NOVA IMS Information Management School

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Master Degree Program in
Statistics and Information Management

Environmental Risk Management and Sustainability In the Banking Sector

Rui Pedro Mendonça Prata

Master Thesis

presented as partial requirement for obtaining the Master Degree in Statistics and Information Management

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação
Universidade Nova de Lisboa

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Environmental Risk Management and Sustainability

In Banking Sector

By

Rui Pedro Mendonça Prata

Master Thesis presented as partial requirement for obtaining the Master's degree in Statistics and Information Management, with a specialization in Risk Analysis and Management.

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June, 2024

STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

[Lisboa, 13th June]

DEDICATION

This final master's degree is the culmination of many hours invested, countless challenges, uncertainties, joys and frustrations which, with a lot of effort and dedication and with the contribution of several people, made it possible to complete this cycle. This result was possible thanks to the support, energy and positivity of several people to whom I thank and dedicate this work.

Firstly, I would like to say a special thank you to my parents, for being models of courage and encouragement, for their unconditional support, companionship and friendship. I thank them for the education they gave me, for the values they instilled in me, for the love and effort that enabled me to get this far.

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DEDICATÓRIA

O presente trabalho final de mestrado é o culminar de muitas horas investidas, inúmeros desafios, incertezas, alegrias e frustrações que, com muito esforço e dedicação e com o contributo de várias pessoas, tornou-se possível o término deste ciclo. Este resultado terá sido possível devido ao apoio, energia e positividade de várias pessoas a quem agradeço e dedico este trabalho.

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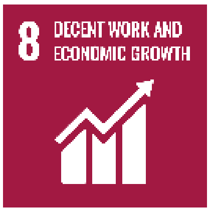
ABSTRACT

In an era characterized by heightened global uncertainties and an escalating emphasis on sustainable practices, financial institutions encounter the intricate challenge of aligning risk mitigation strategies with sustainable development goals. This research employs a combining quantitative and qualitative methodologies, to scrutinize the current landscape of risk management and sustainability initiatives in the banking sector. The study aims to discern gaps and identify areas of synergy, examining the profound impact of significant events such as the recent COVID-19 pandemic and conflicts in the Middle East and Europe on the relationship between risk and sustainability. The entire investment forecast within this domain has necessitated substantial readjustments due to these influential events. Through an analysis of case studies and engagement with industry experts, this document conducts a thorough literature review, presenting diverse perspectives and thoughts on the evolving dynamics between risk management and sustainability in banking. By delving into the implications of recent global events, this research aims to contribute nuanced insights that facilitate a more integrated and resilient approach for financial institutions seeking to navigate the complex intersection of risk and sustainable development.

KEYWORDS

ESG; Financial Sustainability; Risk Management; Bank Performance; COVID-19



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1. INTRODUCTION

Risk management practices have a significant influence on promoting sustainability. The banking sector plays a pivotal role in the global economy. However, the financial industry is exposed to various risks, regulatory changes, and increasingly, environmental and social pressures. As the world embraces sustainability as a core value, there is a growing need for banking institutions to adapt to this changing landscape.

Despite the growing emphasis on sustainability within the banking sector, there exists a notable research gap regarding the integration of environmental risk management practices and their impact on sustainability. The problem is that due to the lack of agreed-upon standards for companies to use for reporting on sustainability issues, there is a paucity of high-quality firm-level data to serve as key inputs in assessing a company's risks and adherence to ESG criteria (Antoncic, 2020). This research aims to provide valuable insights into the relationship between environmental risk management and sustainability within banking institutions. This study will collect and analyze data from banks implementing environmental risk management, including ESG integration, sustainable financing, and environmental risk mitigation. The objective is to offer nuanced insights for sustainable finance and risk management in the banking sector.

The first step involves the collection of financial, sustainability, and compliance data from selected banks throw statistical methodologies. Statistical analysis, including regression, quantitatively evaluates the impact of environmental risk management on financial performance. This methodological approach aims to provide a comprehensive understanding of the interplay between environmental risk management and sustainability in the banking sector. It combines quantitative analyses of financial data with and document analysis, offering a view of the challenges and opportunities associated with sustainable practices in banking institutions.

As a result, banks can have a negative impact on sustainable development during their business strategies without financial risk management (Liu et al, 2022). Inadequate risk management can lead to instability, non-compliance with sustainability regulations, and investments in unsustainable projects. Sound risk management not only safeguards banks from financial crises but also ensures they remain in compliance with evolving sustainability regulations.

2. LITERATURE REVIEW

2.1. RESEARCH FRAMEWORK

This research framework provides a robust structure for the investigation and support of literature review.

Table 1. Research Framework

Select Database • Scopus • Web of Science	Collect data (keywords) • Financial Sustainability • ESG • Bank Value • COVID-19 • Risk Management
Indicators • Data analysis, main authors, journals and keywords	Analysis • Discussion • Content Analysis • Research Gap

To investigate the central theme of financial performance and sustainability in the banking sector, I employed an inclusive search strategy of key terms such as (“Financial performance*” OR "Financial sustainability*") AND ("Bank value*" OR "Bank performance" OR "COVID19*"). The search spanned from 2010 to 2024, ensuring a comprehensive understanding of the evolving landscape over time. A total of 486 results were retrieved from the Scopus and Web of Science databases, with Mendeley serving as a vital tool for eliminating duplicates and streamlining the dataset.

The subsequent phase involved a meticulous screening process, wherein the relevance of each result was assessed through a careful examination of abstracts and conclusions. Specific criteria were applied to exclude articles not aligned with the research focus, resulting in the exclusion of 171 articles deemed irrelevant. To maintain a broad yet focused perspective, our analysis considered research works in both Portuguese and English, with a deliberate exclusion of books and book chapters. This research methodology aims to provide a nuanced and thorough examination of the existing literature, enabling a detailed understanding of the intersection between financial performance, sustainability, and external factors such as the COVID-19 pandemic. The study contributes to the identification of key trends, challenges, and advancements in the field, facilitating a comprehensive exploration of the chosen research domain.

