

**Impact of Incorporating Corporate Sustainability into the Credit Risk  
Assessment of Nigerian Banks**

by

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A thesis

presented to the University of Waterloo

in fulfillment of the

thesis requirement for the degree of

Master of Environmental Studies

in

Sustainability Management

Waterloo, Ontario, Canada, 2024

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## **Author's Declaration**

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

## **Abstract**

Nigeria, a developing country with the largest economy in Africa, has a significant sustainable development (SDG) funding gap, and the banking sector has been identified as a collaborator in closing this gap through asset allocation to sustainable business. Banks' primary concern in their asset allocation is credit risk reduction. However, there have been no studies in Nigeria to ascertain if allocating loans to more sustainable businesses can improve their credit risk prediction. To address this gap, this quantitative thesis sought to assess the cause-effect relationship between sustainability performance and credit risk. Employing the Good Management Theory, the impact of integrating sustainability performance with conventional criteria of Nigerian corporate borrowing clients on borrowers' default risk and banks' credit risk prediction was evaluated. Using a cross-sectional survey design, the study found that integrating sustainability assessment increases the prognostic validity of credit risk prediction by 3.7%, and improved sustainability performance was associated with reduced borrowers' default risk. The study found that the social sustainability subfactor had the most significant impact on credit risk prediction, while the borrowing client's firm sector was found to increase the prediction accuracy. Overall, the study findings agree with the Good Management Theory. The study contributes significantly to the academic literature on the impact of sustainability performance on credit risk in Africa, identified the most significant sustainability indicators, the effect of

the firm's corporate lifecycle, and designed a new survey instrument suitable to measure sustainability performance in Africa.

**Keywords:** Good Management Theory, Sustainability, Credit Risk, Conventional Risk Criteria, Nigeria

## **Acknowledgments**

By the Grace of God, this dream has become a reality.

My deepest gratitude goes to my supervisor, Professor Olaf Weber, for his unwavering dedication, support, and guidance throughout this journey. Your exceptional leadership has been invaluable. I also want to sincerely thank my co-supervisor, Professor Rosella Care, for her support and prompt responses to my inquiries during the thesis writing process.

To my committee member, Professor Jason Thistlethwaite, and reader, Zachary Folger-Laronde, thank you for your timely support, constructive criticism, and invaluable feedback that helped me improve my thesis. A special thanks go to the SEED graduate program administrator, Anastasiya Saparaliyeva. Your supportiveness, resourcefulness, and constant availability have been amazing.

Finally, to my incredible husband, Ola, thank you for always cheering me on to succeed. To my daughters, thank you for your unwavering support and understanding. My appreciation also extends to my parents and siblings for always believing in me.

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## **Chapter 1: Introduction**

### **1.1 Background and Context**

Interest in achieving the Sustainable Development Goals (SDGs) has grown; however, emerging economies are not progressing as quickly as developed economies (Colenbrander et al., 2023). The African Continent has a significant SDG achievement gap among emerging economies, and inadequate funding has been identified as a substantial obstacle to attaining SDGs in Africa (SDG Center for Africa, 2019). Nigeria, Africa's largest economy and the most populous country, faces significant challenges in achieving SDGs (African Development Bank, 2024). The Nigerian Sustainable Banking Principles, which provide a guideline for integrating sustainability into financial institutions' lending decisions, was published in 2012 to promote sustainable bank lending (CBN, 2012). However, the annual SDG funding gap for Nigeria was still projected to be the US(\$) 10 billion pre-COVID-19 pandemic and this has further increased post-COVID-19 due to reduced capital inflows, although the private sector, such as commercial banks, could aid the closure of the SDG funding gap (Integrated National Financing Framework, 2022). UNEP-FI (2022) suggests that integrating sustainability issues into financing decisions in the private sector can help close the SDG funding gap in emerging economies. Despite the SDG funding gap, there is a weak adaptation in assessing corporate sustainability

performance as an integral part of bank lending decision criteria in the African continent (Choruma, 2019).

The banking industry has been identified as essential in driving sustainable corporate behavior by incentivizing organizations to imbibe sustainable practices or penalizing unsustainable organizations through loan terms (Weber & Feltmate, 2016). In addition to analyzing firms' creditworthiness through conventional risk assessment methods, some banks have recognized the significance of accounting for the sustainability risk of borrowers in their credit risk assessment model, and they have voluntarily committed to abide by the United Nations Environment Program for Financial Institutions (UNEP FI) framework; a framework designed to guide banks to integrate environmental, social, and governance issues into their investment decisions to aid sustainable development (UNEP, 2019). There are several motivations for banks' commitment to assessing the environmental risk of borrowers, including the prevention of reputational risks that might arise from funding environmentally harmful projects, the impact of environmental risk on the value of loan collaterals (Basah & Yusuf, 2013; McKenzie & Wolfe, 2004), the increased customer preference for sustainable banks, and regulatory requirements (Kulkarni, 2010). The most significant reason banks incorporate sustainability assessment in their lending decisions is the potential increase in their credit risk due to borrowers' sustainability risk (Weber & Feltmate, 2016). Aside from the financial motivations for environmental sustainability assessment in banks, Mccammon (1995) suggests that banks should seek to contribute towards

sustainable development. Elkington (1998) defines sustainable firms as organizations with a sustainable business model based on ethical models that ensure appropriate human, natural, and social capital management in its operations and supply chain. According to Bansal (2005), corporate sustainability performance (CSP) entails the integration of economic, environmental, and social sustainability considerations into organizations' business practices.

## **1.2 Rationale**

The impact of environmental performance, defined as carbon emissions on an organization's financial risk, has been extensively studied, and these studies' findings revealed that good environmental performance reduces credit risk (Gu et al., 2023; Höck et al., 2020; Hrazdil et al., 2023; Zhang et al., 2023; Zhang & Zhao, 2022). Beyond environmental consideration, there has been research to ascertain the impact of environmental, economic, and social sustainability performance on credit risk (Abdul Razak et al., 2020, 2023; Bannier et al., 2022; Dorfleitner et al., 2020; Srivisal et al., 2021; Weber et al., 2010, 2015; Yang & Hu, 2023). However, there have been mixed findings in these studies. Some studies have found that high corporate sustainability performance reduces credit risk (Caiazza et al., 2023; Chodnicka-Jaworska, 2021; Kim & Li, 2021; Weber et al., 2010, 2015). Conversely, others, such as Veltri et al. (2023), have found that corporate sustainability performance does not influence credit risk, while Kanno et al. (2023) found that it increases credit risk.

Interestingly, other studies suggest that there could be variations in the direction of the relationship between corporate sustainability performance and credit risk depending on the level of countries' commitment to sustainability practices, and the relationship varies between developed and developing economies (Srivisal et al., 2021). Studies have been conducted on developing economies, but they have primarily focused on emerging economies in Asia (Li et al., 2022; Srivisal et al., 2021; Wang & Yang, 2023; Weber et al., 2015); despite all African countries being developing nations (King & Ramlogan-Dobson, 2015), they have not received the same research attention. However, African banks have not embedded sustainability as an integral part of their lending decisions (Choruma, 2019). There has been no research on this subject in Nigeria, even though, according to the Integrated National Financing Framework (2022), the country has a significant SDG funding gap. The slow progress on SDGs increases businesses' sustainability risks (Alijoyo, 2022), leading to increased credit risk (Weber & Feltmate, 2016). The variations in the direction of this relationship between sustainability performance and credit risk, the lack of research in Nigeria, and the weak adaptation of corporate sustainability in bank lending decisions suggest further research focused on the country. Also, previous research in emerging economies aside from Weber et al. (2015) used secondary data to assess this relationship, mostly excluding unlisted firms and assessing sustainability focusing on credit rating agencies data (Jeon, 2021; Kim & Li, 2021; Srivisal et al., 2021); they did not determine how the corporate sustainability performance of bank

borrowers could influence their credit risk. However, one question that needs to be asked is how the corporate sustainability performance of borrowing clients impacts Nigerian banks' credit risk prediction.

The research on the impact of sustainability performance has also found that variations exist between the effect of corporate sustainability performance and credit risk across the sustainability subfactors: economic, environmental, social, and governance (Caiazza et al., 2023; Dorfleitner et al., 2020; Drago et al., 2019; Jeon, 2021; Srivisal et al., 2021). An interesting finding is that of Srivisal et al. (2021), which states that while performance on some sustainability subfactors could reduce credit risk, higher performance on other sustainability sub-factors in the same country could increase credit risk. However, Dorfleitner et al. (2020) observed that although higher sustainability performance reduced credit risk, the level of impact varied across the sustainability subfactors: economic, social, and environmental. It would be essential to ascertain how the performance of borrowing clients on each of the sustainability subfactors influences the credit risk prediction of Nigerian banks. This knowledge is essential because it will help banks understand Nigerian firms' most credit-relevant sustainability subfactor.

The next section of this chapter will describe how this thesis will address the gap in the literature.

