboredo, J. C. (2018). Green bond and financial markets: Co-movement, diversification and price spillover effects. *Energy Econ., 74*, 38–50.

Reboredo, J. C., & Ugolini, A. (2020). Price connectedness between green bond and financial markets. *Economic Modelling, 88*, 25–38.

Rehmatulla, N., & Smith, T. (2015a). Barriers to energy efficient and low carbon shipping. *Ocean Engineering, 110*, 102–112.

Rehmatulla, N., & Smith, T. (2015b). Barriers to energy efficiency in shipping: A triangulated approach to investigate the principal agent problem. *Energy Policy, 84*, 44–57.

Relano, F. (2008). From sustainable finance to ethical banking. *Transformations in Business and Economics, 7*(4), 123–131.

REN21. (2017). Renewables 2017 Global Status Report. REN21 Secretariat, Paris, France.

Rizzi, F., Pellegrini, C., & Battaglia, M. (2018). The Structuring of social finance: Emerging approaches for supporting environmentally and socially impactful projects. *Journal of Cleaner Production, 170*, 805–817.

Rizzello, A. (2022). *Green investing. Changing paradigms and future directions*. Palgrawe Macmillan.

Ryszawska, B. (2016). Sustainability transition needs sustainable finance. *Copernican Journal of Finance & Accounting, 5*(1), 185–194.

Robinson, M. S. (2001). *The microfinance revolution*. World Bank Publications.

Rosenthal, J., Quinn, A., Grieshop, A. P., et al. (2018). Clean cooking and the SDGs: Integrated analytical approaches to guide energy interventions for health and environment goals. *Energy for Sustainable Development, 42*, 152–159.

Sean, K., & Padraig, O. (2014). *Greening China's Financial Markets*. International Institute for Sustainable Development (IISD), Report. https://www.iisd.org.

Semieniuk, G., Campiglio, E., Mercure, J. F., Volz, U., & Edwards, N. R. (2021). Low-carbon transition risk for finance. *Wiley Interdisciplinary Reviews: Climate Change, 48*, 101240.

Schaltegger, S., & Wagner, M. (2011). Sustainable entrepreneurship and sustainability innovation: Categories and interactions. *Business Strategy and the Environment, 20*(4), 222–237.

Shiller, R. J. (2013). *Finance and the good society*. Princeton University Press.

Schoenmaker, D. (2017). *Investing for the common good: A sustainable finance framework*. Bruegel.

Schub, J. (2015). Green banks: Growing clean energy markets by leveraging private investment with public financing. *The Journal of Structured Finance, 21*(3), 26–35.

Shrivastava, P. (1995). The role of corporations in achieving ecological sustainability. *Academy of Management Review, 20*(4), 936–960.

Singh, Y. (2015). Environmental management through green banking: A study of commercial banks in India. *International Journal of Interdisciplinary and Multidisciplinary Studies, 2*(4), 17–26.

Soppe, A. (2009). Sustainable finance as a connection between corporate social responsibility and social responsible investing. *Indian School of Business WP Indian Management Research Journal, 1*(3), 13–23.

Stahel, W. R. (2016). The circular economy. *Nature, 531*(7595), 435–438.
Sun, Q., Chen, L., Chou, M. C., & Meng, Q. (2022). Mitigating the financial risk behind emission cap compliance: A case in maritime transportation. *Productions and Operations Managements*. https://doi.org/10.1111/poms.13837
Taylor, C. (2010). Carpe crisis: Capitalizing on the breakdown of capitalism to consider the creation of Social Businesses. *New York Law School Law Review, 54*(743), 10–22.
Tara, K., Singh, S., & Kumar, R. (2014). Green banking for environmental management: A paradigm shift. *Current World Environment, 10*(3), 1029–1038.
Thomson, H., Bouzarovski, S., & Snell, C. (2017). Rethinking the measurement of energy poverty in Europe: A critical analysis of indicators and data. *Indoor and Built Environment, 26*, 879–901.
Transport & Environment. (2018). https://www.transportenvironment.org/wp-content/uploads/2022/02/2202_Port_Rankings_briefing-1.pdf
Ullah, M. M. (2013). Green banking in Bangladesh—A comparative analysis. *World Review of Business Research, 3*(4), 74–83.
Umar, M., X., J, Mirza, N., Navqi, B. (2021). Carbon neutrality, bank lending and credit risk: Evidence from the Eurozone. *Journal of Environmental Management, 296*, 113156.
UNCTAD. (2021). https://unctad.org/webflyer/review-maritime-transport-2021
UNEP. (2016). *Definitions and concepts. Background note,* Inquiry working paper 16/13, New York.
Utting, P. (2015). *Social and solidarity economy: Beyond the Fringe* (p. 386). Zed Books.
Van Duuren, E., Planting, A., & Scholtens, B. (2016). ESG Integration and the investment management process: Fundamental investing reinvented. *Journal of Business Ethics, 138*, 525–533.
Vickers, I., & Lyon, F. (2014). Beyond Green niches? Growth strategies of environmentally motivated social enterprises. *International Small Business Journal, 32*(4), 449–470.
Waddams Price, C., Brazier, K., & Wang, W. (2012). Objective and subjective measures of fuel poverty. *Energy Policy*.
Wagner, M. (2017). *Entrepreneurship, innovation and sustainability*. Routledge.
Walley, E. E., & Taylor, D. W. (2002). Opportunities, champions, mavericks…? A typology of green entrepreneurs. *Greener Management International, 38*, 31–43.
Wang, X., Stern, R., Limaye, D., Mostern, W., & Zhang, Y. (2013). *Unlocking commercial financing for clean energy in East Asia*. World Bank Publications.

Warner, M. E. (2013). Private finance for public goods: Social impact bonds. *Journal of Economic Policy Reform, 16*(4), 303–319.

Weber, O., & Duan, Y. (2012). Social finance and banking. In H. K. Baker & J. R. Nofsinger (Eds.), *Socially responsible finance and investing: Financial institutions, corporations, investors, and activists* (pp. 161–180). John Wiley & Sons.

Weber, O., & Remer, S. (2011). *Social banks and the future of sustainable finance* (Vol. 64). Taylor & Francis.

Yang, S., Yuan, J., Nian, V., Li, L., Li, H. (2022). Economics of marinised offshore charging stations for electrifying the maritime sector. *Applied Energy*, *322*. 119839.

Yigit, K., Kökkülünk, G., Parlak, A., & Karakaş, A. (2016). Energy cost assessment of shoreside power supply considering the smart grid concept: a case study for a bulk carrier ship, *Maritime, Policy & Management, 43*(4), https://doi.org/10.1080/03088839.2015.1129674

Yip, A. W., & Bocken, N. M. (2018). Sustainable business model archetypes for the banking industry. *Journal of Cleaner Production, 174*, 150–169.

York, J. G., & Venkataraman, S. (2010). The entrepreneur-environment nexus: Uncertainty, innovation, and allocation. *Journal of Business Venturing, 25*(5), 449–463.

Zadek, S., & Flynn, C. (2013). *Sout-originating green finance: Exploring the potential*. https://doc.rero.ch/record/208970/files/06-south-originating.pdf

Zerbib, O. D. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds. *Journal of Banking & Finance, 98*, 39–60.

Zhou, X., & Cui, Y. (2019). Green bonds, corporate performance, and corporate social responsibility. *Sustainability, 11*, 6881.

Ziolo, M., Fidanoski, F., Simeonovski, K., Filipovski, V., & Jovanovska, K. (2017). Sustainable finance role in creating conditions for sustainable economic growth and development. *Sustainable Economic Development*, 187–211.

PART III

Governance and the Role of Women

CHAPTER 8

Are Women the Panacea? Exploring the Direction of Socially Responsible Commitment

Alessandra Caragnano, Marianna Zito, Antonia Brandonisio, Francesco D'Ercole, and Domenico Frascati

1 Introduction

In recent years, the need for firms to behave more responsibly has gained momentum as the right thing to do in order to overcome and to invert the footprint of an economic system which has marked for decades

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our history and which is not bearable anymore. In fact, environmental concerns and climate change issues represent a worldwide emergency leading government, central banks, policymakers, supervisory authorities, financial markets players, firms, and thus all citizens to combine their efforts.

In this sense, the outbreak of COVID-19 pandemic, which despite being a symmetric shock for the entire world has hit in different ways different social groups has highlighted the need to engage more proactively to mitigate environmental depletion. On the same vein, the Energetic Crisis and the outbreak of the Russian-Ukrainian war have highlighted the need to overcome the traditional tie with the most common fossil energetic sources, meeting the expectations of different pressures to mitigate the detrimental impact of our economic system.

According to Patricia Espinosa, the United Nations Framework Convention on Climate Change (UNFCCC) Executive Secretary, "*energy is at the heart of the climate change emergency and it must be at the heart of its solution. A swift and broad transition to renewable energy will be essential to achieve the emission reduction goals laid down by the Paris Agreement*".[1] As it clearly emerges, firms among other players within financial markets are called to push the transition toward renewable energy adoption, as environmentally virtuous behaviors required to actively overcome environmental depletion. In line with the U.S. Energy Information Administration (EIA) forecasts, renewable energies are expected to increase relevant, gaining 6 percentage points of the overall consumption by 2050 (Morgan Stanley, 2023).[2]

To achieve this aim, it is required to materially integrate environmental concerns into the decision-making processes metrics, daily activities, and

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[1] https://unfccc.int/news/the-world-needs-a-swift-transition-to-sustainable-energy.

[2] https://www.morganstanley.com/articles/decarbonization-renewable-energy-investment-ideas.

business strategies. The academic debate has long striven to explore the main factors and determinants driving corporate strategies toward stronger non-financial commitment. Previous studies have stressed the role of corporate governance features in promoting the adoption of environmentally friendly practices, with specific reference to the presence of women in management structure (Atif et al., 2021; Burkhardt et al., 2020; Elmagrhi et al., 2019; García Martín & Herrero, 2020; Gull et al., 2022; He & Jiang, 2019).