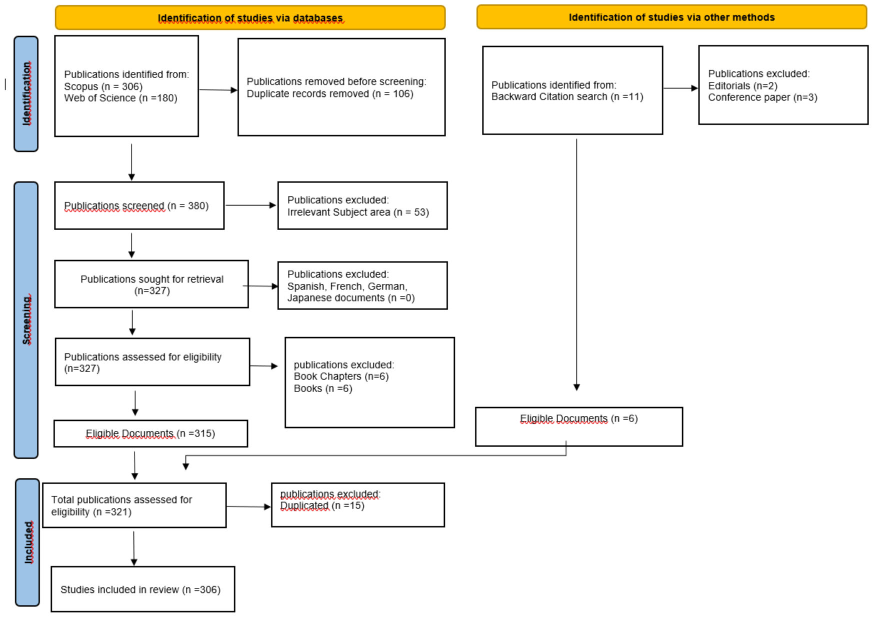

Figure 1. PRIMSA Flow Diagram

2.2. Related Works

The process of identifying relevant literature played a pivotal role in our study, providing a more extended insight into the existing literature in this area of study and recent contributions. This thorough examination formed the foundation of our research, ensuring that our study is built upon up-to-date and pertinent contributions to the subject. It also facilitated a fundamental understanding of the research domain.

As our study progressed, the identification of related works served multiple purposes. It allowed us to compare existing conclusions, enriching our comprehension of the topic and blowing up the credibility and potential impact of our study.

Table 2. Related Works

Author	Year	Title
Kim S. & Li Z.	2021	*Understanding the impact of ESG practices in corporate finance*
Di Tommaso C. & Thornton J.	2020	*Do ESG scores effect bank risk taking and value? Evidence from European banks*
Fatimah Y. & Kannan D. & Govindan K. & Hasibuan Z.	2023	*Circular economy e-business model portfolio development for e-business applications: Impacts on ESG and sustainability*
Veronica M. & Ida I. & Peteriandi D.	2022	*Factors Predicting Financial Sustainability in the Banking Sector*
Lamanda G. & Tamásné Vőneki Z.	2024	*Is ESG disclosure associated with bank performance? Evidence from the Visegrad Four countries*
Landi G. & Iandolo F. & Renzi A. & Rey A.	2022	*Embedding sustainability in risk management: The impact of environmental, social, and governance ratings on corporate financial risk*

The results obtained through applied filters correspond to articles, literatures reviews and conference papers. The articles represent more than 50% of the results.

Notable journals that make significant contributions to the subject include Banks and Bank Systems, Journal of Islamic Accounting and Business Research and International Journal of Middle Eastern Finance and Management. The top five journals, showcasing publications related to the subject under examination, are emphasized in Figure 3.

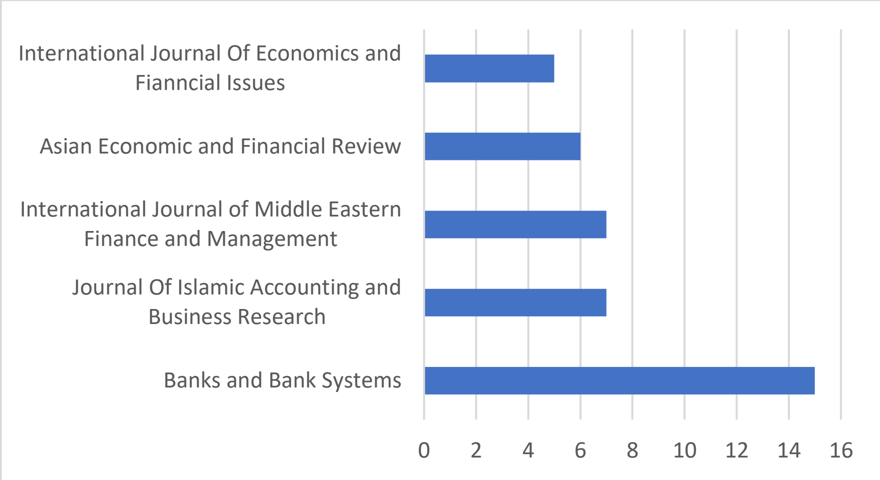

Figure 2. Top Journals and Publications

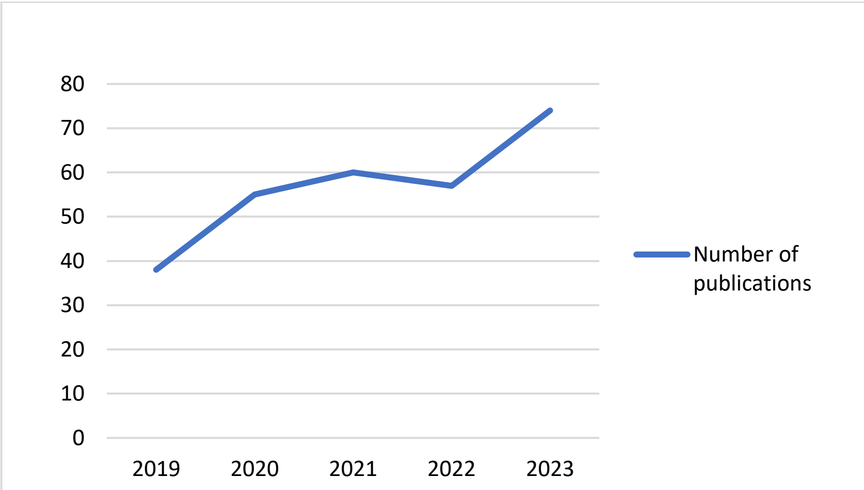

Figure 3. Number of publications over the years

In 2023, there was more significant number of publications, namely 74, following by a period of stabilization between 2020 and 2022 at around 60.

The VOS Viewer was a tool was also adopted to analyze the fundamental characteristics of publications about the subject under analysis, which allows the visualization of bibliometric networks.

Initially, five was chosen for the minimum occurrence threshold for keywords, resulting in 37 identified keywords. From the figure 3 it is possible visualize the most used keywords. The figure shows that the most commonly used keywords are “Financial Performance”, “Bank Performance” and “Corporate Governance”.