### **1.3 Statement and Purpose**

This thesis aims to conduct a quantitative investigation testing the Good Management Theory by Waddock and Graves (1997), which proposes that well-managed firms will have better sustainability performance and be rewarded with lower financial risk to ascertain if there is a cause-and-effect relationship between sustainability performance and loan performance of corporate borrowing clients of Nigerian banks. The sustainability subfactors under investigation are economic sustainability, environmental sustainability, and social sustainability. Presently, literature has focused on using secondary data, mostly excluding unlisted firms (Jeon, 2021), while for those that used primary data, (Weber et al., 2015) their population and sample did not include Nigerian banks borrowing clients. Additionally, this study is cross-sectional because the loan performance, sustainability performance, and conventional credit assessment criteria of Nigerian banks' borrowing clients will be measured at a single point in time in a post hoc view when the loan outcomes are already known. This study employs a survey instrument to measure the performance of Nigerian banks' corporate borrowing clients on both sustainability and conventional credit risk assessment criteria. The conventional credit risk criteria are based on banks' credit policy guides. The economic, social, and environmental sustainability indicators were obtained from Mengistu and Panizzolo's (2021) study and adapted to the Nigerian business environment. The sample borrowing clients for this study will be selected from five (5) Nigerian



banks that remain anonymous based on a stratified random sampling approach. The bank's credit officers were requested to classify their most recent corporate borrowing clients whose loan outcomes are already known, and data is available to measure their sustainability performance into default and non-default groups. They were also asked to randomly select the borrowers to rate from those who meet these criteria using the survey instrument. Thus, this study uses the descriptive component to understand the distribution of the data collected and the binary logistic regression model for the hypothesis testing component to answer the research questions.

The next section of this chapter will discuss this thesis's theory and practice contributions.

#### **1.4 Significance of the Study**

This thesis presents an original contribution to sustainable finance literature by investigating the relationship between sustainability performance and the credit risk of Nigerian banks' corporate borrowing clients, using Waddock and Graves' (1997) Good Management Theory. This thesis tests the cause-effect relationship between sustainability performance and credit risk. The first contribution of this thesis is the test of the relationship between sustainability performance and credit risk of bank corporate borrowers in Nigeria. No study has focused on testing this relationship in Nigeria, although Oladele et al. (2021)

found that sustainability performance improved the return of assets of Nigerian manufacturing firms. Literature on this relationship in emerging economies has been focused on Asian countries (Li et al., 2022; Wang & Yang, 2023; Weber et al., 2015). Also, the study will assess the relationship using primary data and provide a survey instrument that can be used to evaluate the sustainability and conventional credit risk assessment of Nigerian and African businesses using primary data. Previously, studies in developing economies have focused on using secondary data except for Weber et al. (2015). Understanding this relationship in a different country, Nigeria, is important because previous studies have found that the relationship between corporate sustainability performance and credit risk can differ across economies and countries (Abdul Razak et al., 2020; Srivisal et al., 2021).

From the practice standpoint, this thesis will provide an understanding of the value of including sustainability performance evaluation with conventional credit assessment criteria when evaluating the credit risk of borrowers. This could improve the credit rating process of Nigerian banks, and integrating sustainability criteria into their loan evaluation could aid in closing the SDG finance gap. Nigerian businesses could also understand the impact of their sustainability performance on their credit risk and which of the sustainability subfactors has the most significant effect on this relationship. The knowledge of the sustainability subfactors could help businesses ascertain which areas they need to improve.

Overall, this thesis aims to contribute to practice and theory by testing the impact of sustainability performance on credit risk using the Good Management Theory in a different context.

### **1.5 Research Questions**

This thesis aims to answer the following questions and test the following hypotheses:

- Does integrating the sustainability performance of corporate borrowing clients with conventional rating criteria into the credit risk assessment procedure improve the validity of credit risk prediction in Nigerian Banks?
- What sustainability performance indicator of Nigerian banks' corporate borrowing clients significantly impacts credit risk prediction?
- How do loan size, firm size, firm sector, and firm's bank impact the relationship between sustainability performance, conventional credit assessment criteria, and credit risk prediction?

To answer the research questions and based on existing literature, this study tests the following hypothesis:

Hypothesis 1 (H1): Incorporating sustainability assessments alongside conventional credit risk evaluation criteria will improve Nigerian banks'

accuracy in predicting default risk, as corporate borrowers with stronger sustainability performance will exhibit lower default risk.

Hypothesis 2 (H2): Among the various sustainability indicators, environmental sustainability performance will significantly reduce borrowing clients' credit risk and improve the accuracy of default risk prediction for Nigerian banks.

Hypothesis 3 (H3): Nigerian banks' corporate borrowing clients' loan size impacts the relationship between sustainability performance and credit risk and improves the predictability of default risk.

Hypothesis 4 (H4): Nigerian banks' corporate borrowing client's firm size impacts the relationship between sustainability performance and credit risk and improves the predictability of default risk.

Hypothesis 5 (H5): Nigerian banks' corporate borrowing client's firm sector impacts the relationship between sustainability performance and credit risk and improves the predictability of default risk.

Hypothesis 6 (H6): Nigerian corporate borrowing client's bank impacts the relationship between sustainability performance and credit risk and improves the predictability of default risk.

This study is grounded in the Good Management Theory, which uses sustainability performance to predict a reduction in financial risk, such as credit risk.

## **1.6 Assumptions**

The design of this thesis makes two assumptions. First, it assumes credit officers can rate corporate borrowing clients' sustainability and credit performance. This assumption was made based on similar research (Weber et al., 2010, 2015) because credit officers obtain and evaluate relevant information on intending borrowers prior to loan approval. Second, based on previous research, this study assumes that credit officers have adequate information to rate the sustainability performance of corporate borrowing clients and would not give misleading information.

## **1.7 Chapter Summary**

This section of the thesis has provided the background, context, significance of the literature gap, and intended contributions of this study. The following chapters begin with bibliometric reviews of relevant academic literature. Then, the theoretical framework of this study is presented. Afterwards, the research design of this quantitative study is presented. The statistical results are stated. The thesis reports are discussed with the Good Management Theory. Finally, the conclusion summarizes the study's approach, contributions, and recommendations to practice and theory.

## **Chapter 2: Literature Review**

### **2.1 Bibliometric Analysis**

The bibliometric analysis methods used for the literature section of this thesis are the performance analysis and science mapping approach, as Cobo et al. (2011) suggested. Zupic and Čater (2015) suggest that performance analysis could be used to answer questions about the number of publications, publications per country, and most contributing authors, providing a comprehensive overview of the research landscape. They also recommend science mapping techniques such as co-word analysis to help understand authors' focus in a research field over the years, shedding light on the evolving trends and themes in the field. In line with this recommendation, the literature review section of this thesis used performance analysis to ascertain the number of publications in the credit risk and sustainability field, publications per country, and most contributing authors. A science mapping was also conducted using the author's keywords to ascertain the context and focus of the research, offering a deeper understanding of the research context.

The articles used for the bibliometric analysis were obtained from a comprehensive search of the Scopus database conducted in November 2023 because it is robust and often used in previous bibliometric analyses (Alshater

et al., 2021; Baker et al., 2020; Carè et al., 2023). Like Carè et al. (2023), the search terms were broad to ensure it captured all relevant literature based on the search words that appeared in Titles, Abstract, and Keywords, as detailed in table 1. The search was filtered to only journal articles written in English, as Migliavacca et al. (2022) suggested, because it is the widely accepted language for academic research, and no time filters were applied, like Carè et al. (2023) to ensure all relevant literature are included. A total of 1913 articles written in English were generated. A meticulous review of the title, abstract, and article keywords was conducted to identify the articles that did not relate to credit risk and sustainability, as suggested by Bhatnagar and Sharma (2022). After eliminating irrelevant articles, 165 relevant articles were identified, and the bibliometric analysis was conducted based on these articles. The performance analysis and science mapping results are detailed in the following sections.

The first section of the bibliometric analysis presents a performance analysis showing how the field has evolved, including the total publications per year, top contributing countries, and authors. Next, science mapping is done using the Vosviewer application, and a detailed analysis of the focus and findings of articles in each cluster is presented. Overall, 6 clusters were identified from existing literature. The studies in the first cluster explore the role of banks and green credit policy in promoting environmental sustainability. Cluster 2 examines the relationship between environmental performance and credit risk. The third cluster investigates how sustainability performance impacts credit

risk. Cluster 4 discusses the impact of country-level sustainability on the relationship of sustainability performance and corporate social responsibility (CSR) with credit risk. The fifth cluster examines the environmental credit risk management practices in banks. Cluster 6, the final cluster, investigates how COVID-19 impacts the ESG-credit risk relationship and machine learning techniques for credit risk assessment. The chapter concludes with a summary of literature review gaps and future research direction.

*Table 1: Search Protocol*

<b>Task</b>	<b>Description</b>
Type of document	The search was limited to only peer-reviewed academic journal articles excluding review papers
Language	Only articles published in English language
Time span	No restrictions
Subject areas	No restrictions
Query description	TITLE-ABS-KEY (( credit AND risk* ) AND TITLE-ABS-KEY ( sustainab* ) OR TITLE-ABS-KEY ( environment* ) ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( LANGUAGE , "english" ) )
Exclusion criteria	Incoherence with credit risk, sustainability performance, and sustainability disclosure

## **2.2 Performance Analysis**

This section presents and discusses the results in three categories- publications and citations per year, publications per country, and top contributing authors.



### 2.2.1 Total publications and citations per year

Fig 1 below shows that research in this area started in 1989. However, there were only a few studies in the field until 2021, when the number of articles on this subject increased significantly. From 2021 to 2023, there has been a steady increase in studies on this subject.