Given what has been said until now, by empirically observing the most capitalized European firms in the Bloomberg European 500 Index, spanning from 2016 to 2021, the chapter aims at testing if having a higher number of women on management boosts the recourse to renewable energy. The sample choice is referred to the attempt of including only those firms capturing more interest and attention in Europe, being in the middle of several stakeholder expectations and pressures due to their market stance. In addition to this, the chapter aims at verifying if and to what extent this beneficial impact exists.

By adopting the Climate Change Sentiment Index by Sautner et al. (2020), the analysis attempts to show the effective role of a higher number of women in improving environmental engagement, as well as in the dyad between substantial and actual environmental commitment. The analysis highlights the existing benefits of including women in management, while jointly underlining how these benefits result partially braked by an already positive sentiment concerning each firm own position and exposure toward climate change matters.

In this sense, the chapter underlines that a substantial commitment is required, going beyond a mere perception, to shed a concrete impact and to effectively take advantage of gender diversity as a driver to mitigate environmental damaging practices. In this sense, the moderation analysis stresses how the role of women is not the panacea, rather a first step into a more complex path. The reminder of the chapter continues as follows: Literature Review & Hypotheses Development section presents the main strands of literature on the analyzed topics; the Data & Methodology section presents the source of data, the sampling strategy and the empirical specification of the model; the Results and Discussion section introduces the main analysis outcomes, discussing the main implications; the Conclusions section draws out the main conclusions, implications, and possible analysis limitations.

2 Literature Review and Hypotheses Development

Thinking about climate change means without a doubt taking care of all the risks that are embedded within such a concept, ranging from physical (catastrophic events and natural disasters) to transition (decisions and policies by governments and international organizations) ones. As an example of such a renewed effort, the UN 2030 Agenda for Sustainable Development has included Goal 13 among the Sustainable Development Goals (SDGs) for the future development of our society, focusing on the need to "*take urgent action to combat climate change and its impacts*".

In this context, both scholars and practitioners hugely stress the need for firms to adapt to the existing surrounding context and to do their part in the fight against climate change, becoming a sort of imperative the active inclusion of environmental concerns into corporate decision-making processes.

There is consensus in literature about the beneficial effect of a greater environmental proactiveness on some crucial aspects of corporate financial choices, like, for example, boosting financial performances (Dixon-Fowler et al., 2013; Hart & Ahuja, 1996), or being tied to lower costs for financial sources (among the others, Caragnano et al., 2020; El Ghoul et al., 2018; Gupta, 2018; Maaloul, 2018; Mariani et al., 2021; Sharfman & Fernando, 2008).

Given what has been said up to now, environmental issues are today part of the overall strategic decision-making process by firms and the investigation of potential determinants of a higher environmentally oriented engagement remains one of the key concerns of the academic debate. Among the others, previous studies have dwelled on the role of corporate governance mechanisms in boosting environmental commitment, determining new corporate policies marked by the presence of more consistent environmentally friendly practices. With regard to the various elements of corporate governance mechanisms, the role of gender diversity has been lately addressed as a pivot for environmentally virtuous practices.

This relationship may be observed through the theoretical perspective of Upper Echelons Theory (Child, 1972; Hambrick & Mason, 1984) that moves from the idea of corporate choices mirroring those who are in charge to govern such choices, in light of inner thoughts, convictions, and values (Finkelstein & Hambrick, 1996; Waldman et al., 2004).

Thus, observing corporate choices as the reflection of gender diversity in the board of directors, literature has identified lower risk taking and higher reflexivity to face the consequences of their choices[3] and of course it has proven the extent to which gender diversity implies higher extent socially responsible commitment and in particular environmental engagement.

Among the most important studies in this flow of research, Atif et al. (2021) analyzed gender diversity underlining how more diverse boards seem to be associated to higher proneness to engage in renewable energy adoption, despite the existence of a "critical mass" required to disclose the actual latent effect. In a similar way, Zhang et al. (2021) have investigated a sample of 1027 listed companies, proving how corporate governance characteristics, both internally and externally, are crucially contributing to the effective use of renewable energy. In particular, what the authors show is that women appear to be more socially responsible than men.

Liu (2018) also tries to shed an impact on the topic, highlighting the decrease in corporate environmental violations when women are included in board of directors, and specifically if they are appointed as CEOs. In a similar way, Bassyouny et al. (2020) prove how CEOs disclosure is affected by personal traits and gender diversity, among other typical corporate governance features, is related to more realistic disclosures, marked by a less positive tone. Also, Gul et al. (2011) highlight the better market perception connected to gender diversity in the board of directors, implying this last, higher information disclosure, and improved stock price informativeness.

Despite these traces in literature, it cannot be said that the inclusion of women implies positive effects on its own and in an unconstrained way. Kassinis et al. (2016) at first confirm the positive environmental impact of more diverse boards, but they underline a subjective aspect connected to the inclusion of women in the board of directors, emphasizing a mitigating effect of having a higher number of women. Thus, gender diversity impact is undoubtable, but it must not be thought as an unconstrained panacea, since it should not be seen as reaching mere quotas, but it must represent a concrete stimulus to higher extent virtuous environmental practices.

[3] https://www.forbes.com/sites/kimelsesser/2022/04/29/women-arent-risk-averse-they-just-face-consequences-when-they-take-risks/?sh=6b7b72305a3f.

In this stream of research, Birindelli et al. (2019) highlight the nonlinearity of the relationship between board gender diversity and environmental engagement, underlining the not automatic and unconstrained positive impact on environmental performance. In the same vein, Ben-Amar et al. (2017) by empirically observing a sample of listed Canadian companies shed light on the effect of gender diversity on the willingness to disclose climate related information voluntarily and accurately, finding evidence of a critical mass. Similarly, Perrault (2015) by 34 semi-structured interviews finds out that board gender diversity is tied to a better perception in terms of board instrumental (objective and concrete), relational, and moral (subjective) legitimacy.

In line with what has been said until now, this chapter firstly aims at shedding light on the existing association between higher presence of women on the management and corporate environmental commitment, further attempting to assess if there is somehow a mitigating impact connected to a general positive sentiment concerning climate change at firm level. This would ideally represent a condition reducing the power of gender diversity, being this a sort of instrument to gain self-legitimacy and to perceive a more positive climate-related situation at firm level. The analysis aims at filling a gap existing within the intriguing debate connected to the drivers of virtuous corporate environmental strategies, having some scholars already focused on the role of climate change consciousness and perception of exposure to the disruptive desire to further engage in environmentally friendly practices.

Among the others, Todaro et al. (2021) through a survey submitted to Italian manufacturing corporate managers verify that climate change awareness and perceived exposure to climate risks are substantial drivers of firms further reaction to climate change, leading to corporate climate actions. Similarly, Ben-Amar et al. (2022) observe firm-level climate change exposure and connect it to a sort of rationale for engaging into voluntary adoption of the internal carbon pricing (ICP) metrics by Carbon Disclosure Project (CDP). The analysis findings shed light on how stronger perceived climate change exposure is associated to a higher proneness to voluntary engage into ICP metrics.

In this perspective, the second step of our investigation is the attempt of verifying if the already positive perception of environmental engagement toward climate change can actually mitigate the beneficial effect of women on management in further boosting corporate environmental commitment.

Therefore, we postulate the following hypotheses:

HP1: There is a positive association between the number of women on management and the corporate environmental commitment.
HP2: In a context of positive sentiment about environmental commitment, the role of women is mitigated.

To sum up, our analysis aims at deepening the existing relationship between management gender diversity and environmental engagement, introducing into the academic debate as a possible moderator of the aforementioned relationship the sentiment of each firm, namely the own perception of its position toward climate change.

3 Data and Methodology

The analysis is based on a sample of European firms included in the Bloomberg 500 Index, retrieved from the Bloomberg Database. They represent the top 500 European firms according to their Market Capitalization, considering a timespan from 2016 to 2021.

The dependent variable is represented by the Renewable Energy Consumption Ratio, namely the ratio between Renewable Energy Consumption and Total Energy Consumption both expressed in thousands Megawatt hours (Atif et al., 2021; Zhang et al., 2021).

Considering the main control variables, both market and accounting data are collected in order to capture the possible impacts of each variable on the tendency to adopt renewable energy. Thus, we include as control variables the Market Capitalization, computed as the natural logarithm of Market Capitalization, Price Earnings ratio, as the price for each unit of earnings, WACC (Weighted Average Cost of Capital) computed as the Weighted Average percentage cost of Debt and Equity, ROA (Return on Assets), controlling for the link between profitability and firm environmental commitment (Atif et al., 2021; He & Jiang, 2019; Nuber et al., 2020; Zhang et al., 2021), R&D, computed as the ratio between Research and Development (R&D) expenditures and Total Assets (He & Jiang, 2019); Size, as the natural logarithm of revenues, Quick Ratio, computed as the ratio between short-term assets (net of inventories) and short -term debt.

Considering the main regressor, the presence of women in the management structure of the firms in the sample is computed by the Percentage of Women in Management variable. This variable allows to consider the relative value among both top and middle management, differing from literature generally based on the percentage or the number of women among executives or in the board of directors (He & Jiang, 2019; Nuber et al., 2020; Tingbani et al., 2020; Zhang et al., 2021) and/or in the workforce (Atif et al., 2021). Such choice is strictly tied with the analysis aim, namely comprehending if and to which extent women at all levels of the strategic decision process might affect the share of renewable energy.

Lastly, the Climate Change Sentiment Index[4] by Sautner et al. (2020) is adopted to assess the role of Sentiment and firms' own perception in this relationship. It is computed as the result of a machine learning approach, searching for specific bigrams related to climate change (like, e.g., climate change, global warming, renewable energy, carbon tax) in the transcripts of earning conference calls for 10,000 firms from 34 countries.

The number of positive/negative words connected to Climate Change/Regulatory/Physical Risks/Opportunities/Sentiment is computed in percentage, based on the positive or negative words in the tone of the text analysis by Loughran and McDonald (2011).

Adopting this index permits to assess the firm own perception of its climate change related position during earning conference calls. In this sense, the sentiment measure permits to assess the real perception among managers of their exposure to climate change, their attention to the topic, and the overall positivity of their perceived stance. The index has been used to compute a dummy variable, namely positive sentiment counting 1 in case of a positive tone of the disclosure connected to climate change and 0 otherwise. The analysis is based on a Panel regression model.