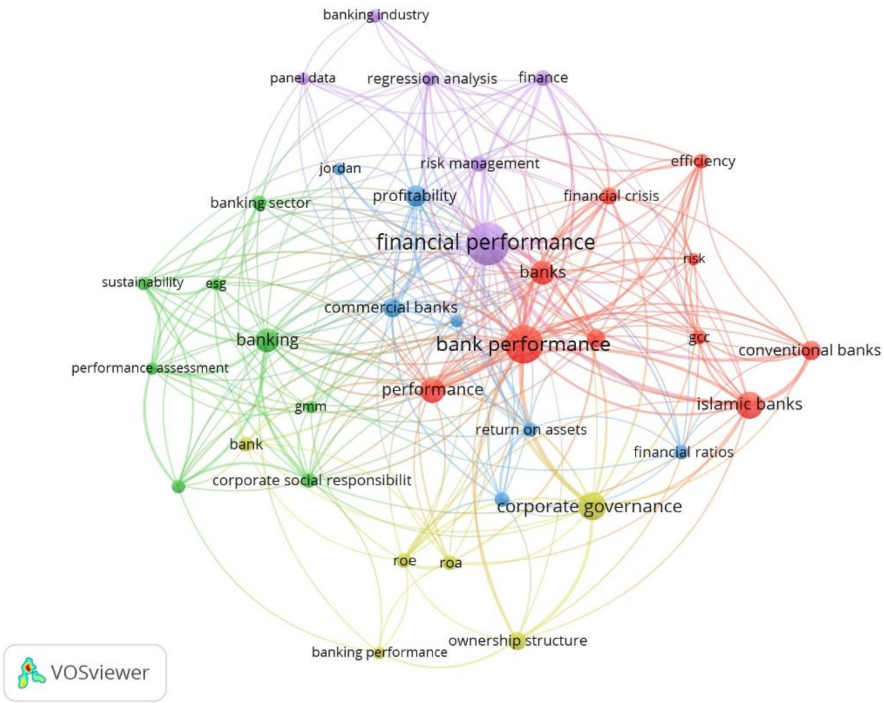

Figure 4. Keywords with at least 5 occurrences

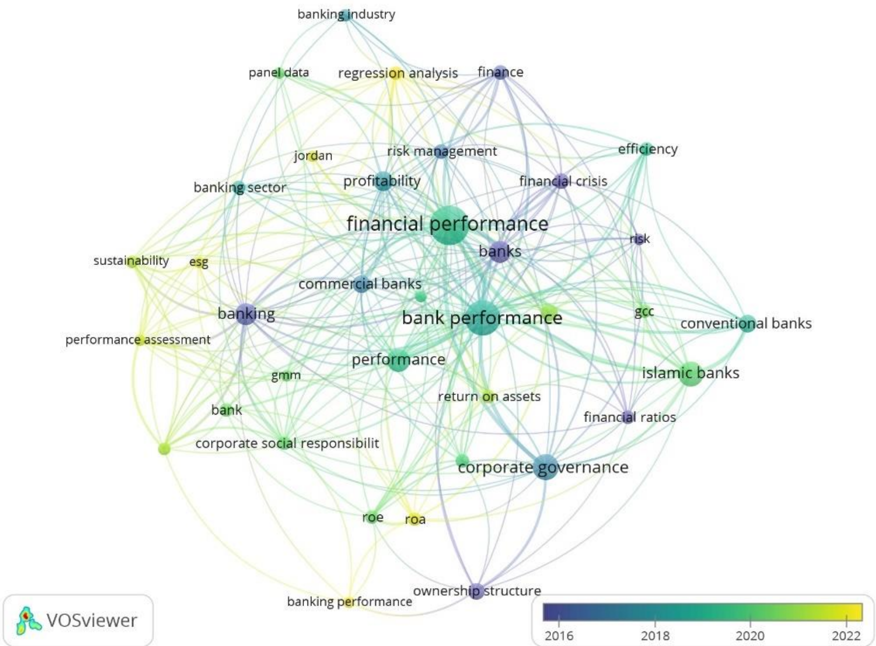

Figure 5. Keywords over the years

Figure 4 and 5 represent key words interrelated with the topic under study. The figures are divided into different colored clusters, each representing a specific theme within the study of banking performance. The clusters are formed based on the connections and proximity between the terms.

- The cluster in red, centered on “bank performance” and “banks”, involves terms such as “conventional banks” and “financial ratios”, suggesting a focus on comparing types of banks and their financial indicators.
- The green cluster seems to focus on “sustainability” and “corporate social responsibility”, connecting terms such as “sustainability”, “banking”, and “corporate social responsibility”.
- The purple cluster includes terms such as “financial performance”, “profitability”, and “risk management”, indicating a focus on general financial performance and risk management.

There is a high degree of interconnectivity between the terms, which suggests that these topics are often discussed together.

“Financial performance” and “bank performance” are highlighted, indicating that these terms are the most recurrent in the literature and studies represented. The central position of these terms suggests that they are frequently cited and discussed in conjunction with the other topics in the network.

This type of visual analysis makes it easier to identify trends and gaps in the academic literature, guiding new research and a broader understanding of the interrelationships between different aspects of banking performance.

2.3. CONTENT ANALYSIS

Today we are facing a scenario where all countries have to take measures to preserve the world and combat climate change. Since the beginning of the twenty-first century, sustainable development has been a major concern on a global scale. This greater concern was triggered by the measures/objectives imposed by the United Nations: Sustainable Development Goals (SDGs).

The banking sector can be considered as a way of implementing sustainable measures. The term "green banking" describes how banks can reach their full potential by taking on responsibility, being socially conscious, and, most importantly, lending money to borrowers who behave well in terms of the environment, society, and government (Sharma et al., 2014).

The study by Sharma et al. (2014) examines the relationship between green banking practices and the sustainability performance of the banking sector in Indonesia, based on information provided in sustainability reports over a nine-year period. The results demonstrate that disclosures related to sustainability and green banking remain dynamic from year to year. Environmental disclosures are the least common, on the other hand economic disclosures are the most common. This study makes use of the sustainability disclosure requirements from the using a content analysis method. When these two metrics were combined, a more thorough list of disclosures as a guide. This research is significant since it will add to the body of knowledge on green banking, which the literature currently in publication lacks.

Kim et al., (2021) discovered a connection between company financial performance and environmental, social, and governance (ESG) factors through their investigative research. They analyzed various ESG subcategories, assessing their merits and drawbacks, as well as the overarching ESG factor, examining their impact on the profitability and financial risk of corporations. We can thus conclude that ESG considerations have a favorable impact on corporate profitability, with a stronger impact on larger businesses. Corporate governance is the ESG category having the biggest impact, especially for companies with poor governance. Additionally, Kim et al.'s study allows us to derive that credit rating is often positively impacted. Specifically, the environmental score surprisingly has a negative effect on credit rating, but the social aspect has the most impact. In general, this study offers a justification for integrating ESG. Certain individual and aggregate variables have a favorable impact on the selected performance measures, despite the fact that it is challenging to generalize the positive impact of ESG factors on corporate financial performance. Corporate profitability is positively impacted by the overall ESG score. Corporate governance is the component that most significantly affects corporate profitability. Only companies with lax governance were found to have a positive correlation between corporate profitability and governance. All variables significantly affect credit rating when it comes to the relationship between credit risk and ESG. The credit rating is positively impacted by social, governance, and overall scores; however, the credit rating is shockingly negatively impacted by environmental scores, and social factors have the greatest influence on credit ratings.