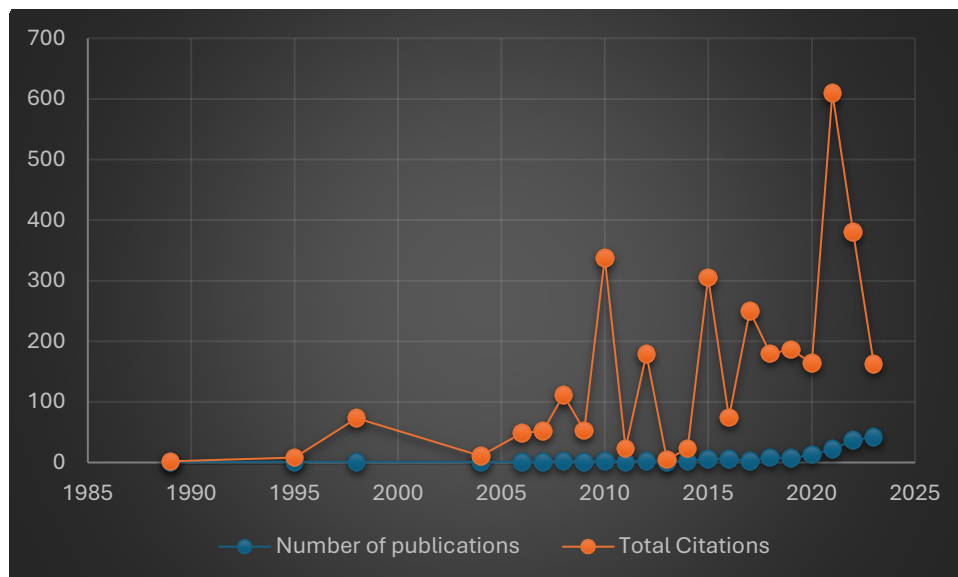


Figure 1: Total Publications and Citations per Year

### 2.2.2 Total publications per country

The results in Fig 2 below show the author's country of affiliation at the time of publication for countries with publications from four or more affiliated authors. It reveals a significant increase in publications by authors affiliated with

institutions in emerging economies, with most studies focused on Asian countries such as China, India, South Korea, and Taiwan.

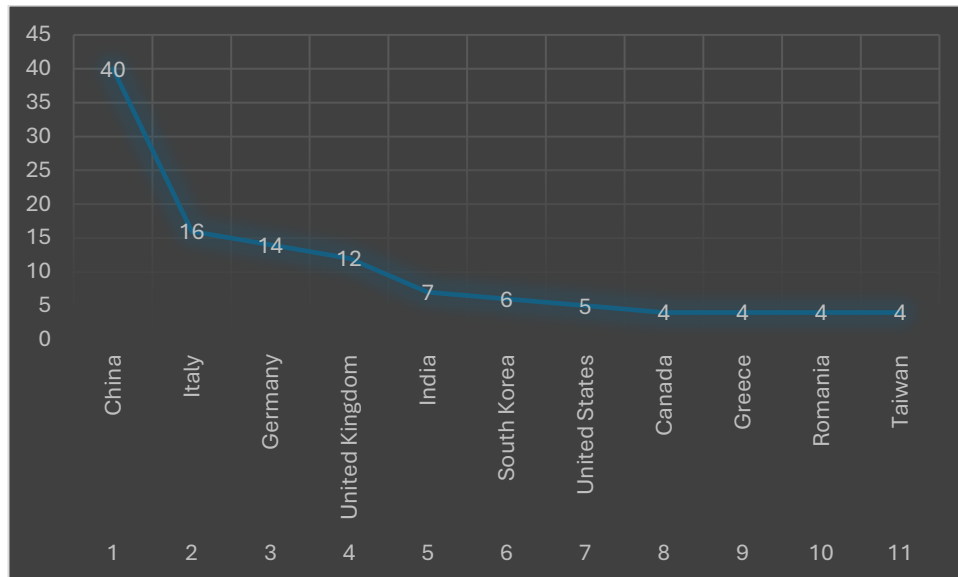


Figure 2: Total Publications per Country

### 2.2.3 Most Contributing Authors

Table 2 below presents the most prolific authors in this research field with the most publications. Weber is the most contributing author, with 439 citations. The studies by this author have focused on environmental credit risk management and examining the impact of integrating sustainability into credit risk assessment.

Table 2: Most Contributing Authors

S/N	Author	Total publication	Total citation	Affiliation	Country	Research area
1	Weber O.	4	439	Schulich School of Business, York University, University of Waterloo, Waterloo, ON	Canada	Environmental credit risk management in financial institutions, integrating sustainability into credit risk management
2	Chodnicka-Jaworska P.	2	21	University of Warsaw,	Poland	ESG and credit ratings
3	Abdul Razak L.	2	15	UBD School of Business and Economics (UBDSBE),	Brunei	ESG and Credit default swaps

### 2.3 Science Mapping

The results of the co-word analysis of the author's keywords in this research field are presented in a graphical visualization below. Co-word analysis of keywords can be used to understand and find the relationship between keywords in the same research field, with a closer appearance of the keywords representing stronger relationships (An & Wu, 2011). The clustering analysis of the author's keywords was carried out using Vosviewer software, similar to Carè et al. (2023) and Castriotta et al. (2021). The Vosviewer software was developed by Van Eck et al. (2006), which groups closely related keywords into different clusters; the lines represent the relationship between the keywords, while the size of the keyword node represents how prominently they are in the research field. This study chose the keywords with three or more occurrences, as suggested by Paltrinieri et al. (2023). The standardization procedure included

extracting keywords from articles with missing authors' keywords, synchronizing similar keywords, consolidating singular and plurals, converting abbreviations, and removing irrelevant keywords similar to Carè et al. (2023) and Castriotta et al. (2021) studies. The detailed keyword standardization procedure is presented in Appendix A. The most occurring keyword is credit risk, as shown in Figure 3 below; Appendix B shows the overlay visualization of how the research keywords have changed over time, revealing that most recent research has focused on assessing the impact of country-level sustainability and carbon risk. The cluster analysis from the science mapping of keywords is presented in the following section.

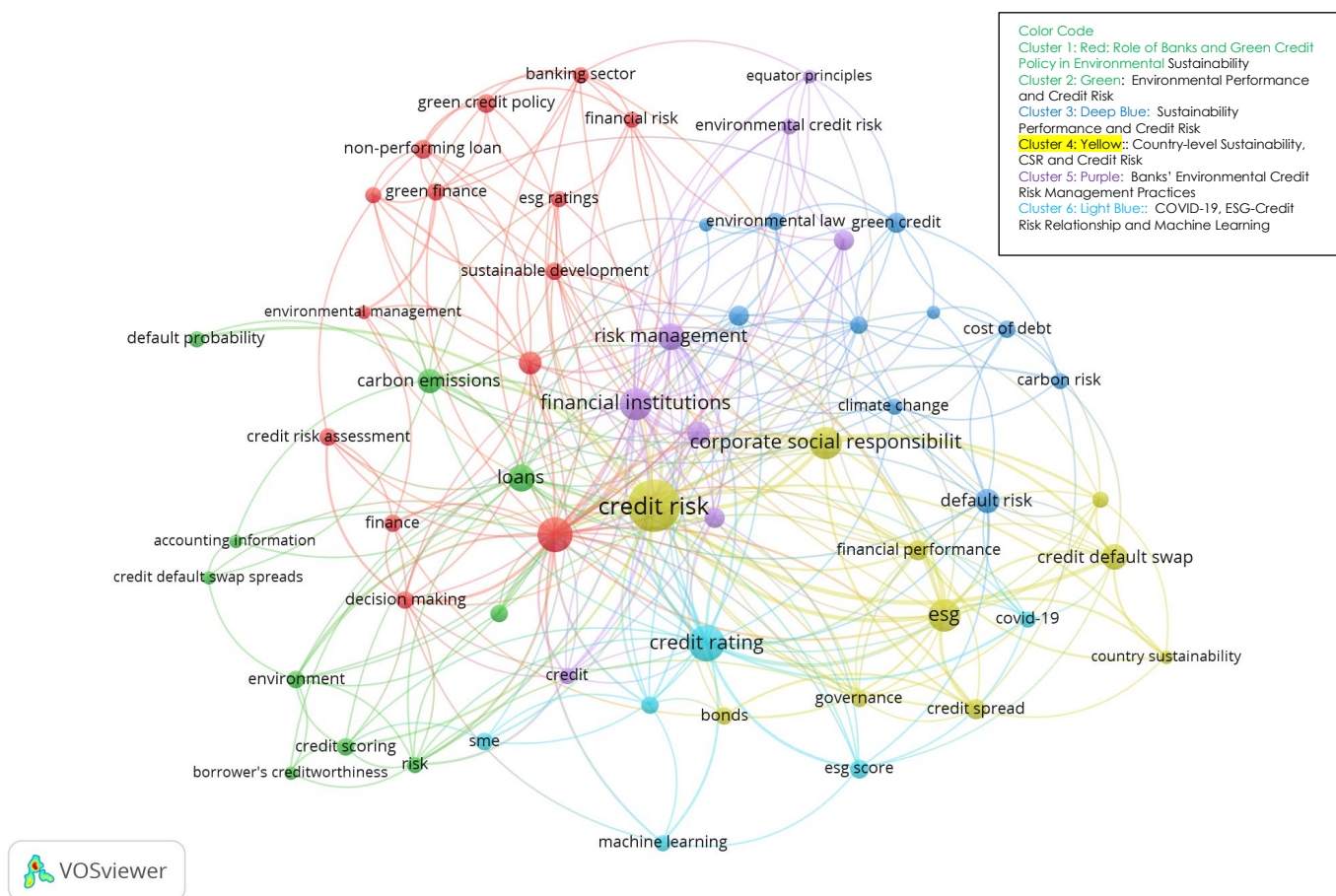


Figure 3: Keyword Map

## **2.4 Cluster Analysis**

The Vosviewer application grouped the academic literature in this field into six clusters; a summary of this is presented in Appendix C. The conceptual analysis of the articles in each cluster is detailed in this section.