[4] https://osf.io/.

Two main models have been tested, namely:

$$
\begin{aligned}
&\text{RENEWABLE ENERGY CONSUMPTION}_t = \\
&\beta_0 + \beta_1 \text{MARKETCAPITALIZATION}_{i,t-1} \\
&\quad + \beta_2 \text{PRICE EARNINGS}_{i,t-1} + \beta_3 \text{WACC}_{i,t-1} \\
&\quad + \beta_4 \text{ROA}_{i,t-1} + \beta_5 \text{SIZE}_{i,t-1} + \beta_6 \text{R\&D}_{i,t-1} \\
&\quad + \beta_7 \text{QUICKRATIO}_{i,t-1} \\
&\quad + \beta_8 \text{PERCENTAGE WOMEN ON MANAGEMENT}_t \\
&\quad + \text{TIME EFFECTS} + \text{INDUSTRY EFFECTS} + \varepsilon_t;
\end{aligned} \tag{1.}
$$

$$
\begin{aligned}
&\text{RENEWABLE ENERGY CONSUMPTION}_t = \\
&\beta_0 + \beta_1 \text{MARKETCAPITALIZATION}_{i;t-1} \\
&\quad + \beta_2 \text{PRICE EARNINGS}_{i,t-1} + \beta_3 \text{WACC}_{i,t-1} \\
&\quad + \beta_4 \text{ROA}_{i,t-1} + \beta_5 \text{SIZE}_{i,t-1} + \beta_6 \text{R\&D}_{i,t-1} \\
&\quad + \beta_7 \text{QUICKRATIO}_{i,t-1} \\
&\quad + \beta_7 \text{PERCENTAGE WOMEN ON MANAGEMENT}_{i,t} \\
&\quad + \beta_8 \text{CLIMATE CHANGE SENTIMENT}_{i,t-1} \\
&\quad + \beta_8 \text{PERCENTAGE WOMEN ON MANAGEMENT} \\
&\quad \times \text{CLIMATE CHANGE SENTIMENT}_{i,t-1} \\
&\quad + \text{TIME EFFECT + INDUSTRY EFFECTS} + \varepsilon_t;
\end{aligned} \tag{2.}
$$

We exclude 1st and 99th percentile outliers by a statistical process. Moreover, after testing by a Breusch-Pagan version for unbalanced Panels (Breusch & Pagan, 1979) for both time effects and individual effects to be included in the model we include Year and Industry effects in the model. Furthermore, after testing for the presence of both heteroskedasticity and autocorrelation in the residuals of the models, the results have been filtered with the industry level Clustered version of robust standard errors to take care of both issues by addressing the existence of consistent industry variability and oscillation in the sample (Abadie et al., 2017).

Considering the distribution in the sample, Figs. 1 and 2 display the share of Renewable Energy Consumption as well as Women on all levels management per Industry in the sample. The graphical analysis permits to assess the higher degree of energy savings and renewable energy use in the Consumer Cyclical, Defensive and Communication Services industries, next to Industrials. Communication Services, Healthcare, and Real Estate are the sectors marked by a higher share of women in all levels management. Intriguingly, Services is the industry with the lowest average value of women on management and it is the one with the highest standard deviation on the value, demonstrating a volatile distribution of the share in that peculiar sectorial context.

4 Results and Discussion

The main descriptive statistics are depicted in Table 1.

Going more in detail, the average value of the percentage of women on management shows an average value of 25%, with a similar median value, suggesting an almost normal distribution confirmed by the value of the Kurtosis, near to zero. Concerning the sentiment and perception variables, the Climate Change Sentiment immediately shows a lower scale with respect to the other variables, with a mean value equal to 0.036%, suggesting the slight impact of the variable and the depth of the observed detailed phenomenon. In addition, Renewable Energy Consumption shows an average value equal to 28.8%. With reference to the main market and financial variables included in the models, the average Market Capitalization is equal to 9.689, with an almost normal distribution, while the Price Earnings ratio records an average value equal to 29.845. Such results convey a message concerning the average position on markets of those entities which, given the chosen index of analysis, are the most represented in the European stock markets. Such results are confirmed when dealing with operating Size of the firms included in the sample, with an average value equal to 8.966 marked by a left tail skewed distribution. Going more into detail in the operating dimension of firms, on average, ROA records a 5.5% value, while the average WACC value is equal to 7.6%. The 1.9% average value for R&D expenditures suggests an average low engagement in R&D activities, with a distribution marked by the right tail, while the Quick Ratio is marked by an average value equal to 0.905, which indicates high amount of liquidity in the sample.

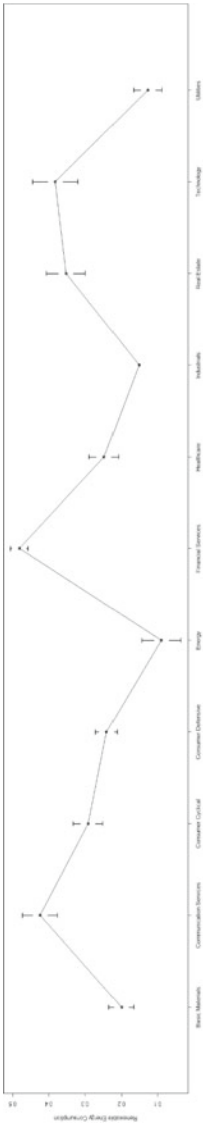

Fig. 1 Renewable energy per industry

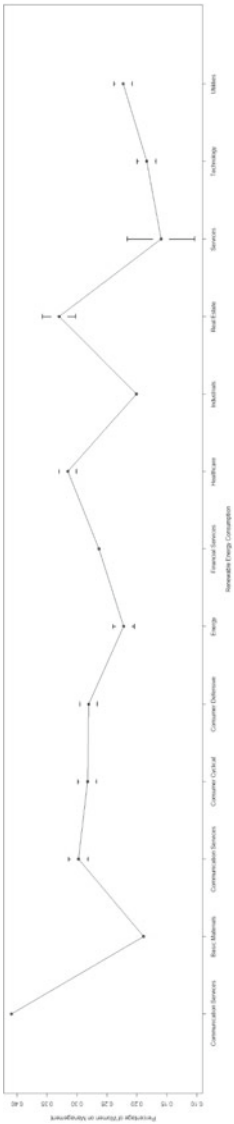

Fig. 2 Percentage of women in management per industry

Table 1 Descriptive statistics

	Percentage women management	*Climate change sentiment*	*Renewable energy consumption*	*Size*	*R&D*
Number of observation	3000	3000	3000	3000	3000
1. Quartile	0.175	0.000	0.039	7.837	0.000
3. Quartile	0.317	0.0004	0.485	10.111	0.025
Mean	0.251	0.0004	0.288	8.966	0.019
Median	0.241	0.000100	0.216	9.098	0.003
Skewness	0.437	3.857	0.717	−0.228	2.439
Kurtosis	0.033	28.816	−0.591	−0.536	6.261

	Market capitalization	*Price earnings*	*ROA*	*Wacc*	*Quick ratio*
Number of observation	3000	3000	3000	3000	3000
1. Quartile	8.715	12.510	0.011	0.055	0.510
3. Quartile	10.610	30.450	0.082	0.094	1.040
Mean	9.689	29.845	0.055	0.076	0.905
Median	9.489	19.840	0.044	0.074	0.740
Skewness	0.387	4.457	1.519	0.448	3.021
Kurtosis	−0.456	23.393	4.874	0.309	11.991

In addition, Table 2 shows the values of the correlation among the variables included in the analysis. Renewable Energy Consumption is positively and significantly correlated with a higher percentage of women on management. A divergent correlation emerges when dealing with the dimension of firms, since higher Size is related to a lower value of Renewable Energy Consumption, maybe due to the increasing complexity of the operating transition processes. Moreover, gender diversity seems to be connected with Climate Change Sentiment, while having a better sentiment clearly has an impact on the use of renewable energy. Regarding the main financial and market variables, higher capitalization seems to be connected with higher engagement with respect to renewable energy use. Higher dimensionality seems to be associated with lower female participation. On the other hand, worse financing conditions seem to reduce renewable energy consumption.

Table 2 Correlation analysis

	1	*2*	*3*	*4*	*5*	*6*	*7*	8	9
1. Percentage Women Management	1								
2. Climate Change Sentiment	0.101***	1							
3. Renewable Energy Consumption	0.065*	0.467***	1						
4. MarketCapitalization	0.103***	−0.003	0.054*	1					
5. PriceEarnings	−0.016	0.039	0.014	0.006	1				
6. ROA	0.045	−0.011	0.016	0.092***	−0.102***	1			
7. Wacc	−0.053*	0.125***	0.082***	0.039*	0.118***	0.278***	1		
8. QuickRatio	0.016	−0.034	−0.011	−0.138***	0.110***	0.223***	0.156***	1	
9. R&D	−0.021	−0.032	−0.012	0.105***	0.076***	0.137***	0.183***	0.270***	1

Table 3 shows the main results. The first model in Table 3 shows how, consistently with literature, having a higher percentage of women on board positively affects the tendency to prefer renewable energies over non-renewables. Such results confirm how corporate governance features may amplify the dedication with respect to the environmental commitment of firms. In the model it is clear how the ROA as a measure of profitability sheds an impact on the proneness to adopt renewable energy, while no impact emerges when dealing with the Price Earnings ratio and the WACC. Quick Ratio reduces the adoption of less depletive energetic sources. Intriguingly, having a higher size reduces the tendency to adopt renewables, in line with the difficulty to transform the production process of a bigger firm. On the other hand, having a higher market presence recalls the perception by investors and, in fact, market capitalization is tied with the need to engage in environmentally positive activities. The goodness of the model is confirmed by the value of the R-squared and F-Statistic, confirming the regression analysis robustness.