Lamanda G. et al (2024) conducted a study investigating the dynamic relationship between ESG (Environmental, Social, and Governance) disclosure and bank performance. They applied theoretical frameworks such as Stakeholder theory, Legitimacy theory, Resource-based view, and Agency theory. Analyzing data from banks situated in Hungary, the Czech Republic, Poland, and Slovakia, the researchers categorized information from 26 banks into four main groups: Framework, Environmental aspects, Social aspects, and Corporate governance aspects. Using a coding system where 1 signified that the question was answered in reports and 0 otherwise, the authors calculated the ESG Disclosure based on annual reports. The application of the Breush-Pagan test confirmed the absence of heteroskedasticity issues, and the Hausman test emerged as the preferred method to delve into relationships. The regression models suggested a positive correlation between banking sector disclosures and the size of the banks. Their findings underscored that, leading up to 2019, bank reports predominantly underscored social issues and corporate governance, possibly in response to heightened regulatory demands. Poland emerged as the leader in ESG Disclosure within the study period, followed by the Czech Republic, Hungary, and Slovakia.

Tommaso et al (2020) investigated the relationship between ESG scores and risk-taking, as well as their value, based on the testing of six hypotheses supported by the Stakeholder Theory View and the Overinvestment View. Through the estimation of linear models, they concluded that elevated scores are associated with a reduction in risk-taking for banks, whether they have high or low risks. The impact of these values depends on the characteristics of the boards of directors, where composition and size are crucial for effective ESG management. Despite an overall negative impact of ESG, the study found an indirect positive link between ESG scores and the value of ESG on risk-taking. The ESG activities undertaken by banks, coupled with their management, supported by independent and gender-diverse boards of directors, can effectively mitigate risk-taking and contribute to financial stability. The authors argue that these findings should serve as a warning for regulatory bodies, boards of directors, and banks that promote these activities.

In today's digital environment, the circular economy has become a major force behind the advancement of sustainability. Businesses operating in the circular economy have made major contributions to employment and the gross domestic product. In the future, fresh strategies will be required to address global trends in digitalization, resource depletion, and ecological issues. Digital e-business must not only take care of the sustainable growth of the circular economy, but must also focus on environmental problems. Fatimah et al., (2022) study is feature-based and aims to improve sustainability and environmental, social, and governance (ESG) performance. In this study, metrics were used to assist the technical parts of the circular economy process, lower operating costs and resource demands, lessen the impact on the environment, and increase social and economic.

The development of an ESG-based sustainable circular economy e-business model to assist the enhancement of ESG performances for overall business developments has been illustrated by Morea et al., (2022) study. Under the consideration, this study offers particular and crucial digital approaches and applications that the circular economy industry might implement in a sustainable and intelligent environment. It offers some insightful instances of how sectors that encourage the creation of fresh and creative circular economy company models have adopted the circular economy e-business. Also, it makes clear that stakeholders in the circular economy need to work together more thoroughly. The growth of e-business in the circular economy holds promise for social and environmental benefits in addition to financial gains. Goals such as “sustainable development goals” and “climate action plans” can be considered good initial targets for promoting sustainability in companies.

With banks being one of the main sectors driving sustainability measures, the phase of change and initial investment wasn’t always easy. There were some situations that occurred over the years that slowed down the process of growth in terms of sustainability. The COVID-19 has caused an interruption in the banking sector, pushing the economy into a downward phase (Li Y., 2023). The banking sector is struggling to maintain its operations among the challenges posed by the COVID-19 outbreak. In order to increase financial performance and enable community service provision, innovation is required. Veronica (2022) study was to examine how financial performance functions as a mediator between intellectual capital and financial sustainability. Intellectual capital is considered to be all the knowledge and information that an individual has gained through experience, in this case in the banking sector. Banking sector should pay attention to manage and invest in intellectual, human, structural and physical capital because be used as a advantage to improve performance and promote business survival.

Jordão et al., (2017) and Siswanti et al., (2019), showed the outcome that the relationship between intellectual capital and financial sustainability is mediated by the financial performance variable. Consequently, it is imperative for the banking industry to prioritize the development of its intellectual capital, as this initiative not only enhances its bottom line but also fosters long-term commercial viability.

Analyzing the impact of ESG and sustainability in the banking sector is a constantly evolving area of research. We can still consider some research gaps. In reality COVID-19 has caused an increase in the level of uncertainty and risk. The way in which the pandemic has propagated has affected the sustainability disclosures and reporting behavior of the banking sector. The quality and consistency of reported ESG data ranges significantly between financial institutions, making comparative analysis more diverse.

3. METHODOLOGY

"In recent years, environmental performance, social responsibility and corporate governance (ESG) have become increasingly relevant for banks and financial institutions. ESG issues are not just an ethical issue, but are also becoming an economic issue, as they have a direct influence on economic stability" (Menicucci E., 2022).
Evaluating the relationship between environmental, social and governance (ESG) criteria and banks financial performance has emerged as a topic of growing interest in banking practice. Financial institutions should be regarded not only as producers of financial value but also as drivers of more sustainable development.

This research adopts a comprehensive methodological approach, combining quantitative and qualitative analyses to understand the mechanisms by which ESG factors impact banks financial performance. The methodology employed is guided by a series of carefully delineated steps aimed at ensuring rigour, analytical precision and validity of the results obtained.

3.1. NATIONAL VISION (PORTUGAL)

3.1.1. BANK OF PORTUGAL

As the organization in Portugal responsible for supervising credit institutions and financial companies, as well as for issuing the national currency, the Bank of Portugal has taken on the task of implementing the best measures to promote sustainability in the banking sector in Portugal. The Bank of Portugal has operated under the premise that "without ESG sustainability, macroeconomic and financial stability will always be at risk." Over the past three years, the Bank of Portugal has increased its commitment to issues related to environmental sustainability and sustainable finance. This includes its membership in the Network for Greening the Financial System (NGFS), the development of a strategy and work plan (Strategic Plan 2021-25), the production of studies and analyses, and the implementation of supervisory measures.

Before implementing the 2021-25 Strategic Plan, the institution prioritized four areas of sustainability:

- Risk identification and assessment
- Internal sustainability practices
- National and international intervention
- Communication and collaboration

In its Strategic Plan 2021-25, Banco de Portugal identified five key points for action:

1. Robustness of the financial system
2. Protecting the banking market
3. Economic recovery and resilience
4. Trust and influence in society
5. Governance and internal management

With all these measures, banks nationwide have had to adapt by making various investments to comply with these new rules.

3.1.2. SANTANDER TOTTA BANK

At the environmental level (E), Banco Santander Totta mobilised around 28.8 billion in Green Finance during 2022, ensuring that 100% of the energy consumed by Banco Santander in Portugal came from renewable sources. At the Social level (S), it has ensured that more than 550,000 people have been financially empowered since 2019. 47% of employees are women and 33% are women in management positions. In terms of Governance, 36% of the members of the Board of Directors are also women. It was a bank that was very concerned with the concept of sustainability. Based on the acronym ESG, it has defined its main highlights for 2022:

- E – Supporting the transition to a low-carbon
- S – Promoting inclusive growth
- G – Strong governance and culture throughout the organization

It's not just the Bank of Portugal that imposes these regulatory and supervisory measures. The UN founded the Principles for Responsible Banking, and in accordance with these principles there has been positive progress on the part of the Banco Santander Group towards some of these goals.