### **2.4.1 Cluster 1: Red: Role of Banks and Green Credit Policy in Environmental Sustainability**

The financial sector plays a crucial role in promoting environmental sustainability (Bennett, 2022). This cluster examines the complex relationship between banks, green credit policy, and environmental sustainability. Some studies explore how banks' lending practices can impact the environment (Coulson, 2009; Samour et al., 2022) and how environmental considerations influence bank profitability and risk (Al-Qudah et al., 2022; Anagnostopoulos et al., 2018; Choi et al., 2023; Guan et al., 2017). Additionally, other research investigates the effectiveness of green credit policies in driving sustainable practices (Shao et al., 2023; Wang et al., 2023; Xue et al., 2023).

#### **2.4.1.1 Banks and Environmental Impact**

The traditional focus on economic growth in the banking sector can have unintended environmental consequences. For instance, Samour et al. (2022) highlight how the expansion of the South African banking industry, while boosting GDP, has also led to increased investments in non-renewable energy,

contributing to higher carbon emissions, which poses an environmental risk because it increases the occurrence of adverse climate-related events and negatively impacts the environment. This highlights the need for banks to consider environmental risks alongside traditional financial metrics to reduce the adverse environmental impact of their growth. However, banks can also be agents of positive change. Bennett (2022) argues that banks have an essential role in combating climate change by financing climate-friendly companies and projects and integrating environmental considerations into their lending practices to prevent global warming. Banks' lending approach can help incentivize sustainable business practices and promote environmental well-being. In addition to evaluating environmental risk, Coulson (2009) noted that some banks prohibit investment in specific sectors, highlighting that although non-governmental organizations (NGOs) advocate for environmentally responsible practices by banks, market restrictions may hinder collective action by banks.

#### **2.4.1.2 The Challenge of Balancing Risk and Sustainability**

Several studies have explored how environmental performance can impact bank risk. Studies by Županović (2014) and Abel et al. (2023) demonstrate that inadequate credit risk management can lead to bank failures. Additionally, Abel et al. (2023) identified in a study of Zimbabwe banks using the autoregressive distributed lag model on the financial data of the banks obtained from the Reserve Bank and ZimStat that there is a negative correlation between their credit risk and profitability in the short-term and long-

term. Conversely, research suggests lending to environmentally sustainable firms can reduce credit risk and lower banks' non-performing loan ratios (Al-Qudah et al., 2022; Anagnostopoulos et al., 2018; Guan et al., 2017; Umar et al., 2021). Guan et al. (2017) found that Chinese banks that lent to firms with lower carbon emissions had lower nonperforming loan ratios. At the same time, Umar et al. (2021) noted that the credit infection ratio of European banks that lent to low-carbon emitters was lower, which led to a significant increase in the capital adequacy ratio of smaller banks. In the same vein, Su et al. (2022) found that in a study of 290 banks in emerging economies, those with high loan portfolio exposure to high emitters had a higher credit risk and reduced banking spread. A significant gap in this study is that despite the robust sample size, South Africa was the only African country included, even though King and Ramlogan-Dobson (2015) noted that all African countries are developing economies. This indicates that more analysis is needed in African countries. A likely explanation for the reduction in credit risk of environmentally sustainable firms is because of less volatile cashflows due to being less susceptible to rising production costs associated with carbon taxes and stricter environmental regulations (Al-Qudah et al., 2022; Guan et al., 2017; Umar et al., 2021). Additionally, Benjamin (2013) points out that revenue generated from carbon credits can further enhance the financial stability of sustainable firms.

Along the same lines, Mirza et al. (2023) note that Brazil, Russia, India, and Chinese banks that lent to environmentally sustainable small and medium enterprises had lower default risk and higher net interest margins. Shan et al. (2023) and Chen et al. (2023) make a similar point: lending to environmentally

sustainable firms increases the net interest margin and profitability of European and Brazilian, Russian, Indian, Chinese, and South African (BRICS) banks, respectively. However, Chen et al. (2023) did not identify if the higher banking spread was because of an increase in the interest rate charged to renewable energy consumers or producers, which could indicate an increase in credit risk.

Luo et al. (2021) identified a possible explanation for banks' improved profitability due to green credit: Chinese banks that granted green loans improved their core competence because it reduced their reputational risk. Similarly, Su et al. (2023) found that banks can improve their environmental reputation by advancing more green credit because it improves the green innovation of renewable energy firms. Choi et al. (2023) also made a broadly similar point: that a bad environmental reputation reduced deposits and mortgage generation of banks located within US regions highly susceptible to extreme climate change events, and the relationship was more significant in the areas occupied by Democrats. This finding suggests that political inclination and regional climate risk of bank locations might increase the financial risk posed by their environmental reputation and increase banks' motivation to act responsibly.

#### **2.4.1.3 Green Credit Policy and its Effectiveness**

Researchers have also investigated the efficacy of green credit policies in prompting environmental sustainability. Green credit policies are government initiatives that incentivize banks to prioritize environmentally friendly lending



practices (Wang et al., 2023). These policies are crucial as banks, while capable of influencing business behavior, cannot act alone to promote environmental sustainability because their influence is limited to their loan terms; there is a need for regulation that promotes environmental sustainability (Coulson, 2009). Another reason why green credit policy is important was identified by Sunio et al. (2021), who stated that banks might be unwilling to lend to environmentally friendly firms due to default risk. The study found that only government-owned Philippine banks were willing to lend to small and medium-sized renewable energy merchants because of their default risk. Some studies offer encouraging evidence for the effectiveness of green credit policies. For example, Wang et al. (2023) study in China demonstrates a reduction in carbon emissions intensity among high-polluting firms following the implementation of such a policy; there was an annual reduction in the average carbon emissions intensity of high-polluting Chinese firms by 0.267 tons per 10 yuan. This suggests that green credit policies can motivate firms to adopt greener practices to secure access to financing. However, other studies identify the potential drawbacks of green credit policies. Xue et al. (2023) argue that a lack of long-term funding for high-emitting industries can hinder green innovation, even if these firms are trying to reduce emissions. Additionally, the study identified that this could create social problems because the reduced access to funding could lead to job losses in these industries. These findings highlight the need for carefully designed green credit policies that balance environmental goals with social considerations. Shao et al. (2023) identified that institutional quality determines the effectiveness of

green credit policies. They argue that government investments that contradict environmentally friendly policies can significantly weaken the impact of green credit initiatives on emissions reduction. This underscores the importance of government commitment and policy coherence in achieving environmental sustainability.

The evidence presented in this cluster paints a complex picture of the relationship between banks, green credit, and environmental sustainability. While banks can significantly promote sustainable practices, they must balance ecological considerations with financial risk management. Green credit policies can be powerful, but their effectiveness hinges on design, implementation, and supporting institutional frameworks. Collaboration between banks, governments, and businesses is crucial to developing comprehensive strategies that achieve environmental and financial goals.

#### **2.4.2 Cluster 2: Green: Environmental Performance and Credit Risk**

This cluster examines the relationship between environmental performance and credit risk, exploring how a firm's environmental performance influences its borrowing costs and loan terms. Articles in this cluster focus on how firm-level environmental performance influences credit risk (Gu et al., 2023; Zhang & Zhao, 2022; Zhu & Zhao, 2022). The studies found that higher emissions increase credit risk.

### **2.4.2.1 Environmental Performance and Creditworthiness**

Researchers have examined how environmental risk and environmental performance influence the creditworthiness of firms. For example, Dobre and Stoica (2014) examined the impact of assessing environmental risk on the credit score of agricultural firms. The study found that an increase in adverse climate-related events in the firm's environment reduces its credit score. Other studies have examined the impact of firms' environmental performance on their creditworthiness. Kabir et al. (2021), and Kim and Kim (2022) examined the relationship between environmental performance measured as carbon emissions and credit risk. Kabir et al. (2021) observed that higher carbon emission increases credit risk more substantially for firms in high-emitting industries; however, firms with no controversies and high environmental commitment had a less significant impact of carbon emissions on their credit risk. The finding suggests that firms in high-emitting industries can reduce their credit risk by improving their environmental commitment and preventing controversies. However, the study's weakness is that although it focused on global firms, 50% of the data collected were from the US, Japan, the UK, and Canada. Interestingly, Zara and Ramkumar (2022) also found in a study that measured environmental performance as a circularity score that firms with higher circularity scores had a lower default probability; however, the relationship was more significant during a 5-year lag analysis. This finding suggests that environmental performance is more rewarding in the long term. Chatzitheodorou et al. (2021) focused on the risk classification of firms in a high-

emitting industry, energy firms, in a study that designed a framework for assessing their environmental sustainability risk. The study found none of the international energy firms studied achieved a moderate risk classification. This finding indicates that firms' industry categorization influences their risk assessment. These studies suggest that industry categorization and firms' environmental performance influence their credibility.