In order to fully and better understand the impact of women on energy consumption, aiming at understanding if and to what extent having women on management represents a benefit on Renewable Energy Consumption, we run a moderation analysis concerning the role of sentiment in the main relationship. This is aimed at analyzing if the impact of women on the objective engagement in environmental concerns, measured by the use of renewable energy, is moderated by a subjective perception of climate change. In this sense, the ratio of women on all levels management has been moderated by the value of Climate Change Sentiment. The result of the moderation model, confirms the positive impact of the Percentage of Women on Renewable Energy Consumption. In the same vein, the coefficient of the sentiment variable, introduces the beneficial impact of the sentiment concerning climate change on the actual engagement toward renewable energy use. However, as main result of the moderation model, ceteris paribus, a higher Percentage of Women on Management has a positive impact which is, however, mitigated in case of an already positive and higher Climate Change Sentiment. Henceforth, in case of already positive sentiment, the marginal effect of having an additional woman in all level management is reduced by the increasing value of the moderator. Such a result conveys a message which is almost in line with the idea of a critical mass, underlining how having women has a beneficial impact on the Environmental commitment which is mitigated when already having reached a positive attitude toward environmental

Table 3 Regression analysis

	Regression model	*Moderation model*
Intercept	0.0001	−0.1312
	(0.0845)	(0.0952)
Percentage of Women on Management	0.3643**	0.3153***
	(0.0851)	(0.1004)
WACC (lag,1)	−0.0044	0.0031
	(0.0033)	(0.0037)
ROA (lag,1)	0.0073**	0.0062***
	(0.0014)	(0.0015)
Market Capitalization (lag,1)	0.0364**	0.0366**
	(0.0100)	(0.0118)
Size (lag,1)	−0.0246*	−0.0226**
	(0.0094)	(0.0108)
R&D (lag,1)	0.5382	0.7313
	(0.3212)	(0.3355)
Quick Ratio (lag,1)	−0.0765***	−0.0680**
	(0.0161)	(0.0169)
Price Earnings (lag,1)	0.0001	0.0001
	(0.0002)	(0.0002)
Climate Change Sentiment (lag,1)		51.8797*
		(26.8851)
Percentage of Women on Management × Climate Change Sentiment (lag,1)		−146.0303*
		(98.7070)
Year Dummies	Yes	Yes
Industry Dummies	Yes	Yes
R-Squared	0.2978	0.3408
Adjusted R-Squared	0.2792	0.3171
F-Statistics	16.0025	14.3749
p-value	0.0000	0.0000

Industry-Clustered robust Standard Errors
p-values (0, 0.01, 0.05, 0.1, 1) < = > symbols("***", "**", "*", ".","").

related issues. In this sense, thus, firms need to consider women not as capable a priori to unleash a beneficial flow of socially responsible results, but as partially responsible of a virtuous process enhancing socially proactive perception and a higher green stance.

5 Conclusions

The academics and practitioners' attention emerging in the last years and connected to the increase of socially responsible engagement by firms has led Environmental, Social, and Governance (ESG) criteria in the middle of the debate as new metrics for corporate evaluation.

The most recent series of events has represented a practical call to action for our economic system, highlighting the need to overturn and concretely engage to reduce the depletive impact of human behaviors.

In this broader framework, the aim of this chapter is the identification of possible existing relationship between some main metrics of non-financial environmentally oriented engagement. By a Panel data analysis on the Blomberg European 500 Index constituents in the timespan going from 2016 to 2021, the analysis consistently shows the positive association between a higher percentage of women in all levels of the managerial structure and higher environmental commitment, testified by the use of renewables. Despite this first order result, the chapter shows how the beneficial role of a more diverse managerial structure in terms of environmentally proactive choices is mitigated by the achievement of a positive perception of own position toward the environment, measured throughout the Climate Change Sentiment Index by Sautner et al. (2020), which reduces further commitment and consistent engagement.

As food for thought, what emerges is that having an already positive perception of the own position towards the environment reduces the positive impact of a unitary increase in the percentage of women on management.

In terms of main implications, this chapter clearly points out the effective role of higher engagement in gender diversity issues shedding an impact on the environmentally responsible commitment, underlining at the same time the main limits of such virtuous vortex, and aiming at pushing firms to choose in terms of real commitment and not mere compliance.

Concerning the main limitations, the analysis could certainly be extended not only to the USA, but also to emerging countries in which the role of women is even more reduced with respect to developed countries. In addition, the analysis could benefit from other measures of environmental commitment, and different timeframes highlighting alternative normative contexts.

References

Abadie, A., Athey, S., Imbens, G. W., & Wooldridge, J. (2017). *When should you adjust standard errors for clustering?* National Bureau of Economic Research.

Atif, M., Hossain, M., Alam, M. S., & Goergen, M. (2021). Does board gender diversity affect renewable energy consumption? *Journal of Corporate Finance, 66*, 101665.

Bassyouny, H., Abdelfattah, T., & Tao, L. (2020). Beyond narrative disclosure tone: The upper echelons theory perspective. *International Review of Financial Analysis, 70*, 101499.

Ben-Amar, W., Chang, M., & McIlkenny, P. (2017). Board gender diversity and corporate response to sustainability initiatives: Evidence from the carbon disclosure project. *Journal of Business Ethics, 142*(2), 369–383.

Ben-Amar, W., Gomes, M., Khursheed, H., & Marsat, S. (2022). Climate change exposure and internal carbon pricing adoption. *Business Strategy and the Environment, 31*(7), 2854–2870.

Birindelli, G., Iannuzzi, A. P., & Savioli, M. (2019). The impact of women leaders on environmental performance: Evidence on gender diversity in banks. *Corporate Social Responsibility and Environmental Management, 26*(6), 1485–1499.

Breusch, T. S., & Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica: Journal of the Econometric Society, 47*(5), 1287–1294.

Burkhardt, K., Nguyen, P., & Poincelot, E. (2020). Agents of change: Women in top management and corporate environmental performance. *Corporate Social Responsibility and Environmental Management, 27*(4), 1591–1604.

Caragnano, A., Mariani, M., Pizzutilo, F., & Zito, M. (2020). Is it worth reducing GHG emissions? Exploring the effect on the cost of debt financing. *Journal of Environmental Management, 270*, 110860.

Child, J. (1972). Organizational structure, environment and performance: The role of strategic choice. *Sociology, 6*(1), 1–22.

Dixon-Fowler, H. R., Slater, D. J., Johnson, J. L., Ellstrand, A. E., & Romi, A. M. (2013). Beyond "does it pay to be green?" A meta-analysis of moderators of the CEP–CFP relationship. *Journal of Business Ethics, 112*, 353–366.

El Ghoul, S., Guedhami, O., Kim, H., & Park, K. (2018). Corporate environmental responsibility and the cost of capital: International evidence. *Journal of Business Ethics, 149*(2), 335–361.

Elmagrhi, M. H., Ntim, C. G., Elamer, A. A., & Zhang, Q. (2019). A study of environmental policies and regulations, governance structures, and environmental performance: The role of female directors. *Business Strategy and the Environment, 28*(1), 206–220.

Finkelstein, S., & Hambrick, D. C. (1996). *Strategic leadership: Top executives and their effects on organizations*. West Publishing Company.

García Martín, C. J., & Herrero, B. (2020). Do board characteristics affect environmental performance? A study of EU firms. *Corporate Social Responsibility and Environmental Management, 27*(1), 74–94.

Gul, F. A., Srinidhi, B., & Ng, A. C. (2011). Does board gender diversity improve the informativeness of stock prices? *Journal of Accounting and Economics, 51*(3), 314–338.

Gull, A. A., Atif, M., & Hussain, N. (2022). Board gender composition and waste management: Cross-country evidence. The British Accounting Review, 101097.

Gupta, K. (2018). Environmental sustainability and implied cost of equity: International evidence. *Journal of Business Ethics, 147*(2), 343–365.

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review, 9*(2), 193–206.

Hart, S. L., & Ahuja, G. (1996). Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance. *Business Strategy and the Environment, 5*(1), 30–37.

He, X., & Jiang, S. (2019). Does gender diversity matter for green innovation? *Business Strategy and the Environment, 28*(7), 1341–1356.

Kassinis, G., Panayiotou, A., Dimou, A., & Katsifaraki, G. (2016). Gender and environmental sustainability: A longitudinal analysis. *Corporate Social Responsibility and Environmental Management, 23*(6), 399–412.

Liu, C. (2018). Are women greener? Corporate gender diversity and environmental violations. *Journal of Corporate Finance, 52*, 118–142.

Loughran, T., & McDonald, B. (2011). When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks. *The Journal of Finance, 66*(1), 35–65.

Maaloul, A. (2018). The effect of greenhouse gas emissions on cost of debt: Evidence from Canadian firms. *Corporate Social Responsibility and Environmental Management, 25*(6), 1407–1415.

Mariani, M., Pizzutilo, F., Caragnano, A., & Zito, M. (2021). Does it pay to be environmentally responsible? Investigating the effect on the weighted average cost of capital. *Corporate Social Responsibility and Environmental Management, 28*(6), 1854–1869.

Morgan Stanley. (2023). https://www.morganstanley.com/articles/decarbonization-renewable-energy-investment-ideas

Nuber, C., Velte, P., & Hörisch, J. (2020). The curvilinear and time-lagging impact of sustainability performance on financial performance: Evidence from Germany. *Corporate Social Responsibility and Environmental Management, 27*(1), 232–243.

Perrault, E. (2015). Why does board gender diversity matter and how do we get there? The role of shareholder activism in deinstitutionalizing old boys' networks. *Journal of Business Ethics, 128*(1), 149–165.

Sautner, Z., van Lent, L., Vilkov, G., & Zhang, R. (2020). *Firm-level climate change exposure* (Finance Working Paper, 686). European Corporate Governance Institute.

Sharfman, M. P., & Fernando, C. S. (2008). Environmental risk management and the cost of capital. *Strategic Management Journal, 29*, 569–592.

Tingbani, I., Chithambo, L., Tauringana, V., & Papanikolaou, N. (2020). Board gender diversity, environmental committee and greenhouse gas voluntary disclosures. *Business Strategy and the Environment, 29*(6), 2194–2210.

Todaro, N. M., Testa, F., Daddi, T., & Iraldo, F. (2021). The influence of managers' awareness of climate change, perceived climate risk exposure and risk tolerance on the adoption of corporate responses to climate change. *Business Strategy and the Environment, 30*(2), 1232–1248.