- The amount of Green Finance mobilized rose from 19 billion euros in 2019 to 94.5 billion euros in 2022, with the aim of reaching 120 billion euros by 2025 and 220 million euros by 2030.
- In 2018, 43% of the electricity used in the group's properties came from renewable sources. By 2022 this figure had risen to 88 per cent and the aim is for the properties to use 100 per cent of their energy from renewable sources by 2025.
- In 2021 around 7 billion euros were recorded as a result of the elimination of exposure related to thermal coal, with the main objective being to reach 0 by 2030.
- In 2019, absolute emissions from gas and oil totaled 23.84 $mtCO_2$, with a target of 16.98 $mtCO_2$ by 2030.

Given the good evolution of these sustainability metrics, Santander was elected the ‘Most Responsible Bank - ESG’ in Portugal, taking first place in the sector in the Merco ESG 2022 ranking.

3.1.3. Caixa Geral de depósitos

Caixa Geral de Depósitos is another of the national banks with a lot of influence and a big impact on promoting sustainability. It has developed strategic approaches supported by internal policies and an alignment with international measures and references.

When analyzed publicly available, the improvement in the ESG rating serves as evidence of the solid, transparent and innovative implementation of internal ESG practices, along with their due disclosure in the bank's Sustainability Report and other external channels. Caixa Geral de Depósitos became the bank with the best ESG rating in Portugal. Acquired as a central element of Caixa's 2021-2024 Strategic Plan, the ESG dimension is driven by a progressive and dynamic action plan developed internally, with the active participation of various structures. The main objective is to remain at the forefront of sustainable financing in Portugal, investing in and promoting the transition to a low-carbon economy and supporting projects with a positive social impact.

According to a study by Brandscore, Caixa was recognised as the Best Bank in Sustainability in 2021. Brandscore is a national study conducted among individuals aged between 15 and 70, through 8,000 telephone interviews, with around 2,000 interviews per quarter.

Caixa has been developing ESG policies:

- Environmental - through the implementation of measures that promote eco-efficiency in operations.
- Social - community involvement policies, a gender equality plan and a policy for the group's employees, contributing to consistency between the strategic plan and the group's training priorities.
- Governance - from codes of conduct, to general sustainability principles, to policies on corruption prevention, diversity, protection...

The Bank also has international commitments such as the Net Zero Banking Alliance (NZBA) and the Women's Empowerment Principles (WEP), to which the group has affiliated itself through the United Nations. It is a founding member of the Principles for Responsible Banking (PRB), also under the United Nations program.

In addition, the group has also committed itself at the national level. It is part of the Portuguese network Global Compact Network Portugal (GCNP); signed the Charter of Commitment for Sustainable Finance in Portugal, coordinated by the Ministries of Environment, Finance, and Economy; it also signed the Lisbon European Green Capital 2020 Commitment, which is based on 21 actions in various areas such as energy, mobility, water, emissions, and promotion and dissemination of events.

Caixa Geral de Depósitos has a very well-defined sustainability strategy 2021-2024 for the coming years. Everything it will and is developing is based on five areas:

1. Sustainable and inclusive financing

2. Climate risk management
3. Equity, Digital and Financial Inclusion
4. Transparent Government Models
5. Disclosure of Sustainability Information

In the first year of implementing these strategies, there was a realization rate of 76% in the year 2021.

One of the focus areas of the banking sector in Portugal continues to be the improvement of the offering of new financial products in a way that contributes to a more efficient economy with less environmental impact.

Caixa has developed a financing line for families and businesses, namely a leasing scheme aimed at supporting investment in hybrid and electric vehicles. In 2018, only €6.4 million had been financed, and by 2021, this amount had increased to €35.9 million. They also developed Caixa Invest Green Land, which supports the transformation of business by promoting greater environmental responsibility.

3.1.4. Millenium BCP

Another influential bank in Portugal is Millennium BCP. The BCP group, in its approach to sustainability policies, focuses on three fundamental points:

- Environment (E) - implementation of measures that incorporate the environmental component into the Bank's risk models and into the offer of new products and services;
- Social (S) - involving different communities in establishing relationships with a common goal;
- Corporate governance (G) - integrating sustainability principles into the Bank's decision-making processes.

Like Caixa Geral de Depósitos, Millenium also has international commitments (UN Global Compact, Science Based Targets) and national commitments (Letter of Commitment for Sustainable Financing, PMEL - Urban Mobility, Lisbon Green Capital 2020).

Millenium BCP seeks to be a national benchmark, and during the 2021-2024 Strategic Plan will endeavor to keep all its facilities in Portugal operating with electricity from renewable sources and reduce exposure to coal-intensive sectors.

The group has become involved in realizing the United Nations' Sustainable Development Goals (SDGs). Millenium recognizes these goals as a benchmark that will stimulate new processes of change in the economic, social and environmental reality.

3.2. DATASET

The data to be used to obtain the results is taken from the Sustainability Reports published annually by the banks on their official websites. Based on this information, various indicators are created, organized into different variables.

The data used in the sample will therefore be from Santander Totta Bank. The time period will be from 2018 to 2023. The relationship between these variables will be analyzed using a linear regression model. This tool is very useful for analyzing data due to its simplicity and easy implementation. It allows us to analyze the results and check the fit of the model to the data. For this analysis we needed metrics such as R-square, adjusted R-square, T-test, F-test and p-value.

To carry out this analysis the variables chosen were based on three pilars of ESG: environmental, social and governance. Carbon footprint, employee diversity, board diversity (male and female) and revenue growth were the variables chosen and remaining as explanatory variables carbon footprint, board diversity and employee diversity.

3.3. ANALYZING DATA

In order to analyze the sustainability and ESG measures imposed by different entities in the banking sector, it was necessary to use a combination of environmental, social and governance variables. The application of quantitative methods such as linear regression, correlation analysis, panel data modelling and multivariate analysis allowed for a comprehensive understanding of the relationships between ESG practices and banks financial performance.

To measure financial performance in the banking sector, several financial variables were considered that are commonly used to assess the financial health and success of banking institutions, particularly in this case revenue growth.

The data used will be taken from Santander from the period 2018-2023.

Table 3. Data taken from Santander Totta bank's sustainability reports

Year	carbon_footprint	employee_diversity	board_diversityM	board_diversityF	revenue_growth
2018	28311	6492	4	2	50,50%
2019	10095	6226	4	2	46,00%
2020	5558	6012	4	2	46,10%
2021	6912	4817	4	2	40,80%
2022	5214	4653	5	1	36,30%
2023	7688	4619	5	1	26,00%

The following variables were taken into account: CO_2 emissions in tones, diversity of employees in the institution and gender diversity on the board of directors.

Were defined as independent variables:

- carbon footprint - Amount of CO_2 emissions disclosed by the institution
- employee diversity - number of employees at the organization
- board diversity - proportion of male and female board members

The dependent variable was revenue growth (the rate of growth of the organization's revenue)

Three fundamental premises were created for the development of this methodology in order to reach a conclusion:

- H1: Environmental performance of emerging market banks and their financial performance are positively associated
- H2: Social performance of emerging market banks and their financial performance are positively associated
- H3: Governance performance of emerging market banks and their financial performance are positively associated

The following multiple linear regression model was created and used:

$$revenue\ growth = \beta 0 + \beta 1 \times carbon\_footprint + \beta 2 \times employee\_diversity + \beta 3 \times board\_diversityM + \gamma \quad (1)$$

This model was estimated using the R software version 4.3.3. Using this software and to develop the regression the following packages and libraries were installed: dplyr, ggplot2, car and readxl.