#### **2.4.2.2 Credit Default Swaps (CDS) and Environmental Performance**

Other studies investigate the link between environmental performance and credit default swaps (CDS) spreads (Höck et al., 2020; Zhang et al., 2023; Zhang & Zhao, 2022). Höck et al. (2020) observed a negative correlation, where a 1% improvement in environmental sustainability score lowered the CDS spread for non-financial European firms by 1.8%. Zhang et al. (2023) support this finding, noting that increased carbon emissions in US firms are associated with wider CDS spreads and lower credit ratings. They further highlight a more substantial impact on long-term bonds. Similarly, Zhang and Zhao (2022) observed a positive association between higher carbon emissions and CDS spreads for US firms by 13.1 basis points, with a more significant effect for financially constrained firms. This suggests financial limitations may hinder a firm's ability to adapt to low-carbon transition policies. Likewise, Tan et al. (2022) found a marginal increase in carbon emissions, leading to a significant rise in bond yield spreads by 16% for Chinese firms. Dumrose and Höck (2023) also reported a positive correlation between emissions and credit spreads. A contrasting viewpoint emerges from Agranat (2023), who found that improved

environmental performance in BRICS firms is associated with decreased credit ratings but increased market value. The limitation of this study is its focus on diverse countries, where other factors might influence credit ratings.

Beyond firm-level analysis, de Boyrie and Pavlova (2020) observed that countries with higher environmental performance indices had lower CDS spreads. Hill Clarvis et al. (2014) offer a potential explanation that environmental risks can lead to resource depletion, inflation, and lower GDP, which negatively impact sovereign credit risk assessment. Interestingly, Idris and Nayan (2016) found that rising crude oil prices could mitigate the negative impact of environmental risk on non-performing loan ratios in oil-producing economies, likely due to increased cash flow within those economies. This suggests that environmental risk considerations of banks might differ from risk to ecological systems as the increase in demand and price for crude oil that poses ecological risk could mitigate bank's credit risk.

#### **2.4.2.3 Environmental Performance and Loans**

Several studies examine how a firm's environmental performance affects its borrowing costs. Zhu and Zhao (2022) found that higher carbon emissions in Chinese firms were associated with higher interest rates due to increased income volatility and lower profitability. This effect was particularly pronounced for already struggling firms in high-emitting industries. Similarly, Gu et al. (2023) observed a link between higher particulate matter emissions, prior environmental penalties, and a significant increase in loan interest rates for

firms with low credit ratings, highlighting that firms with higher particulate matter emissions and prior environmental penalties have a 12.64% increase in their loan interest rate floating ratio. Environmental regulations can also influence borrowing costs (Fard et al., 2020; Huang et al., 2021). Fard et al. (2020) found that firms located in countries with stricter environmental laws faced higher bank loan costs. Huang et al. (2021) support this notion, demonstrating that China's clean air policy led to a rise in loan spreads for high-emitting industries and an 80% increase in their risk of default. This suggests a need for gradually implementing stricter environmental regulations to avoid financial instability.

Other studies have found that the impact of environmental performance extends beyond just interest rates. Ding et al. (2023) observed that while carbon emissions may not directly affect loan costs, they can influence loan tenure and access. The study found that firms with higher emissions were likelier to have limited access to loans and less transparent information disclosure. Wellalage and Kumar (2021) found that firms with better environmental performance had increased access to loans, which did not translate to more favorable loan tenures or collateral requirements. However, they observed that even firms in high-emitting industries with improved environmental practices still faced stricter loan terms. Conversely, Hrazdil et al. (2023) observed that firms facing negative climate-related news received loans with shorter tenures and more stringent collateral requirements. This reflects lenders' perception of increased risk. A possible explanation for the impact of

environmental risk on loan collateral requirements is that contamination of loan collateral can impair lenders' ability to recoup bad loans because it reduces the collateral values (Brown, 2018). In addition, McCammon (1995) points out that banks have been held liable for the clean-up cost of collaterals. Interestingly, Zhang et al. (2022) found that factors beyond a firm's emissions can also influence the impact of environmental performance on loan terms. They found a surprising gender disparity: environmental performance assurance reduced access to finance for female-led firms while increasing it for male-led firms by 7.15 percentage points. This suggests that organizational leadership gender can affect how lenders perceive environmental risk. In addition to environmental performance, Agliardi and Agliardi (2021) found that climate policy shocks increase defaultable bond prices; however, Mastouri et al. (2022) note that climate risks are not reflected in corporate bond prices.

#### **2.4.2.4 Factors Influencing the Relationship**

Studies have explored the factors that modify the relationship between environmental performance and credit risk and the reasons why environmental performance impacts credit risk. Researchers have found that improved information disclosure (Dumrose & Höck, 2023; Tan et al., 2022; Zhang et al., 2023) and market environment (Kim & Kim, 2022) modify the relationship between environmental performance and credit risk. Tan et al. (2022) found that corporate governance practices, such as improved information disclosure, may reduce the impact of carbon emissions on credit

risk. Along the same lines, Dumrose and Höck (2023), and Zhang et al. (2023) further suggest that carbon emissions management disclosure can mitigate the effect of emissions. Interestingly, Höck et al. (2020) observed that firms with high leverage did not experience a decrease in CDS spread despite improving their environmental performance. Kim and Kim (2022) add that the market environment plays a role, with environmental performance having a more substantial impact on reducing credit risk in industries with low market competition. Conversely, Liu (2023) found that linking executive pay to sustainability performance could increase credit risk, suggesting that if motivated by personal gain, executives' environmental improvements may be at the expense of other parts of the firm.

Recent studies also explore the reasons behind the relationship between environmental performance and credit risk. Tan et al. (2022) suggest that increased carbon emissions lead to higher financial risk, such as credit risk for Chinese firms. Similarly, Bandyopadhyay and Kashyap (2023) found that rising emissions reduce a firm's solvency. A possible reason for higher credit risk for high carbon emissions is the increased cost of compliance with climate change transition policies. Additionally, Fernandez (2022) suggests that environmental performance can enhance a firm's productivity, contributing to lower credit risk. These findings imply that lower emissions translate to better cash flow management.



In conclusion, the studies reviewed here highlight the complex relationship between environmental performance and the cost of debt. While higher emissions often translate to higher interest rates and stricter loan terms, the specific effects depend on various factors, including firm characteristics, industry context, and environmental regulations.

### **2.4.3 Cluster 3: Deep Blue: Sustainability Performance and Credit Risk**

The cluster examines the relationship between environmental, social, and governance (ESG) performance and credit risk, including credit default swap (CDS) spreads, credit ratings, and default probability. The studies in this cluster went beyond just environmental performance to evaluate the impact of social, economic, and governance sustainability on credit risk. There are mixed findings on the relationship between ESG performance and credit risk; some found a negative relationship exists ( Li et al., 2022; Wang & Yang, 2023; Weber et al., 2010, 2015), some found a positive relationship exists (Kanno, 2023), and others found no relationship exists (Veltri et al., 2023).

#### **2.4.3.1 ESG Performance and Credit Spreads**

Several studies find a negative correlation between ESG performance and credit spreads. Caiazza et al. (2023) observed a 5.1% reduction in CDS spreads for US firms with every unit increase in ESG performance, with the social factor having the most substantial impact. Similarly, Abdul Razak et al. (2023) found

lower CDS spreads were associated with higher ESG scores but identified governance as the most impactful factor. However, Drago et al. (2019) suggest that only improved environmental, social, and economic ratings, not governance ratings, lead to lower CDS spreads in European non-financial firms, possibly due to the uniformity of country-specific regulations. These findings highlight the potential influence of ESG factors and regional contexts on credit spreads.

#### **2.4.3.2 ESG Performance and Credit Ratings**

Studies examining the impact of ESG performance on credit ratings also present mixed results. Chodnicka-Jaworska (2021) observed that higher ESG risks decreased credit ratings for European firms, with Fitch ratings being more sensitive to ESG factors than Moody's ratings. The study found environmental factors had the most substantial impact, and the energy sector showed the most significant relationship between ESG risk and credit ratings. However, Bannier et al. (2022) found no significant impact of ESG ratings on Standard & Poor's credit ratings for US and European firms. Jang et al. (2020) observed that although a high ESG score reduces the bond returns paid by smaller firms because it reduces information asymmetry, the ESG rating of Korean firms had yet to be fully integrated into their bond credit ratings. Jeon (2021) also observed that while governance factors most impacted Korean listed companies' credit ratings, social and environmental factors became more relevant between 2017 and 2019, suggesting evolving stakeholder priorities. Broadly along the same lines, Zanin (2022) found that the impact of ESG rating

on the Standard & Poors and Fitch credit rating of North America, Europe, and Asia-listed firms varied across industries, highlighting that the environmental score had the most significant impact in extraction-intensive sectors such as mining. Wadhvani (2022) argues that the impact of physical and transition climate risk on the costly healthcare infrastructure increases the relevance of environmental assessment to the credit ratings in the healthcare sector. Kim and Li (2021) argue that better governance and social performance improved firms' credit rating. A possible explanation of the impact of governance performance on credit rating was suggested by Ur Rehman et al. (2023) , who identify that excellent governance practices increase the quality of sustainability disclosure, improving credit ratings.

Interestingly, Agoso et al. (2023) observed that although the impact of ESG scores on credit rating differs across rating agencies for European firms, the combined ESG scores across ESG ratings positively impacted credit ratings. Samaniego-Medina and Giráldez-Puig (2022) also found in a study that used regression analysis to ascertain the relationship between ESG controversies from Refinitiv Eikon and Moody credit rating of European banks that high ESG controversies reduced the credit rating of the banks and also negatively impacted the probability of obtaining a higher future credit rating. Along the same lines, Srivisal et al. (2021) observed that while ESG performance did not affect the credit ratings of Chinese firms, improved environmental and governance performance increased the credit rating of Japanese firms, and social performance reduced their credit rating. The findings in China and

Japan indicate that the impact of ESG on credit rating might vary based on each country's economic development level. Surprisingly, Anand et al. (2023) observed that higher ESG ratings reduce the sovereign credit risk of countries proxied as sovereign CDS spread and increase the distance to default of sovereign debt. However, a limitation of this study is the use of corporate ESG ratings as a proxy for country ESG ratings. Similarly, Hübel (2022) argues that countries with higher ESG performance had lower CDS spread. These findings indicate variations in the relationship between ESG performance and credit ratings across rating agencies, industries, countries, and over time.