Waldman, D. A., Javidan, M., & Varella, P. (2004). Charismatic leadership at the strategic level: A new application of upper echelons theory. *The Leadership Quarterly, 15*(3), 355–380.

Zhang, D., Zhang, Z., Ji, Q., Lucey, B., & Liu, J. (2021). Board characteristics, external governance and the use of renewable energy: International evidence. *Journal of International Financial Markets, Institutions and Money, 72*, 101317.

CHAPTER 9

Social Sustainability in Equity Crowdfunding: The Role of Women in the Platforms' Boards

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1 Introduction and Aim of the Research

In the last years, crowdfunding has developed as a new mean of funding where success depends on the crowd behaviour, that is, a large group of individuals use small amounts of money to finance entrepreneurial ventures through online platforms that act as intermediaries (Agrawal et al., 2013; Ahlers et al., 2015; Bruton et al., 2015; Cholakova &

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Clarysse, 2015; Mollick, 2014). The popularity of this new method to finance projects has increased to the point that in 2021; the global crowdfunding market was valued at USD 13.64 billion and it is expected to double by 2028, growing at a compound annual growth rate of 11.2% (Statista, 2022).

In addition to benefits for personal and business borrowers as time savings, flexibility, and less bureaucracy and the support in bridging the funding gap for firms, scholars have underlined that crowdfunding contributes to sustainable development (Hörisch, 2015; Jovanović, 2019; Lam & Law, 2016; Testa et al., 2019; Wehnert et al., 2019). Crowdfunding seems to have enormous potential, and this is also attributable to the stimulus it produces in innovation that allows SMEs and start-ups to reduce information asymmetries and exploit the market of potential funders (Giudici & Rossi-Lamastra, 2018).

Most of the studies on crowdfunding try to detect the determinants of the campaigns' success. One stream of research focuses on founders' characteristics, such as social capital, intellectual background, profile, and gender (Duan et al., 2020; Piva & Rossi-Lamastra, 2018; Skirnevskiy et al., 2017). Other researchers focused on company-related features, such as the industry or the investment sector, the business model, the age of the company at the time of crowdfunding, customer orientation, the company performance, the characteristics of the updates provided by the company during the fundraising phase, and communication and advertising along with other online marketing tools (Angerer et al., 2017; Di Pietro et al., 2018; Hornuf & Schwienbacher, 2018). Other studies analyse the influence played by campaign-specific characteristics, such as funding objectives, minimum investment, campaign duration, provision of financial data, pre-campaign evaluation, and percentage of the target money collected (Lukkarinen et al., 2016; Vulkan et al., 2016; Wald et al., 2019). Among the campaign-specific characteristics, the sustainability of the project has received increasing given the relevance of sustainability in every area, both for companies and individuals (World Bank, 2021). Exploring donation and reward-based crowdfunding—the most investigated types of crowdfunding (De Crescenzo et al., 2020; Walthoff-Borm et al., 2018)—some scholars have tried to shed light on the link between sustainability and crowdfunding success (Caputo et al., 2022; Hornuf et al., 2021; Troise et al., 2021; Vismara, 2019). Over time scholars have started to investigate another type of crowdfunding that is equity crowdfunding (EC), a relevant segment that in 2020 generated about

4.41 billion U.S. dollars (Cambridge Judge Business School, 2021); thus, scholars worked on providing evidence of its success factors (Caputo et al., 2022). The number of papers that focuses on the link between sustainability and campaigns' success in EC is very restricted and these scholars also reached contrasting results (Calic & Mosakowski, 2016; Vismara, 2019). In this research stream, the literature that examines the relationship between Social Sustainability (SocSus)—defined as specifying and managing both positive and negative impacts of systems, processes, organizations, and activities on people and social life (Balaman, 2019; Colantonio, 2007)—and EC is even less extensive (Turan, 2021; Vizcaíno et al., 2021). SocSus can be analysed by declining it in terms of gender gap (Bapna & Ganco, 2021; Cicchiello et al., 2021; Cumming et al., 2021; Malaga et al., 2018; Mohammadi & Shafi, 2018; Prokop & Wang, 2022; Serwaah, 2022; Vismara et al., 2017; Wang et al., 2022). Over time, studies on the gender gap in EC have evolved along two lines. The first considers the presence of women on the board of firms seeking equity financing (creators/founders), both with and without leading or managing roles. The second looks at female investors and how their behaviours may differ from their male counterparts. To our best knowledge, no studies have adopted the view of the equity crowdfunding platforms (ECP). Relying on these premises, this chapter aims to investigate the link between SocSus and EC; in doing so, we decided to focus on ECP, in order to understand the influence of SocSus of ECP on the success of the campaigns. Only recently, the crowdfunding platform has been recognized as an important factor which plays an essential role in the crowdfunding process and the campaign's success (Battisti et al., 2022; Graziano et al., 2023; Vrontis et al., 2020). The role of the crowdfunding platform tends to be generally overshadowed (Cosma et al., 2021) and studies focused on a restricted number of variables as the due diligence process (Cumming et al., 2019), the platform's number of social links (Battisti et al., 2022; Graziano et al., 2023), the number and type of post-campaign services (Rossi & Vismara, 2018), and the adoption of different campaign mechanisms (Hornuf & Schwienbacher, 2018). The governance of the ECP might play a crucial role given the possibility of the board members boosting relationships which contribute to the campaigns' success (Battisti et al., 2022). For this reason, in this chapter we want to study if and how the female presence—as board member or CEO—on the ECP boards influences the success of the EC campaign.

Besides finding an alternative source of financing, campaigns' launchers might benefit from the knowledge, skills, networks, and relations of investors and platforms (Troise & Tani, 2021; Troise et al., 2020) for their innovation process (Le Pendeven, 2016). Even if the campaigns' performance and success are the main variables investigated in the crowdfunding literature, other nonfinancial motivations drive the demand for collecting funding using EC. Innovation is an essential variable in the crowdfunding context that recently attracted researchers' attention (Banerji & Reimer, 2019; Giudici & Rossi-Lamastra, 2018; Troise et al., 2021). Troise et al. (2021) showed that EC represents a significant source of knowledge-based inputs for agri-food businesses in pursuing sustainability-oriented innovations and leveraging crowd investors' relations to fine-tune efforts on key sustainability-oriented challenges and related changes. Campaigns' performance and success are the main variables investigated in the crowdfunding literature, but other nonfinancial motivations besides raising money are crucial: innovation and its link with gender diversity are pivotal for the development of crowdfunding campaigns (Dai et al., 2019; Nekhili et al., 2017; Stanko & Henard, 2017), and this issue has recently attracted researchers' attention (Banerji & Reimer, 2019; Giudici & Rossi-Lamastra, 2018; Troise et al., 2020). According to Dai et al. (2019), gender heterogeneity strengthens the innovation performance of new ventures. In a field study of 2185 Kickstarter campaigns, Seigner et al. (2022) observe that innovation claims yield better fundraising performance for women than men, particularly in male-stereotyped categories. This means that women are perceived as more able when launching campaigns in male-stereotyped categories, suggesting that ability perceptions might play an important role. Based on a large set of projects on the rewards-based crowdfunding platform Kickstarter.com, Bort and Meoli (2022) reveal that female founders, adopting an open innovation strategy for their projects, have superior outcomes. Drawing on a data set of 356 crowdfunded projects over the period 2015–2019, through a Difference-in-Differences approach, Battaglia et al. (2022) find that female founders increase the success of innovative EC campaigns. As in the literature on SocSus, also in the case of studies on EC that focus on the intersection between innovation and gender diversity, the perspectives outlined are those relating to the female presence in the creators' boards, or those analysing the women's investment behaviours in the EC, while no studies adopt the ECP perspective. Filling this gap, this chapter aims to test whether a link exists between the

presence of female members or a female CEO on the board of directors of ECP and the presence of innovative campaigns on the platforms.

To answer our research questions, we hand-collected data about all the Italian campaigns launched in any Italian ECP. Italy is an interesting country to answer our research questions since it is placed on a higher level of visibility compared to its competitors, such as Germany (Rossi et al., 2019). Through the Decree Law N. 179/2012 Italy was the first nation in Europe to regulate EC which was subsequently reinforced and improved by the issuance of six other regulations by the National Commission for Companies and the Stock Exchange. Regulation supported and boosted the EC market growth allowing Italy to achieve significant positive results in terms of the magnitude of money raised (over EUR 148 million by 2021) (Politecnico di Milano, 2022). Moreover, unlike other countries, Italy has a specific register for authorized platforms (Vismara, 2016) which makes it possible to analyse a multi-platforms sample.

This chapter contributes to the literature in several ways. First, it contributes to the research on the determinants of EC success and innovation, which is underexplored compared to the other types of crowdfunding. We highlight that the presence of women on the boards of ECP attracts innovative campaigns but negatively affects EC success. Second, we contribute to the poorly investigated link between sustainability and EC, focusing on a specific dimension that is SocSus.

The remainder of the chapter is organized as follows: Sect. 2 describes the data and methodology, Sect. 3 presents the main findings and Sect. 4 concludes discussing the results and explaining the implication, the limitations, and further avenues of our research.

2 Data and Methodology

The data are hand-collected and related to all the EC campaigns ($n = 823$) that were launched on any of the Italian ECP ($n = 30$) over the period 2014–2021. Following previous studies (Block et al., 2018; Cosma et al., 2021; Hornuf & Schwienbacher, 2018; Vrontis et al., 2020), data about EC campaigns were retrieved from Italian ECP's websites. Out of the launched campaigns, 655 are successfully closed, while the remaining 168 fail to reach the pre-established minimum target.

In order to test whether the presence of women on the board of ECP influences the success of EC campaigns, we measure the EC success by creating two variables: (1) SUX, which is a dichotomous variable that

indicates whether a project reached or exceeded its funding goal, and (2) INTENS, which is a continuous variable equal to the ratio between the total amount of capital raised ant the target capital (Cosma et al., 2021). To test whether the presence of women on the board of ECP is related to the presence on the ECP of innovative campaigns, for each campaign we computed the variable INNOV as a dummy variable which assumes value 1 if the text of the pitch displays words related to innovation, 0 otherwise.