The significance of the coefficients was checked using the t-test. The overall significance of the model is assessed by the F-test.

The results of the regression analysis are interpreted to understand the impact of ESG variables on the financial performance of banking institutions. The significance of the coefficients and the direction of the relationships (positive or negative) provide insights into the relative importance of each ESG variable.

4. RESULTS AND DISCUSSION

In this section, the results obtained from the statistical analysis described in the methodology will be presented and discussed. The main focus is to assess the influence of ESG variables (CO2 emissions, gender diversity in the institution and diversity on the board of directors) on the financial performance of banking institutions, measured by revenue growth.

Before analyzing the regression, we proceeded with a descriptive analysis of the variables involved. The following table shows the descriptive statistics of the selected variables, including mean, standard deviation, minimum values and maximum values.

Table 4. Descriptive analysis of the variables involved

	carbon_footprint	employee_diversity	board_diversityM	board_diversityF	revenue_growth
Min	5214	4619	4	1	0.2600
1st Qu.	5896	4694	4	1.250	0.3743
Median	7300	5414	4	2	0.4340
Mean	10630	5470	4.333	1.667	0.4095
3rd Qu.	9493	6172	4.750	2	0.4607
Max	28311	6492	5	2	0.5050

Based on this information, we can conclude that some variables have suffered big oscillation in recent years, mainly as a result of significant global events such as the COVID-19 pandemic. There is a large fluctuation in the carbon footprint, reaching a minimum value of 5214 tonnes and maximum of 28311 tonnes. The huge fluctuation in CO2 emissions reflect the difference in sustainability practices, and in this case, the pandemic was a natural cause that resulted in an improvement of this value. The number of employees shows less fluctuation compared to the previous variable, but here the pandemic acts as a negative factor, since it forced the dismissal of many employees, and since 2019 the number has been decreasing. Diversity on the board of directors is fairly homogeneous, with little fluctuation for both male and female members.

These data have important implications for analyzing the relationship between ESG practices and financial performance. The large fluctuation in carbon footprint and the relative homogeneity in board diversity suggest that environmental practices have a more diverse impact on financial performance, while gender diversity practices are more uniformly implemented and may have less differentiated effects.

From the following overview of the multiple linear regression model, various conclusions can be drawn about the relationship between the dependent and independent variables.

Table 5. Adjustment of the multiple linear regression model

```
Call:
lm(formula = revenue_growth ~ carbon_footprint + employee_diversity +
    board_diversityM + board_diversityF, data = bank_data)
```

Residuals					
1	2	3	4	5	6
0.007888	(-0.012157)	0.001810	0.002459	0.051593	(-0.051593)

Coefficients: (1 not defined because of singularities)

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.5223766069	0.5252627892	0.995	0.425
carbon_footprint	0.0000007028	0.0000035353	0.199	0.861
employee_diversity	0.0000456910	0.0000507258	0.901	0.463
board_diversityM	(-0.085446860)	0.0703251293	(-1.215)	0.348
board_diversityF	NA	NA	NA	NA

```
Residual standard error: 0.05264 on 2 degrees of freedom
Multiple R-squared:  0.8573,   Adjusted R-squared:  0.6432
F-statistic: 4.004 on 3 and 2 DF,  p-value: 0.2063
```

None of the independent variables is statistically significant at a significance level of 0.05. So the variables carbon footprint, employee diversity and board diversity do not have a statistically significant association with the dependent variable in this model. But with an R square of 0.8573, it indicates that approximately 85.73% of the variability in revenue growth can be explained by the model's independent variables.

However, this regression shows some limitations, particularly in relation to the difference between the R squared and the adjusted R squared values. This difference is associated to the number of variables, especially if they do not contribute significantly to explaining the dependent variable. Multicollinearity is also a factor that influences these values: the presence of high correlation between variables can lead to a higher R squared and a lower adjusted R squared. This may also indicate that the model is overfitted, which means that it is well adjusted to the sample data but may not generalize to other data.

We can see that carbon footprint has a p-value of 0.861, employee diversity has a p-value of 0.463, and board diversity has a p-value of 0.348. In all cases the p-value is > 0.05, so it's possible to conclude that the hypotheses created at the start of the process are not rejected.

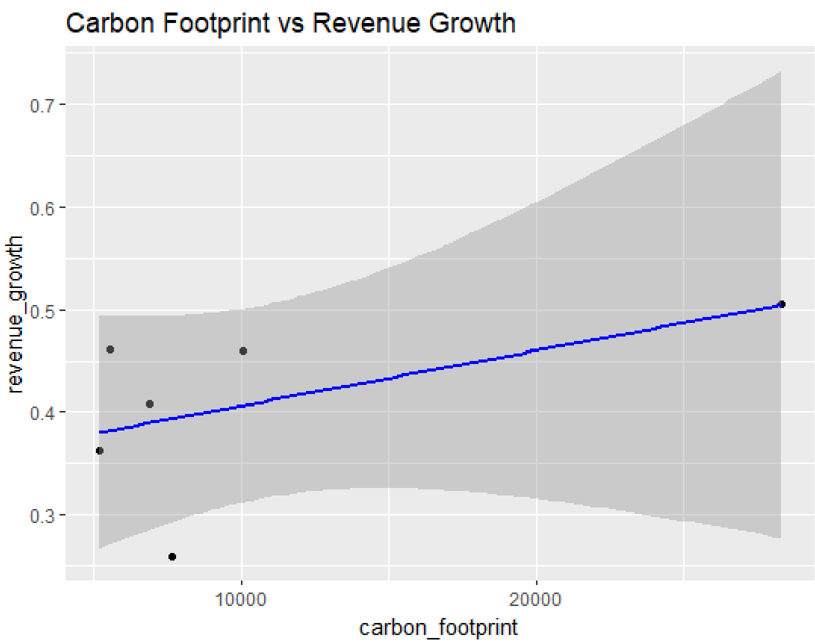

Figure 6. Scatter plot between carbon footprint and revenue growth

The dispersion graph above represents the relationship between the carbon footprint (carbon_footprint) and revenue growth (revenue_growth). The blue line represents the regression line, which shows the average trend of the relationship between the two variables, while the grey shaded area represents the confidence interval around this line.

We can see that there is a positive trend as the blue line has a positive slope. This means that an increase in carbon footprint increases revenue growth, which can be contradictory. But let's analyze: nowadays the costs of making everything more sustainable are still quite high, and if there weren't so many restrictions on banks being more sustainable, they would be able to generate much more financial revenue by increasing their carbon footprint.