#### **2.4.3.3 ESG Performance and Default Risk**

Studies on ESG performance and default risk also suggest a complex relationship. Weber et al. (2015) found in a study that used a cross-sectional survey design of bank credit officers in a post hoc view that integrating sustainability performance into credit risk assessments for Bangladeshi banks reduced default risk and improved prediction accuracy by 17.53%. The study used a regression analysis to find the association and noted that the firm sector does not influence the relationship. Supporting this, Wang and Yang (2023) observed a significant reduction in default risk with improved ESG performance for Chinese firms, highlighting that a 1-point increase in ESG performance leads to a 0.041 increase in distance to default. Along the same lines, Li et al. (2022) found in a study that examined the impact of ESG performance on the default risk of Chinese listed firms using secondary data from the Wind database and

Risk Management Institute (RMI) that higher ESG ratings were associated with a reduction in default risk. Aslan et al. (2021) observed a lower probability of default for US-listed firms with higher ESG scores, which had a more substantial effect in the post-crisis period and the energy sector. Huang et al. (2023) also found that firms in China with higher ESG performance had more commercial credit finance, while Höck et al. (2023) observed that US-denominated bond portfolios with higher ESG ratings had lower credit risk. However, Kanno et al. (2023) found a surprising increase in default risk for ESG management firms with better ESG performance, suggesting potential cash flow trade-offs.

Studies have also suggested the variation in the impact of ESG subfactors on default risk. For example, Widyaka et al. (2019) also observed that negative environmental information reduced the likelihood of loan officers recommending credit approval; however, negative social information did not impact loan decisions.. Similarly, Palmieri et al. (2023), in a study of European firms, found that the environmental factor had the most significant impact on reducing default risk in the long term. Conversely, Veltri et al. (2023) argue that the ESG performance of European Utility companies does not have a statistically significant impact on their corporate efficiency and credit risk. Erragragui (2018) has also found that ESG performance influences US firms' debt cost, as both governance and environmental strength were associated with a reduction in the cost of debt. These findings suggest that ESG performance can influence default risk, but the direction and strength of the relationship may vary.

The studies in this cluster had some limitations. One limitation was that the sample population was restricted to listed firms (Aslan et al., 2021; Atif & Ali, 2021; Kanno, 2023; Palmieri et al., 2023). Another limitation was the use of non-experts by Widyaka et al. (2019) , who used undergraduate students who had taken a financial statement analysis course for credit evaluation.

#### **2.4.3.4 Variation in Effects: Industry and Firm Lifecycle**

Several studies highlight the influence of industry, country context, and firm lifecycle on the relationship between ESG and credit risk. Dorfleitner et al. (2020) found that social and environmental sustainability scores improved credit rating prediction for North American firms by 0.6% and 0.8%, respectively; only social scores improved credit rating prediction for European firms by 0.1%. A broadly similar point has been made by Bannier et al. (2022), who observed that governance performance did not lower the CDS spread of European and US firms, but environmental performance reduced the credit risk of both US and European firms, while social performance only reduced the credit risk of European firms. The findings suggest that the impact of ESG factors on credit risk could depend on what is valued in the country. The firm sector has also been found to influence the relationship between ESG and default risk. For example, Li et al. (2022) observed a stronger association between ESG performance and reduced default risk in non-manufacturing Chinese firms. Conversely, Brogi et al. (2022) linked higher ESG scores with lower default risk in the Oil & Gas, Manufacturing, Transportation, and Construction sectors but not

in the Real Estate, Wholesale, and Service sectors in a study that examined the relationship between ESG performance and the probability of default of 2061 firms from 79 countries. A limitation of this study was that it mainly focused on large firms in America, Europe, and Asia; only 3% of the firms were in Africa.

Along the same lines, Caiazza et al. (2023) argue that ESG had a more significant impact on the CDS spread of firms in the financial sector and the most negligible impact on the oil and information technology sector. Interestingly, Abdul Razak et al. (2023) observed that country-level sustainability impacts the ESG and CDS spread relationship, highlighting that firms with high ESG scores in countries with high levels of sustainability had a more significant reduction in their CDS spread. Broadly along the same lines, Ferriani (2023) observed that the relationship between ESG performance and credit risk differs according to the level of economic development, identifying that the impact of ESG score on lowering credit spread was higher in developed economies than in developing economies. Notably, Wang and Yang (2023) found a more substantial effect of ESG on credit risk reduction for growing firms compared to mature firms because better ESG performance leads to increase cashflows and profitability. Contrarily, Atif and Ali (2021) argue that high ESG performance reduces the CDS spread and increases the distance to default for older firms because it increases profitability and reduces earnings volatility but does not significantly impact the credit risk of newer firms. Additionally, Zhou et al. (2016) observed that the impact of environmental and social performance on bond spread is considerably lower for firms with

institutional ownership. These findings suggest that the effects of ESG performance on credit risk can vary depending on the specific industry, regional context, and firm development stage.

#### **2.4.3.5 Factors Influencing the Relationship**

Some studies have identified the reasons why ESG performance influences credit risk. For example, Waddock and Graves (1997) suggest that the reason for the increased cashflows and profitability is because it reduces financial risk, including credit risk. Along the same lines, Capelli et al. (2021) indicate that a reduction in ESG risk minimizes the volatility of firms' assets. Lian et al. (2023) also argue that good ESG performance reduces firms' financial risk, especially during periods of economic crisis. Similarly, Yang et al. (2019) identify that integrating environmental, social, and economic sustainability evaluation in credit risk assessments improves the credit risk evaluation of borrowers because it overcomes the limitations of financial ratios, which may fail or struggle to evaluate some variables such as ESG-related issues that could influence the future performance of organizations. This finding is supported by the Liu and Huang (2022) study, which highlights that increasing sustainable finance decreases banks' financial risk. These studies suggest a relationship between ESG performance and default risk because it reduces financial risk.

A growing body of research suggests a potential link between ESG performance and credit risk. While the direction and strength of this relationship can vary across factors like industry, country context, and firm's lifecycle, there



is evidence that ESG performance can positively impact creditworthiness. Future research should address limitations in existing studies and delve deeper into the mechanisms driving this relationship to provide valuable.

#### **2.4.4 Cluster 4: Yellow: Country-level Sustainability, CSR and Credit Risk**

This cluster examines the impact of country-level sustainability on the relationship between environmental, social, and governance (ESG) performance (Abdul Razak et al., 2020; Barth et al., 2022; Stellner et al., 2015), corporate social responsibility (CSR), and credit risk (Hu et al., 2023; Kang & Kim, 2022).

##### **2.4.4.1 ESG Performance, Credit Risk, and Country Sustainability**

Several studies highlight that a country's sustainability performance can affect the impact of a firm's ESG performance on its credit risk (Abdul Razak et al., 2020; Barth et al., 2022; Stellner et al., 2015). Stellner et al. (2015) examined the impact of ESG ratings on the credit ratings of bonds issued by non-financial European firms using a regression model and the role of country-level sustainability on the relationship. The study found that higher ESG performance only significantly reduced credit risk and improved credit ratings when companies' high ESG performance aligns with countries' sustainability performance. Similarly, Barth et al. (2022) observed that higher country-level sustainability in Europe led to a more significant reduction in CDS spreads for firms with strong ESG performance compared to the US. This suggests that

being a sustainable firm in countries with higher ESG ratings is more beneficial. However, Abdul Razak et al. (2020) found the opposite, stating that firms in less sustainable countries experience more significant benefits from strong environmental and social performance. Interestingly, they also observed that strong governance performance by firms consistently reduced CDS spreads regardless of the country's sustainability level. Barth et al. (2022) observed that average ESG-performing firms had the most significant reduction in their CDS spread as one standard deviation increase in ESG rating led to an 8% decrease in their CDS spread in comparison with low and high ESG performers who had 4% and 3% reduction respectively. The finding on the variation in the impact of above-average ESG performance on CDS spread indicates that there is an "optimum level" of ESG performance. These findings emphasize the importance of considering firm-level ESG performance and national sustainability context when assessing credit risk.

#### **2.4.4.2 Corporate Social Responsibility (CSR) and Credit Risk**

Research also explores the relationship between CSR performance and credit risk (Hu et al., 2023; Li et al., 2022; Menz, 2010). Li et al. (2022) examined the impact of the CSR performance of highly polluting Chinese firms on their cost of loans using the financial data from China's stock market and accounting research database CSMAR and CSR data from Hexun. The study found that improved CSR performance by high-polluting Chinese firms lowered their loan costs, highlighting that an improvement in CSR performance by one standard deviation leads to a reduction in the price of loans by 3.53%. However, Menz

(2010) observed no significant impact of CSR on European bond spreads. Conversely, Hu et al. (2023) found in a study that examined the effects of CSR ratings on the credit spread and credit rating using regression analysis that higher CSR ratings led to lower credit spreads and better bond ratings for Chinese firms. Kang and Kim (2022) add another layer by suggesting that the CSR-CDS spread relationship depends on the economic cycle. The study found that during economic cycles, a higher CSR rating reduces firms' CDS spread; however, during financial crises, an improved CSR rating increases firms' CDS spread but does not significantly impact credit ratings. This implies that investors might perceive firms heavily focused on CSR during crises as riskier. Together, these studies suggest that the direction of the relationship between CSR and credit risk varies.