The second unit of data is represented by ECP boards. For each ECP, we detected the number and gender of the board members and the CEO. The variable N_BOARD displays the number of members of the board of the ECP; FEMAL_PLAT is a dummy variable that assumes value 1 if on the board of the platform where the campaign is launched sits at least one woman, 0 otherwise; FEMALE_CEO_PLAT is a dummy variable that assumes value 1 if the CEO of the ECP where the campaign is launched is a woman, 0 otherwise.

ENV_SUST and FEMALE_CAMP were added as control variables to consider the influence of the orientation within the campaign towards environmental and social sustainability, respectively. These variables are detected, as for INNOV, analysing the pitch of each campaign. Balance sheet data are downloaded from the AIDA (*Analisi Informatizzata delle Aziende Italiane*) database.

Prior to the analysis, the financial observations that occurred in the extreme 1% tails of the sample distribution were removed. Table 1 displays the variables' definition and their source.

Two models are employed to study the influence of the presence of women on ECP campaigns. In Model 1, a logit analysis is conducted where the dependent variable is the dummy variable SUX:

$$\begin{aligned}\text{Prob}(\text{SUX}_i = 1) = \Lambda(&\alpha_0 + \beta_1 \text{N\_ BOARD}_i + \beta_2 \text{FEMALE\_ PLAT}_i \\ &+ \beta_3 \text{FEMALE\_ CEO\_ PLAT}_i + \beta_4 \text{ENV\_ SUST}_k \\ &+ \beta_5 \text{FEMALE\_ CAMP}_k + \beta_6 \text{DUR}_k + \beta_7 \text{ROA}_k \\ &+ \beta_8 \text{LTA}_k + \beta_9 \text{IND}_k) + \varepsilon_i \end{aligned} \quad (1)$$

We use an OLS regression model to investigate the determinants of the relative success of the campaigns (Model 2):

$$\begin{aligned}\text{INTENS}_i = &\alpha_0 + \beta_1 \text{N\_ BOARD}_i + \beta_2 \text{FEMALE\_ PLAT}_i \\ &+ \beta_3 \text{FEMALE\_ CEO\_ PLAT}_i + \beta_4 \text{ENV\_ SUST}_k \\ &+ \beta_5 \text{FEMALE\_ CAMP}_k + \beta_6 \text{DUR}_k + \beta_7 \text{ROA}_k \\ &+ \beta_8 \text{LTA}_k + \beta_9 \text{IND}_k + \varepsilon_i \end{aligned} \quad (2)$$

Table 1 Variables definition

Variable	*Description*	*Source*
Dependent variables		
SUX	A dummy variable that assumes value 1 if the company collects the target amount, 0 otherwise	Platform website
INTENS	A ratio between the amount collected and the target amount	Platform website
INNOV	A dummy variable that assumes value 1 if the company is classified as innovative, 0 otherwise	Campaign pitch
Independent variables		
N_BOARD	The number of board members of the platform	Platform website
FEMALE_PLAT	A dummy variable that assumes value 1 if on the board of the platform where the campaign is launched sits at least one woman, 0 otherwise	Platform website
FEMALE_ CEO-PLAT	A dummy variable that assumes value 1 if the CEO of the board of the platform is a woman, 0 otherwise	Platform website
Control variables		
ENV_SUST	A dummy variable that assumes value 1 if the company is classified as sustainable, 0 otherwise	Campaign pitch
FEMALE_CAMP	A dummy variable that assumes value 1 if the company involves women, 0 otherwise	Campaign pitch
DUR	The duration of the campaign expressed in days	Platform website
ROA	(Net income/total average assets) × 100%	AIDA
LTA	Logarithm of the total assets ratio	AIDA
IND	Level of debt: total liability/total asset	AIDA

To study the relationship between ECP and INNOV we run the following probit model (Model 3):

$$\begin{aligned}\text{Prob}(\text{INNOV}_k = 1) = \Lambda(&\alpha_0 + \beta_1 \text{N\_ BOARD}_i + \beta_2 \text{FEMALE\_ PLAT}_i \\ &+ \beta_3 \text{FEMALE\_ CEO\_ PLAT}_i + \beta_4 \text{ENV\_ SUST}_k \\ &+ \beta_5 \text{FEMALE\_ CAMP}_k + \beta_6 \text{DUR}_k + \beta_7 \text{ROA}_k \\ &+ \beta_8 \text{LTA}_k + \beta_9 \text{IND}_k) + \varepsilon_i \end{aligned} \quad (3)$$

3 Results

The results of Model 1, the marginal effects, and results from Model 2 are displayed in Table 2.

Results from Model 1 reveal a negative and statistically significant relationship between the dependent variable SUX and the key independent variable FEMALE_PLAT. Marginal effects reveal that the probability that the crowdfunding operation is successful is 12% points lower if there are female members on the platform board. Results also show a positive and statistically significant relationship between SUX and N_BOARD. The probability that the crowdfunding operation will be successful is higher the higher the number of components of the platform board: for each additional component, the probability grows by 2.8% points.

Table 2 Results of the effects of the presence of female members or a female CEO on the board of the ECP and campaigns' success

Variables	*SUX*		*INTENS*
	Model 1: LOGIT	*Model 1: MARGINS*	*Model 2: REG_R*
N_BOARD	0.176**	0.029**	4.288
	(0.070)	(0.011)	(9.625)
FEMAL_PLAT	−0.761**	−0.126**	−66.46**
	(0.322)	(0.052)	(27.43)
FEMALE_CEO_PLAT	0.253	0.042	−43.12
	(0.600)	(0.099)	(46.40)
ENV_SUST	−0.129	−0.021	−22.33
	(0.220)	(0.036)	(22.38)
FEMALE_CAMP	0.911	0.151	70.15
	(0.768)	(0.127)	(61.08)
DUR	−0.004**	−0.001**	−0.025
	(0.002)	(0.000)	(0.280)
ROA	−0.003	−0.001	−0.173
	(0.003)	(0.001)	(0.389)
LTA	0.112	0.019	22.38**
	(0.0720)	(0.012)	(8.966)
IND	−0.906***	−0.150***	−81.63*
	(0.307)	(0.050)	(48.65)
Constant	0.779		131.3*
	(0.540)		(69.47)
Observations	562	562	561
R_squared			0.030

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

Model 2 is supported by the results of collinearity and heteroskedasticity tests. Through the analysis of VIF, the presence of multicollinearity problems is excluded. The White test revealed the presence of heteroskedasticity, thus an analysis with robust standard errors is run. Results from Model 2 show that the presence of female members in the platform board is negatively associated with the intensity of the success of the crowdfunding operation. No statistically significant relationship is detected between FEMALE_CEO_PLAT and either SUX or INTEN.

The results of Model 3 and the marginal effects are displayed in Table 3.

Results from Model 3 reveal a negative and statistically significant relationship between the dependent variable INNOV and the key independent variable FEMALE_PLAT. Marginal effects show that the probability that the crowdfunding operation is innovative is 16% points lower if there are female members on the platform board. Results also reveal a

Table 3 Results of the effects of the presence of female members or a female CEO on the board of the ECP and campaigns' innovation

Variables	*INNOV*	
	Model 3: LOGIT	*Model 3: MARGINS*
N_BOARD	0.410***	0.029***
	(0.101)	(0.007)
FEMAL_PLAT	−2.171***	−0.156***
	(0.434)	(0.032)
FEMALE_CEO_PLAT	2.337**	0.168**
	(1.160)	(0.084)
DUR	0.002	0.001
	(0.003)	(0.001)
ENV_SUST	0.512	0.037
	(0.353)	(0.025)
ROA	−0.007	−0.001
	(0.007)	(0.001)
LTA	−0.232**	−0.017**
	(0.107)	(0.008)
IND	−0.650	−0.047
	(0.494)	(0.035)
Constant	2.213***	
	(0.847)	
Observations	562	562

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

positive and statistically significant relationship between INNOV and N_BOARD. The probability that the crowdfunding operation will be innovative is higher the higher the number of components of the platform board: for each additional component, the probability grows by 2.9% points. Results also show a positive and statistically significant relationship between FEMALE_CEO_PLAT and INNOV. Marginal effects suggest that the probability that the crowdfunding operation is innovative is 17% points higher if the CEO of the ECP is a woman.

4 Conclusion

Features related to crowdfunding platforms have recently been demonstrated relevant in affecting campaigns' success besides creators' and campaigns' characteristics. While previous research investigated the influence of the due diligence process (Cumming et al., 2019), the platform's number of social links (Graziano et al., 2023; Vrontis et al., 2020), the number and type of post-campaign services (Rossi & Vismara, 2018), and the adoption of different campaign mechanisms (Hornuf & Schwienbacher, 2018), no studies investigated whether and how the presence in the ECP boards of female members or CEO affects the campaigns' success and attracts innovative campaigns in the platforms. This study seeks to fill this gap, focusing on a dataset made up of all the EC campaigns launched in any of the Italian ECP. Our study demonstrates that the success of EC campaigns can be influenced by the gender composition of the ECP board. The analysis reveals that the presence of women on the board of directors is negatively related to the probability of success of the campaigns so that the higher the number of female directors on the ECP board, the lower the number of campaigns that reach their funding target. A possible interpretation of this result is that in a context of high information asymmetry such as EC, where creators acknowledge the importance of the ECP boards in supporting and boosting the campaigns' success, women are perceived by creators as less competent and less able to manage the platform. This creators' perceptions about ECP boards might lead the creators with the best ideas to choose platforms entirely run by men.

This interpretation is in line with the literature showing that female representation at senior organizational levels lags well behind male representation (Gould et al., 2018); the low representation of women in managing positions is recognized as one of the obstacles to achieving full

gender equality (Fortin et al., 2017). Anyway, the topic needs researchers' attention since previous studies highlighted that female leadership is positively linked to positive female labour market outcomes, such as the use of flexible employment contracts, female employment, gender wage gaps, retention rates after economic shocks (Devicienti et al., 2019; Flabbi et al., 2019; Lucifora & Vigani, 2016; Tate & Yang, 2015), and firm outcomes as attendance at board meetings and effort on monitoring (Adams & Ferreira, 2009). Conversely, the relationship between board diversity and firm performance is still ambiguous and related to other governance features (Ferreira, 2015; Smith, 2018) thus corroborating the possible creators' expectations for the presence of women on the boards observed in our study.