The positive relationship between carbon footprint and revenue growth suggests that institutions with higher carbon footprints also tend to have higher revenue growth. However, the large variability and broad confidence interval indicate that this relationship is not strong and there are other factors at play that also influence revenue growth. This trend may reflect the fact that larger institutions, which generally have larger carbon footprints due to their size and operations, also have greater capacity for revenue growth. However, this analysis also highlights the need for more effective sustainability policies, since higher revenue growth associated with larger carbon footprints is not be sustainable.

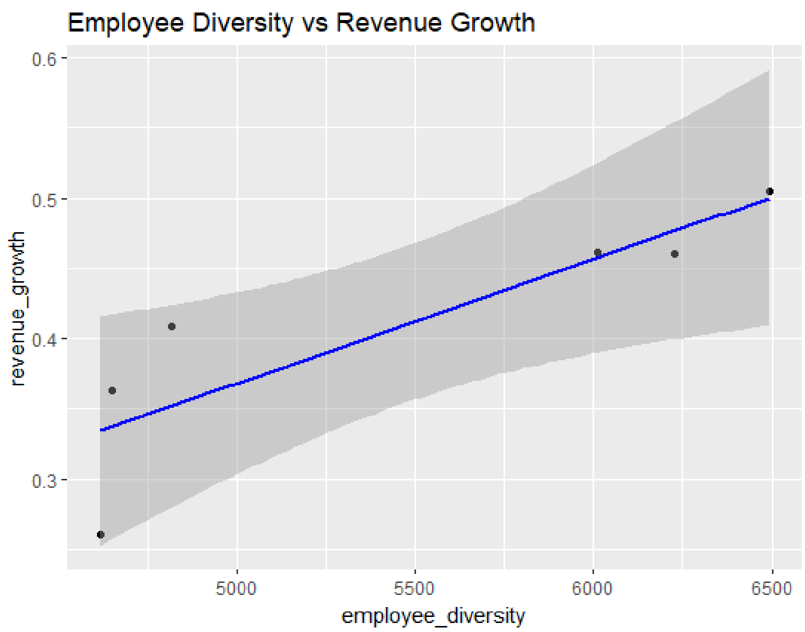

Figure 7. Scatter plot between employee diversity and revenue growth

In this case, there is also a positive trend, since for the same reason the blue line has a positive slope. This suggest that as the number of employees increases, revenue tends to increase as well. Employee diversity can bring a number of benefits, including varied perspectives, innovation and a better understanding of different markets. These factors can contribute to revenue growth, as suggested by the positive trend seen in the graph.

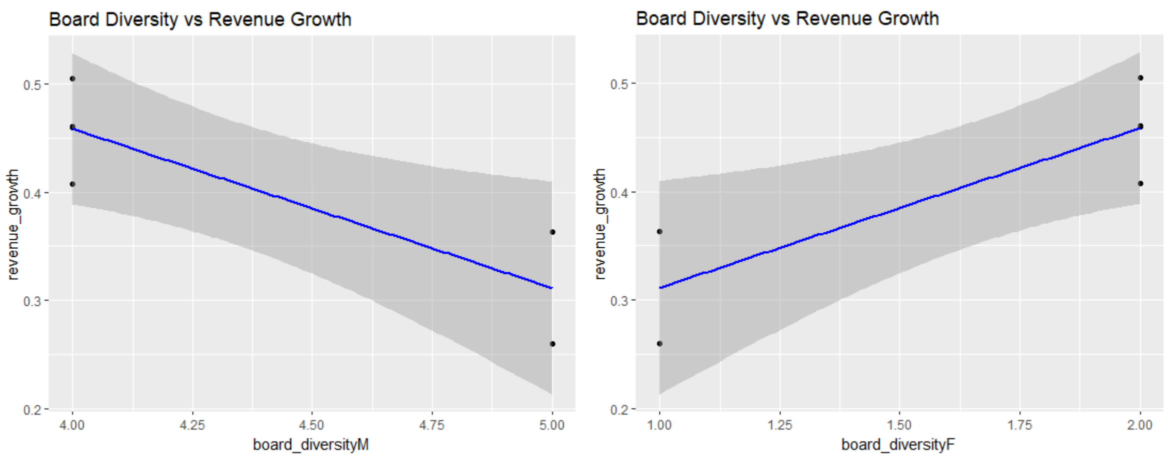

Figure 8. Scatter plot between board diversity and revenue growth

In the case of board diversity there are two relevant opposite findings. In the board diversityM graph, the blue regression line has a negative slope, that there is an inverse relationship between male diversity on the board of directors and revenue growth. This indicates that as the proportion of men on the board increases, revenue growth tends to decrease.

The board diversityF graph, on the other hand, has a positive slope, that there is a direct relationship between female diversity on the board of directors and revenue growth. This indicates that as the proportion of women on the board increases, revenue growth tends to increase.

Banking institutions can consider promoting greater gender diversity on the board of directors as a strategy to boost revenue growth. This could include inclusive recruitment policies for senior leadership positions and development programs to ensure a diverse and equitable board.

5. CONCLUSIONS AND FUTURE WORKS

The analysis conducted throughout this study was designed to assess the influence of variables related to sustainability and ESG (Environmental, Social, and Governance) on the financial performance of banking institutions. Using a linear regression model, we examined the relationship between revenue growth and specific variables.

The analysis revealed that carbon footprint has a positive relationship with revenue growth, mainly due to freedom in decision making. With no restrictions or targets, it becomes more easier to generate revenue (increase), thus also causing an increase in the carbon footprint. Although not a statistically significant relationship, this indicates that, within the period and sample analyzed, carbon reduction initiatives did not have an immediately visible impact on revenue growth, but may reflect more sustainable business practices that appeal to certain market segments.

Employee diversity showed a positive and more robust relationship with revenue growth. Institutions with a greater diversity of employees tend to have higher revenue growth rates.

Male diversity on the board of directors showed a negative relationship with revenue growth. This result can be interpreted as an indication that the simple presence of male gender diversity on the board, without an adequate balance, may not be enough to promote better financial results.

On the other hand, female diversity on the board showed a positive relationship with revenue growth. This finding suggests that the inclusion of more women in leadership positions on the board may be associated with more effective strategic decisions and better financial performance, possibly because of the diverse perspectives and differentiated skills that contribute to a more balanced decision-making environment.

The results of this study highlight the importance of ESG practices, particularly gender and employee diversity, as potentially beneficial factors for the financial performance of banking institutions.

Santander and other financial institutions must continue to promote diversity at all organizational levels, especially on the board of directors, in order to take advantage of the potential benefits associated with financial performance. Although the carbon footprint has not shown a significant impact in the short term, responsible environmental practices are crucial for long-term sustainability and institutional reputation. Implementing inclusive policies and creating a diverse work environment can be effective strategies for driving innovation and revenue growth.

In conclusion, this study provides preliminary evidence on the importance of ESG practices, highlighting diversity in the workplace and on the board of directors as key factors that can contribute to better financial performance in banking institutions. The continued promotion of these practices will be fundamental to the sustainable development and long-term success of the financial sector

We can also conclude that there is still a long way to go before banking institutions, in particular, are at the desired level of sustainability. The major difficulty remains the high cost that these changes will generate, requiring an initial investment something that requires a good structure and good planning.