#### **2.4.4.3 Explanations for the CSR-Credit Risk Relationship**

Several studies propose reasons for the CSR-credit risk connection (Kölbel et al., 2017; Saeed & Sroufe, 2021; Yang & Hu, 2023). Yang and Hu (2023) found that better CSR performance by non-financial Taiwanese firms was associated with improved information disclosure. This suggests a positive link between CSR, transparency, and credit rating. Similarly, Saeed and Sroufe (2021) propose that reduced information asymmetry through CSR disclosure increases investor confidence, lowering a firm's financial risk and improving access to finance. Interestingly, Li et al. (2022) identified that CSR initiatives focused on employees had the most significant impact on reducing loan costs, while community-focused CSR had the least impact. This suggests that employee-oriented CSR

may minimize business risk. Conversely, Kölbel et al. (2017) observed that news of social irresponsibility increases financial risk significantly when the news is severe. These studies identified improved information disclosure and reduced financial risk as likely reasons for the risk reduction effect of CSR.

#### **2.4.4.4 Most Significant Predictors of Credit Risk**

Other studies investigate the most critical factors influencing credit risk risk (Apergis & Eleftheriou, 2012; Caplinska & Tvaronavičienė, 2020; Guo, 2016; Henning & Jordaan, 2016; Omar & Prasanna, 2023; Pandey et al., 2021). Apergis and Eleftheriou (2012) compared the effectiveness of market and accounting information in pricing default risk of US manufacturing firms. The study found that market information is more effective than accounting information in predicting the CDS spread of US manufacturers. Guo (2016) utilized the logistic regression model to ascertain the factors influencing the default risk of China's real estate industry by obtaining data from Eastmoney CSMAR and Sharpthinking. The study identified financial indicators (liquidity, debt ratio) and non-financial ones (firm location) as significant predictors for China's real estate industry. Similarly, Orlando and Pelosi (2020), and Mvula Chijoriga (2011) found leverage ratios crucial for credit risk assessment in Italian firms and Tanzanian banks, respectively. Henning and Jordaan (2016) argue that financial indicators are more important in the agricultural sector, with management experience surprisingly less relevant. However, Caplinska and Tvaronavičienė (2020) observed a shift in the importance of credit risk predictors in Latvian banks between 2011 and 2018. While financial indicators

were initially dominant, management competence emerged as the most critical factor by 2018. This suggests that the relative importance of credit risk factors can evolve.

Omar and Prasanna (2023) differentiate between short-term and long-term credit risk factors. They found that solvency is crucial for short-term default prevention, while sustainability and expansion plans become more significant for long-term default risk, particularly for larger firms. Interestingly, they observed that expansion plans can increase credit risk for smaller firms. This finding suggests that small firms must ensure their expansion plans are reasonable to prevent an increased credit risk. These findings emphasize the need for credit risk assessments to be adaptable and consider both the evolving landscape of risk factors and the time horizon for which the evaluation is being conducted.

#### **2.4.4.5 Qualitative Predictors of Credit Risk**

Some studies have delved into qualitative factors that influence credit risk assessment. For example, Pandey et al. (2021) identify credit history as a powerful predictor of microcredit risk in Germany. Wu and Hsu (2012) emphasize the significance of information disclosure for Taiwanese electronic companies during economic downturns, suggesting transparency plays a more crucial role in assessing creditworthiness during volatile periods. However, Tsai et al. (2016), using surveys of Taiwanese bank officers, highlight operational capability and competitiveness as critical factors influencing other credit risk

factors. This suggests that a borrower's ability to function effectively has a ripple effect on their creditworthiness. Pop et al. (2018) introduce a unique perspective, suggesting that a bank's board risk management ratio influences non-performing loans in Romanian banks. This implies that a bank's internal risk management practices can qualitatively predict overall credit risk exposure. Chen et al. (2018), Orlando and Pelosi (2020) all point to the importance of collateral in credit risk assessment. The finding that adequate collateral reduces loss given default underscores the need to consider factors like environmental risk that could impact collateral value. These findings highlight the multifaceted nature of qualitative credit risk predictors as the most relevant factors can vary; therefore, it is crucial to consider the interplay between these factors for a comprehensive credit risk assessment.

#### **2.4.5 Cluster 5: Purple: Banks' Environmental Credit Risk Management Practices**

This review cluster explores bank environmental credit risk management practices and the factors influencing them (Andika et al., 2021; Bruno & Lombini, 2023; Colenbrander et al., 2023; Mehedi & Kuddus, 2017). It also examines the role of memberships in voluntary initiatives like the UNEP FI and Equator Principles.

#### **2.4.5.1 The Gap Between Awareness and Action**

Andika et al. (2021) state that despite growing environmental awareness, banks sometimes exhibit ambivalent behavior and continue funding environmentally harmful projects such as the Trans Sumatra toll road in Indonesia. Their study highlights the need for improved implementation of responsible investment principles in developing economies, balancing infrastructure development with environmental concerns. Similar inconsistencies are observed in loan terms, where European banks raise interest rates on loans to high-emitting industries but increase the loan exposure to these industries (Bruno & Lombini, 2023). The increase in interest rates in European banks could be an attempt to price low-carbon economy transition risk in their financing decision because of Europe's commitment to a low-carbon economy. Studies in India (Colenbrander et al., 2023) and Bangladesh (Mehedi & Kuddus, 2017) reveal similar patterns in developing economies. Mehedi and Kuddus (2017) identified that Dutch-Bangla Bank Ltd in Bangladesh improved operational sustainability while neglecting to finance environmentally friendly projects, while Colenbrander et al. (2023) observed that Indian banks did not integrate environmental, social, and governance (ESG) factors into lending decisions.

#### **2.4.5.2 Developed vs. Developing Economies**

Thompson (1998) also found that United Kingdom banks are environmentally aware and evaluate the environmental credit risk. In a more recent study, Mengze and Wei (2015) found from the review of sustainability reports of 120 large banks that banks in developed economies generally demonstrate stronger environmental risk management practices than those in developing economies. For example, Brown (2008) stated that HSBC was focused on improving sustainability by reducing its carbon footprint from its financing activities through increased finance for green technology and managing its carbon footprint from its operations by improving its building energy efficiency. These studies depict that banks in developed economies integrate environmental considerations in their credit risk assessment. Other studies have suggested that factors such as the level of vulnerability to environmental risk and bank characteristics also determine the extent of environmental credit risk management. Mengze, Wei (2015), and Weber et al. (2012) found banks in environmentally vulnerable countries, like Canada, are more proactive in environmental credit risk assessment. In addition, Nitescu and Cristea (2020) found that Romanian banks with more management staff tend to have more robust ESG assessment practices, while banks with a higher return on assets may prioritize short-term gains over environmental considerations. Along the same lines, Kulkarni (2010) observed that larger banks are more likely to conduct environmental credit risk assessments. Similarly, Sarfraz et al. (2018)



found that foreign Pakistan banks were more inclined to integrate environmental risk assessment in project finance. In addition to bank characteristics, membership in voluntary initiatives also influences environmental credit risk management. Weber et al. (2008) identified that European banks that were UNEP FI members integrated the evaluation of clients' environmental performance in their credit rating phase; however, integration across all credit risk stages remains limited. Ho and Wong (2023) also observed that UNEP FI member banks in emerging economies price climate risk in their syndicated loans and implement more stringent loan conditions for firms with high emissions. Membership in voluntary initiatives like the Equator principles and environmental credit risk management is beneficial and has improved capital adequacy ratios and reduced non-performing loan ratios in Chinese banks (Chen et al., 2022). Contrarily, Castro Sobrosa Neto (2020) found that membership in voluntary initiatives such as the Corporate Sustainability Index (ISE) did not impact the financial performance of Brazilian non-financial institutions. A limitation of the study is that several factors could influence their financial performance. Therefore, it would be insightful to investigate how it impacts their credit ratings. These studies suggest that banks' characteristics and membership of Equator principles and UNEP-FI can influence the implementation of environmental credit assessment.

#### **2.4.5.3 Motivations for Environmental Credit Risk Management**

Banks engage in environmental credit risk management for various reasons, including: avoiding liability for environmental contamination caused by

financed projects; however, UK banks often ignore this when lending to large clients with the financial capacity to absorb the legal cost of contamination (McKenzie & Wolfe, 2004). Broadly along the same lines, Kulkarni (2010) found that responding to a growing demand for sustainable practices among customers and fulfilling regulatory requirements motivates environmental credit risk management; however, regulatory pressure may be less effective in developing economies with more pressing concerns. The studies enumerate that there are various motivations for environmental credit risk management.

#### **2.4.6 Cluster 6: Light Blue: COVID-19, ESG-Credit Risk Relationship and Machine Learning**

This cluster explores the impact of the COVID-19 pandemic on the ESG-credit risk relationship (Chodnicka-Jaworska, 2022; Wu & Tian, 2022), machine learning for credit risk assessment (Gumerov & Rizvanova, 2023; Lappas & Yannacopoulos, 2021; Zeidan et al., 2015), and factors influencing credit risk in small and medium enterprises (SMEs) (Belas et al., 2018; Uddin et al., 2022).