The present research findings also challenge the social network theory in equity crowdfunding (Vismara, 2016), according to which mixed teams can benefit from more extensive networks of social ties (Vogel et al., 2014), which are positively linked to campaigns' success. While this might be true for creators' teams, our results do not support this interpretation for ECP board of directors. Indeed, creators are not attracted by the presence of women on the board of ECP, probably thinking they might not benefit from their social ties. This interpretation is in line with the stream of the literature that suggests how women are often excluded from accessing high-level networks in politics and industry (Nikolova, 1993; Smallbone & Welter, 2001) and from informal social networks useful for resource acquisition at start-up stages, which tend to be male dominated (Aidis et al., 2008; World Bank, 2019).

This research also explores whether the presence of female members or CEO on the boards of ECP is related to a stronger presence of innovative campaigns on the platforms. Findings point out a negative relationship between the number of innovative campaigns that are launched in the ECP and the presence of female board members, but a positive one with the presence of a female CEO. This finding partially supports the new research stream that challenges the general perception according to which women are less innovative than men (Nählinder, 2010). Indeed, data worldwide report that the percentage of women-led firms that created new to market products is higher than the percentage of firms that are women-led (World Bank, 2015). Recent findings from the United States showed that projects funded by the Small Business Innovation Research (SBIR) programme had a greater probability of being commercialized in women- than in men-led firms (Bednar et al., 2021).

Our chapter offers several theoretical and practical insights for scholars, entrepreneurs, managers, and policymakers.

From a theoretical point of view, this study explicates the role of the gender of the members of the boards, with a specific focus on ECP, thus contributing to both studies on the topic of women's presence in the companies' board (Adams & Ferreira, 2009; Chen et al., 2017; Goergen & Renneboog, 2014; Gul et al., 2011; Terjesen et al., 2009; Ye et al., 2019) and the literature on EC (Agrawal et al., 2015; Battisti et al., 2022; Belleflamme et al., 2014; Colombo et al., 2015; Hornuf & Schwienbacher, 2015; Mollick, 2014). By investigating the EC campaigns' success-pattern in relation to the female presence on the boards of all Italian ECP, we suggest how gender-based board composition plays a role.

From an entrepreneurial and managerial point of view, this study provides novel information to overcome the general funding differences between EC campaigns launched by male- and female-led platforms.

From regulators and policymakers' points of view, this chapter highlights there is room to educate investors, who suffer from mistrust of women in managerial positions in ECP, preferring platforms with male-dominated boards, showing a competence bias. To remove the barriers at the root of the historical distrust of women who hold managerial positions, Italian and European policymakers could evaluate to define specific political actions.

Our study has several limitations that open up avenues for future research. One first limitation of the present research is related to the possibility of generalizing results since the ECP analysed are in a single country. Caution should be taken in generalizing these results to other countries because the social norms governing the behaviours of members of crowdfunding communities may be culturally mediated. Future replication studies across countries and platforms are encouraged to understand whether the institutional context in which platforms, creators, and investors are embedded influences the relationship between female presence on the boards and campaigns' success. For instance, repeating the analysis for countries like Sweden, which displays political and legal systems that encourage gender equality, may affect the results. Second, this study explores the influence of the female presence on the platform board from the investors' side. Future studies could provide a better understanding of the financial inclusion offered by EC in Italy by analysing this method of financing from the entrepreneurs-side. Finally,

researchers' energies should be devoted to pragmatic, pressing issues. For example, Italy, like the rest of the world, is experiencing economic crises due to the price of raw materials and supply difficulties, caused by the war between Russia and Ukraine. Future researchers could investigate how this crisis influences the entrepreneurial activity in the EC, and which role crowdfunding platforms and the female presence on those boards can play in rebuilding after this crisis.

References

Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of Financial Economics, 94*(2), 291–309.

Agrawal, A., Catalini, C., & Goldfarb, A. (2013). *Crowdfunding: social frictions in the flat world* (NBER Working Paper, 16820).

Agrawal, A., Catalini, C., & Goldfarb, A. (2015). Crowdfunding: Geography, social networks, and the timing of investment decisions. *Journal of Economics & Management Strategy, 24*(2), 253–274.

Ahlers, G. K., Cumming, D., Günther, C., & Schweizer, D. (2015). Signaling in equity crowdfunding. *Entrepreneurship Theory and Practice, 39*(4), 955–980.

Aidis, R., Estrin, S., & Mickiewicz, T. (2008). Institutions and entrepreneurship development in Russia: A comparative perspective. *Journal of Business Venturing, 23*(6), 656–672.

Angerer, M., Brem, A., Kraus, S., & Peter, A. (2017). Start-up funding via equity crowdfunding in Germany: A qualitative analysis of success factors. *The Journal of Entrepreneurial Finance (JEF), 19*(1), 1–34.

Balaman, ŞY. (2019). *Sustainability issues in biomass-based production chains* (pp. 77–112). Academic Press.

Banerji, D., & Reimer, T. (2019). Startup founders and their LinkedIn connections: Are well-connected entrepreneurs more successful? *Computers in Human Behavior, 90*, 46–52.

Bapna, S., & Ganco, M. (2021). Gender gaps in equity crowdfunding: Evidence from a randomized field experiment. *Management Science, 67*(5), 2679–2710.

Battaglia, F., Regoli, A., & Agnese, P. (2022). Do local innovation systems promote successful equity crowdfunding campaigns? Evidence from Italy. *Finance Research Letters, 48*, 102932.

Battisti, E., Graziano, E. A., & Christofi, M. (2022). Equity crowdfunding platforms and social media: A Twitter analysis. *International Journal of Entrepreneurial Behavior & Research, 28*(5), 1206–1221.

Bednar, S., Gicheva, D., & Link, A. N. (2021). Innovative activity and gender dynamics. *Small Business Economics, 56*(4), 1591–1599.

Belleflamme, P., Lambert, T., & Schwienbacher, A. (2014). Crowdfunding: Tapping the right crowd. *Journal of Business Venturing, 29*(5), 585–609.

Block, J. H., Colombo, M. G., Cumming, D. J., & Vismara, S. (2018). New players in entrepreneurial finance and why they are there. *Small Business Economics, 50*(2), 239–250.

Bort, J., & Meoli, A. (2022). Gender and innovation strategy in crowdfunding. In *Gender, Diversity and Innovation* (pp. 15–28). Edward Elgar.

Bruton, G., Khavul, S., Siegel, D., & Wright, M. (2015). New financial alternatives in seeding entrepreneurship: Microfinance, crowdfunding, and peer-to-peer innovations. *Entrepreneurship Theory and Practice, 39*(1), 9–26.

Calic, G., & Mosakowski, E. (2016). Kicking off social entrepreneurship: How a sustainability orientation influences crowdfunding success. *Journal of Management Studies, 53*(5), 738–767.

Cambridge Judge Business School. (2021). *The 2nd Global Alternative Finance Market Benchmarking Report*.

Caputo, A., Schiocchet, E., & Troise, C. (2022). Sustainable business models as successful drivers in equity crowdfunding. *Business Strategy and the Environment, 31*(7), 3509–3522.

Chen, J., Leung, W. S., & Goergen, M. (2017). The impact of board gender composition on dividend payouts. *Journal of Corporate Finance, 43*, 86–105.

Cholakova, M., & Clarysse, B. (2015). Does the possibility to make equity investments in crowdfunding projects crowd out reward–based investments? *Entrepreneurship Theory and Practice, 39*(1), 145–172.

Cicchiello, A. F., Kazemikhasragh, A., & Monferra, S. (2021). In women, we trust! Exploring the sea change in investors' perceptions in equity crowdfunding. *Gender in Management: An International Journal, 36*(8), 930–951.

Colantonio, A. (2007). *Social sustainability: An exploratory analysis of its definition, assessment methods metrics and tools* (EIBURS Working Paper Series 2007/01). Oxford Brooks University, Oxford Institute for Sustainable Development (OISD)—International Land Markets Group, Oxford, UK.

Colombo, M. G., Franzoni, C., & Rossi-Lamastra, C. (2015). Internal social capital and the attraction of early contributions in crowdfunding. *Entrepreneurship Theory and Practice, 39*(1), 75–100.

Cosma, S., Grasso, A. G., Pattarin, F., & Pedrazzoli, A. (2021). Platforms' partner networks: The missing link in crowdfunding performance. *European Journal of Innovation Management, 25*(6), 122–151.

Cumming, D. J., Johan, S. A., & Zhang, Y. (2019). The role of due diligence in crowdfunding platforms. *Journal of Banking & Finance, 108*, 105661.

Cumming, D., Meoli, M., & Vismara, S. (2021). Does equity crowdfunding democratize entrepreneurial finance? *Small Business Economics, 56*(2), 533–552.

Dai, Y., Byun, G., & Ding, F. (2019). The direct and indirect impact of gender diversity in new venture teams on innovation performance. *Entrepreneurship Theory and Practice, 43*(3), 505–528.

De Crescenzo, V., Ribeiro-Soriano, D. E., & Covin, J. G. (2020). Exploring the viability of equity crowdfunding as a fundraising instrument: A configurational analysis of contingency factors that lead to crowdfunding success and failure. *Journal of Business Research, 115*, 348–356.

Devicienti, F., Fanfani, B., & Maida, A. (2019). Collective bargaining and the evolution of wage inequality in Italy. *British Journal of Industrial Relations, 57*(2), 377–407.

Di Pietro, F., Prencipe, A., & Majchrzak, A. (2018). Crowd equity investors: An underutilized asset for open innovation in startups. *California Management Review, 60*(2), 43–70.

Duan, Y., Hsieh, T. S., Wang, R. R., & Wang, Z. (2020). Entrepreneurs' facial trustworthiness, gender, and crowdfunding success. *Journal of Corporate Finance, 64*, 101693.

Ferreira, D. (2015). Board diversity: Should we trust research to inform policy? *Corporate Governance: An International Review, 23*(2), 108–111.