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APPENDIX

Certifica-se que o
Projecto N.º: **INFSYS2024-6-139922**
Título do Projecto: **Gestão de Risco Ambiental e Sustentabilidade No Sector Bancário**
Investigador Principal: **Rui Prata** de acordo com os regulamentos da Comissão de Ética da NOVA IMS e Centro de Investigação MagIC este projecto foi considerado atender às exigências do Conselho de Revisão Interna da NOVA IMS, sendo considerado **APROVADO** em 13/06/2024. É da responsabilidade do Investigador Principal garantir que todos os investigadores e partes interessadas associadas a este projeto tenham conhecimento das condições de aprovação e quais os documentos que foram aprovados. O Pesquisador Principal é obrigado a notificar o Comitê de Ética, por meio de alteração ou relatório de progresso, sobre - Qualquer alteração significativa no projeto e o motivo dessa alteração; - Quaisquer acontecimentos imprevistos ou acontecimentos inesperados que mereçam notificação; - A incapacidade do Pesquisador Principal de continuar nessa função ou qualquer outra mudança no pessoal de pesquisa envolvido no projeto. Lisboa, 13/06/2024 Comissão de Ética da NOVA IMS éticacommittee@novaims.unl.pt

ANNEXES (OPTIONAL)

E **Apoiar a transição para uma economia baixa em carbono**	→ Publicamos o Sistema de Classificação de Financiamento Sustentável (SFCS), um documento que define os critérios para um financiamento ser considerado sustentável, inspirado pela Taxonomia Europeia e outros padrões internacionais. → Criamos soluções de financiamento ambientalmente responsável para os nossos clientes. Foram atribuídos 200 milhões de euros em papel comercial no modelo de *Sustainability-Linked Loans*, com condições de financiamento variáveis de acordo com a performance ESG da empresa. → Lideramos uma operação de 122 milhões de euros com a MedWay ROSCO onde foi financiada a aquisição de 16 locomotivas elétricas e 113 vagões intermodais. → Participamos ainda em emissões obrigacionistas verdes num montante superior a 900 milhões de euros. → Aprofundamos a integração de riscos ambientais, sociais e climáticos na nossa gestão diária. Alargamos o universo de empresas, assim como o perímetro de novas operações sujeitas a avaliação de riscos ESCC (*Environmental, Social and Climate Change*). → Implementamos novas Políticas de Riscos Ambientais & Climáticos e iniciámos a formação das equipas de analistas de riscos de crédito nestas temáticas
S **Promover o crescimento inclusivo**	→ Reforçamos largamente a nossa capacidade de impacto na Sociedade através da criação da Fundação Santander Portugal com a missão de transformar a vida das pessoas e das empresas. → Ficamos posicionados em 2º lugar no ranking nacional de NPS – *Net Promoter Score*. → Apoiamos as populações vítimas da guerra na Ucrânia, através da recolha de avião e acolhimento de 178 refugiados de guerra e do lançamento de 500 bolsas de português gratuitas para ucranianos, assim como adaptação e simplificação de processos de admissão no Banco para ucranianos e isenção de comissões de conta básica e em transferências internacionais → Criamos também um fundo que recebeu os contributos de mais de 1.340 colaboradores. O Santander duplicou o valor angariado na campanha, alcançando um total de 68 mil euros que foram entregues à Cruz Vermelha Portuguesa para apoiar os esforços humanitários na Ucrânia.
G **Governo e cultura fortes em toda a organização**	→ Revimos os nossos comportamentos corporativos e criamos os comportamentos T.E.A.M.S., mantendo-se inalterado o nosso propósito – ajudar as pessoas e as empresas a prosperar. A nossa visão: ser a maior plataforma aberta de serviços financeiros e os nossos valores – Simples | Próximo | Justo. → O nosso programa de emprego de pessoas com necessidades especificas foi reconhecido este ano com Prémio *Gold* na categoria Iniciativas dos prémios D&I Awards do Santander. → O Banco foi certificado como Great Place to Work, mantendo também o estatuto "efrA" – Excelência como Empresa Familiarmente Responsável, atribuído pela associação Mais Família em 2020 → Incluímos critérios ESG nos incentivos de longo-prazo e nos esquemas de remuneração a curto-prazo. → Lançamos novas formações ESG, para aumentar a consciência e conhecimento sobre o tema na organização. Em 2022, 97% dos colaboradores realizaram pelo menos uma formação de Introdução à Sustentabilidade.

Figure 9. Descripton of the ESG measures implemented by Santander

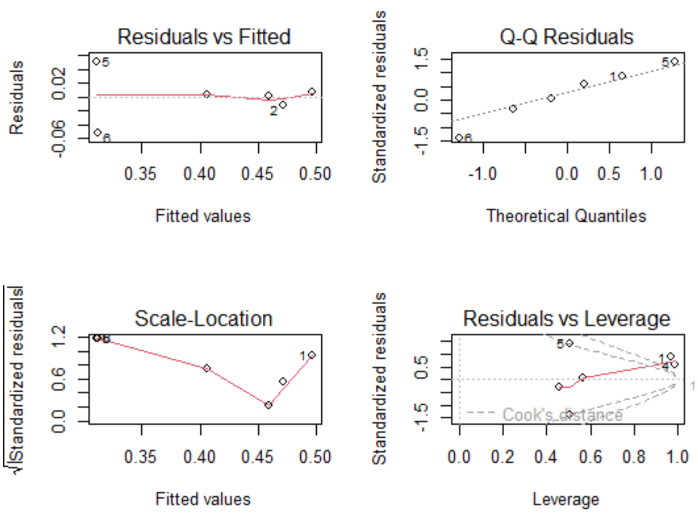
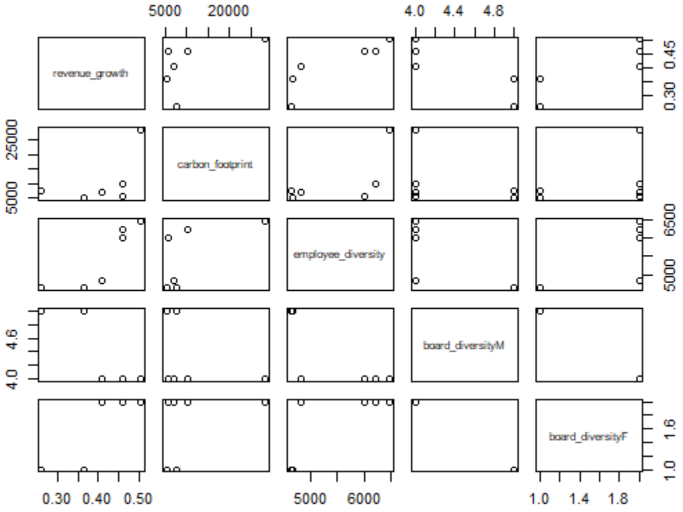


Figure 10. Graphics of residuals



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