Flabbi, L., Macis, M., Moro, A., & Schivardi, F. (2019). Do female executives make a difference? The impact of female leadership on gender gaps and firm performance. *The Economic Journal, 129*(622), 2390–2423.

Fortin, N. M., Bell, B., & Böhm, M. (2017). Top earnings inequality and the gender pay gap: Canada, Sweden, and the United Kingdom. *Labour Economics, 47*, 107–123.

Giudici, G., & Rossi-Lamastra, C. (2018). Crowdfunding of SMEs and startups: When open investing follows open innovation. In *Researching open innovation in SMEs* (pp. 377–396). World Scientific.

Goergen, M., & Renneboog, L. (2014). Inside the board room. *Journal of Corporate Finance, 28*, 1–5.

Gould, J. A., Kulik, C. T., & Sardeshmukh, S. R. (2018). Trickle-down effect: The impact of female board members on executive gender diversity. *Human Resource Management, 57*(4), 931–945.

Graziano, E. A., Fattobene, L., Giovando, G., & Pellicelli, A. (2023). Contacts on LinkedIn: Equity crowdfunding platforms' networks and creators' innovation performance. *European Journal of Innovation Management*. https://doi.org/10.1108/EJIM-03-2022-0125

Gul, F. A., Srinidhi, B., & Ng, A. C. (2011). Does board gender diversity improve the informativeness of stock prices? *Journal of Accounting and Economics, 51*(3), 314–338.

Hörisch, J. (2015). Crowdfunding for environmental ventures: An empirical analysis of the influence of environmental orientation on the success of crowdfunding initiatives. *Journal of Cleaner Production, 107*, 636–645.

Hornuf, L., & Schwienbacher, A. (2015). *Funding dynamics in crowdinvesting* (SSRN Working Paper). https://ssrn.com/abstract=2612998

Hornuf, L., & Schwienbacher, A. (2018). Market mechanisms and funding dynamics in equity crowdfunding. *Journal of Corporate Finance, 50*, 556–574.

Hornuf, L., Stenzhorn, E., & Vintis, T. (2021). Are sustainability-oriented investors different? Evidence from equity crowdfunding. *The Journal of Technology Transfer, 47*, 1662–1689.

Jovanović, T. (2019). Crowdfunding: What do we know so far? *International Journal of Innovation and Technology Management, 16*(01), 1950009.

Lam, P. T., & Law, A. O. (2016). Crowdfunding for renewable and sustainable energy projects: An exploratory case study approach. *Renewable and Sustainable Energy Reviews, 60*, 11–20.

Le Pendeven, B. (2016). Equity crowdfunding: Impact of the innovation degree on fundraising campaigns. In *ICIE 2016 proceedings of the 4th international conference on Innovation and Entrepreneurship: ICIE2016* (pp. 335–344). Academic Conferences and Publishing Limited.

Lucifora, C., & Vigani, D. (2016). *What if your boss is a woman? Work organization, work-life balance and gender discrimination at the workplace* (IZA Discussion Paper No. 9737). Available at SSRN https://ssrn.com/abstract=2732000

Lukkarinen, A., Teich, J. E., Wallenius, H., & Wallenius, J. (2016). Success drivers of online equity crowdfunding campaigns. *Decision Support Systems, 87*, 26–38.

Malaga, R., Mamonov, S., & Rosenblum, J. (2018). Gender difference in equity crowdfunding: An exploratory analysis. *International Journal of Gender and Entrepreneurship, 10*(4), 332–343.

Mohammadi, A., & Shafi, K. (2018). Gender differences in the contribution patterns of equity-crowdfunding investors. *Small Business Economics, 50*(2), 275–287.

Mollick, E. (2014). The dynamics of crowdfunding: An exploratory study. *Journal of Business Venturing, 29*(1), 1–16.

Nählinder, J. (2010). Where are all the female innovators?: Nurses as innovators in a public sector innovation project. *Journal of Technology Management & Innovation, 5*(1), 13–29.

Nekhili, M., Nagati, H., Chtioui, T., & Nekhili, A. (2017). Gender-diverse board and the relevance of voluntary CSR reporting. *International Review of Financial Analysis, 50*, 81–100.

Nikolova, M. (1993). Nyakoi demografski spekti na jenskoto predpriemachestvo [Some demographic aspects of women's entrepreneurship]. *Problemi Na Truda, 9*, 46–61.

Piva, E., & Rossi-Lamastra, C. (2018). Human capital signals and entrepreneurs' success in equity crowdfunding. *Small Business Economics, 51*(3), 667–686.

Politecnico di Milano. (2022). *7° Report Italiano sul Crowdinvesting*.
Prokop, J., & Wang, D. (2022). Is there a gender gap in equity-based crowdfunding? *Small Business Economics, 59*(3), 1219–1244.
Rossi, A., & Vismara, S. (2018). What do crowdfunding platforms do? A comparison between investment-based platforms in Europe. *Eurasian Business Review, 8*(1), 93–118.
Rossi, A., Vismara, S., & Meoli, M. (2019). Voting rights delivery in investment-based crowdfunding: A cross-platform analysis. *Journal of Industrial and Business Economics, 46*(2), 251–281.
Smallbone, D., & Welter, F. (2001). The distinctiveness of entrepreneurship in transition economies. *Small Business Economics, 16*(4), 249–262.
Seigner, B. D. C., Milanov, H., & McKenny, A. F. (2022). Who can claim innovation and benefit from it? Gender and expectancy violations in reward-based crowdfunding. *Strategic Entrepreneurship Journal, 16*(2), 381–422.
Serwaah, P. (2022). Crowdfunding, gender and the promise of financial democracy: A systematic review. *International Journal of Gender and Entrepreneurship, 14*(2), 263–283.
Skirnevskiy, V., Bendig, D., & Brettel, M. (2017). The influence of internal social capital on serial creators' success in crowdfunding. *Entrepreneurship Theory and Practice, 41*(2), 209–236.
Smith, N. (2018). Gender quotas on boards of directors. *IZA World of Labor, 2018*, 7.
Stanko, M. A., & Henard, D. H. (2017). Toward a better understanding of crowdfunding, openness and the consequences for innovation. *Research Policy, 46*(4), 784–798.
Statista Research Department. (2022). *Crowdfunding market size globally 2021.*
Tate, G., & Yang, L. (2015). Female leadership and gender equity: Evidence from plant closure. *Journal of Financial Economics, 117*(1), 77–97.
Terjesen, S., Sealy, R., & Singh, V. (2009). Women directors on corporate boards: A review and research agenda. *Corporate Governance: An International Review, 17*(3), 320–337.
Testa, S., Nielsen, K. R., Bogers, M., & Cincotti, S. (2019). The role of crowdfunding in moving towards a sustainable society. *Technological Forecasting and Social Change, 141*, 66–73.
The World Bank. (2015). *Annual Report 2015.*
The World Bank. (2019). *Annual Report 2019.*
The World Bank. (2021). *Annual Report 2021.*
Troise, C., Tani, M., & Jones, P. (2020). Investigating the impact of multidimensional social capital on equity crowdfunding performance. *International Journal of Information Management, 55*, 102230.

Troise, C., & Tani, M. (2021). Exploring entrepreneurial characteristics, motivations and behaviours in equity crowdfunding: Some evidence from Italy. *Management Decision, 59*(5), 995–1024.

Troise, C., Tani, M., Dinsmore, J., Jr., & Schiuma, G. (2021). Understanding the implications of equity crowdfunding on sustainability-oriented innovation and changes in agri-food systems: Insights into an open innovation approach. *Technological Forecasting and Social Change, 171*, 120959.

Turan, S. S. (2021). Uncovering trust signals in equity crowdfunding: A systematic literature review. *International Journal of Research in Business and Social Science (2147–4478), 10*(4), 215–225.

Vismara, S. (2016). Equity retention and social network theory in equity crowdfunding. *Small Business Economics, 46*(4), 579–590.

Vismara, S., Benaroio, D., & Carne, F. (2017). Gender in entrepreneurial finance: Matching investors and entrepreneurs in equity crowdfunding. In A. Link (Ed.), *Gender and entrepreneurial activity* (pp. 271–288). Edward Elgar.

Vismara, S. (2019). Sustainability in equity crowdfunding. *Technological Forecasting and Social Change, 141*, 98–106.

Vizcaíno, F. V., Cardenas, J. J., & Cardenas, M. (2021). A look at the social entrepreneur: The effects of resilience and power distance personality traits on consumers' perceptions of corporate social sustainability. *International Entrepreneurship and Management Journal, 17*(1), 83–103.

Vogel, E. A., Rose, J. P., Roberts, L. R., & Eckles, K. (2014). Social comparison, social media, and self-esteem. *Psychology of Popular Media Culture, 3*(4), 206.

Vrontis, D., Christofi, M., Battisti, E., & Graziano, E. A. (2020). Intellectual capital, knowledge sharing and equity crowdfunding. *Journal of Intellectual Capital, 22*(1), 95–121.

Vulkan, N., Åstebro, T., & Sierra, M. F. (2016). Equity crowdfunding: A new phenomena. *Journal of Business Venturing Insights, 5*, 37–49.

Wald, A., Holmesland, M., & Efrat, K. (2019). It is not all about money: Obtaining additional benefits through equity crowdfunding. *The Journal of Entrepreneurship, 28*(2), 270–294.

Walthoff-Borm, X., Schwienbacher, A., & Vanacker, T. (2018). Equity crowdfunding: First resort or last resort? *Journal of Business Venturing, 33*(4), 513–533.

Wang, Y., Li, Y., Wu, J., Ling, L., & Long, D. (2022). Does digitalization sufficiently empower female entrepreneurs? Evidence from their online gender identities and crowdfunding performance. *Small Business Economics, 61*, 325–348.

Wehnert, P., Baccarella, C. V., & Beckmann, M. (2019). In crowdfunding we trust? Investigating crowdfunding success as a signal for enhancing trust in

sustainable product features. *Technological Forecasting and Social Change, 141*, 128–137.

Ye, D., Deng, J., Liu, Y., Szewczyk, S. H., & Chen, X. (2019). Does board gender diversity increase dividend payouts? Analysis of global evidence. *Journal of Corporate Finance, 58*, 1–26.

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