##### **2.4.6.1 Impact of COVID-19 on Credit Risk and ESG**

Studies have found that the economic considerations during the COVID-19 pandemic influence the relationship between ESG and credit risk (Cardillo & Chiappini, 2022; Wu & Tian, 2022). Cardillo and Chiappini (2022) suggest that strong sustainability ratings improved the creditworthiness of non-financial European firms during COVID-19. At the same time, Wu and Tian (2022)

observed a muted impact of carbon risk on credit spreads because of a shift in government priorities. Along the same lines, Chodnicka-Jaworska (2022) emphasizes the importance of environmental and social factors for credit risk assessment in the energy sector during the pandemic. The studies have mixed findings on the impact of COVID-19 on the relationship between credit risk and ESG performance.

#### **2.4.6.2 Credit Risk in SMEs**

Some studies have examined credit risk assessment in small and medium enterprises (SMEs) (Belas et al., 2018; Ciampi et al., 2021; Khushnud & Qingjie, 2020; Uddin et al., 2022; Weber et al., 2008). Khushnud and Qingjie (2020) found through a survey of Uzbekistan banks that despite the significance of SMEs to economic development, the SME risk assessment process can be improved by employing more skilled credit officers to analyse their data. Uddin et al. (2022) and Belas et al. (2018) found that non-financial factors like management characteristics and financial literacy are essential in SME risk assessment. Interestingly, Bertinetti (2023) and Weber et al. (2010) observed that incorporating ESG criteria can improve creditworthiness prediction for SMEs. Weber et al. (2010) found that integrating the environmental, social, and economic sustainability criteria into traditional credit rating criteria of German SMEs reduced prediction errors by 22.7%. A limitation of Bertinetti (2023) and Weber et al. (2010) studies is that they were both focused on European firms, suggesting that more research is needed in developing economies. Together,

these studies identify the relevance of qualitative factors in SME credit risk prediction.

#### **2.4.6.3 Machine Learning Techniques for Credit Risk Prediction**

Some studies have also explored the use of machine learning for sustainable risk assessment (Gumerov & Rizvanova, 2023; Zeidan et al., 2015; Zhao & Chen, 2022). Zhao and Chen (2022) noted that the random forest method was 93.75% effective in predicting the green credit risk of paper companies. Similarly, Gumerov and Rizvanova (2023) developed a phenomenological model incorporating ESG risk to determine Russian bank borrowers' loan amount, tenure, and collateral. Similarly, Zeidan et al. (2015) tested a sustainability credit score system (SCSS) in a Brazilian bank and suggested it could enhance the integration of sustainability assessment in bank credit ratings. The study used the analytical hierarchical process to design the sustainability credit score system. This suggests that machine learning techniques can be used to integrate sustainability assessment into the credit evaluation process. Interestingly, Munkhdalai et al. (2019) argue that machine learning models were more effective than expert ratings in credit risk prediction. However, a significant limitation of the study is that it focused only on consumer finance and Fair Isaac Corporation (FICO) experts' scores. Conversely, Lappas and Yannacopoulos (2021) found that combining expert opinion improved credit risk prediction compared to utilizing machine learning models alone. These

studies suggest that machine learning models and expert opinion are adequate for evaluating sustainability risk in credit assessment.

## **2.5 Limitations and Future Research Directions**

While research has explored aspects of credit risk, environmental sustainability, and the link between sustainability performance and credit risk, there are significant gaps. Existing studies on environmental sustainability and credit risk have primarily focused on developed economies (Atif & Ali, 2021; Caiazza et al., 2023; Drago et al., 2019; Erragragui, 2018) and developing Asian countries (Li et al., 2022; Wang & Yang, 2023; Weber et al., 2015). However, the studies examining the impact of economic, environmental, and social sustainability have excluded African countries like Nigeria despite being the largest economy in Africa. Additionally, most research relies on secondary data using sustainability performance measures from ESG rating agencies and credit ratings from credit rating agencies, often omitting data from unlisted firms. Although secondary data are easy to obtain and cover a large sample, they often exclude small and medium firms' data. This suggests the need for future studies that explore the relationship in other developing economies using primary data, at this moment incorporating the data of unlisted firms to provide a more comprehensive picture. It is important to use primary data to ensure that the relationship between sustainability and credit of unlisted firms is understood. To address these limitations, this study will focus on examining the impact of integrating corporate sustainability performance with conventional

risk criteria in evaluating borrowing clients on the credit risk prediction of Nigerian banks.

### **3. 0 Theoretical Framework**

#### **3.1 Introduction**

This chapter first presents the various theories used to understand the relationship between sustainability performance and credit risk. Next, it presents the methods used to measure credit risk and the findings about this relationship. The first hypothesis of this thesis is presented, followed by the methods used in previous studies to measure sustainability performance and the second hypothesis. The section concludes by presenting the moderating variables and the third, fourth, fifth, and sixth hypotheses designed to test the moderating variables.

#### **3.2 Theories Linking Sustainability and Credit Risk**

Several theories underpin the connection between sustainability performance and credit risk:

Stakeholder Theory: The theory proposed by Freeman in 1984 posits that firms do not exist to satisfy only shareholders' needs, but they should meet all stakeholder needs, including community and employee well-being; creating value for stakeholders may reduce their risk(Freeman, 2010). Donaldson and Preston (1995) discussed the three approaches identified in the Stakeholder Theory; the descriptive approach describes the interconnectedness of stakeholders to firms, the instrumental approach states that creating value for

stakeholders results in the achievement of firms' goals and mitigates their risk, while the normative approach states that firms creating value for stakeholders is the right thing to do. Studies have examined the relationship between sustainability and credit risk based on the risk-mitigating instrumental stakeholder theory view that suggests improved firms' performance by meeting stakeholders' needs reduces their risk (Abdul Razak et al., 2020). Caiazza et al. (2023), Samaniego-Medina & Giráldez-Puig (2022), and Srivisal et al. (2021) tested this in their study of ESG performance and CDS spread, ESG controversies and credit rating, and ESG performance and credit rating, respectively. These studies proxied ESG performance as an effective management of stakeholders' needs and sought to ascertain its impact on firms' credit risk, expecting that better ESG performance and fewer ESG controversies lead to better stakeholder satisfaction, improved performance and reduced credit risk (Caiazza et al., 2023; Samaniego-Medina & Giraldez-Puig, 2022; Srivisal et al., 2021).

Agency Theory: According to Jensen and Meckling (1976), the separation of ownership from the control of firms creates agency problems because the interests of the principal's "shareholders" often conflict with the interests of their agents "managers," who often pursue short-term rewards over long-term gain that is most beneficial to their principals. Hu et al. (2023) tested this theory to ascertain if corporate sustainability performance reduces or increases agency problems and its impact on credit risk. Similarly, Ur Rehman et al. (2023) tested



the theory in the study on sustainability performance disclosure and the credit rating of Islamic bonds.

**Resource-Based Theory:** This theory posits that firms can combine tangible and intangible resources, including a positive reputation from maintaining good relationships with stakeholders that are valuable (improving efficiency and effectiveness), non-substitutable, and difficult to imitable to create competitive advantage (Barney, 1991). Valuable resources can give firms a competitive advantage if they are able to reduce their threats, maximize their opportunities, reduce their operating cost and increase their revenue (Dagnino, 2012). Sustainability performance is often used by firms to create a good reputation and improve their competitive advantage (Gangi et al., 2019) . Atif and Ali (2021) tested the Resource-Based Theory to examine whether better ESG disclosure can create a competitive advantage for US non-financial firms and reduce their credit risk proxied as the distance to default and CDS spread. Chatzitheodorou et al. (2021) also tested the theory to ascertain if ESG disclosure of energy firms creates a competitive advantage that influences their credit risk categorization.

**Good Management Theory:** Waddock and Graves (1997) proposed this theory, stating that well-managed firms are more likely to exhibit strong sustainability performance, which can translate to reduced financial risk, including credit risk, because they have increased cash flow. The reasons for the increased cash flow of well-managed firms, according to the Good Management Theory, is that when firms address sustainability concerns, they

are rewarded with the following: an improved reputation, an increase in their social license to operate, fewer litigations, and fewer fines. Based on the Good Management Theory, it is expected that well-managed Nigerian bank's corporate borrowing clients will have better sustainability performance and improved cashflows because of the following reasons: namely, increased demand for their products and services, reduction in fines, reduction in litigations and they would be able to repay their loans. Therefore, sustainability performance in credit assessment is expected to help Nigerian banks predict the borrowers likely to repay or default on their loans. According to Chollet and Sandwidi (2018), it is essential to evaluate sustainability performance in risk assessment because sustainability performance is a long-term risk indicator. An example of a study that has tested the relationship between sustainability performance and financial risk is Drago et al. (2019), who examined the impact of good management (high sustainability ratings) on the credit risk, measured as the CDS spread of firms, to ascertain if firms with better sustainability ratings had lower CDS spread. Weber et al. (2010, 2015) also examined if good management (sustainability performance of borrowers) led to a decrease in their default risk and how it impacted the credit prediction of banks. This study will address the Good Management Theory by examining if Nigerian corporate borrowing clients' good management (sustainability performance) impacts their corporate financial risk (credit risk) to ascertain if banks can better predict loan outcomes by integrating sustainability performance with conventional rating criteria.

Therefore, this study will test the Good Management Theory to ascertain the cause-effect relationship between corporate sustainability performance and credit risk.

### **3.3 Measuring Credit Risk**

Credit risk assessment involves estimating the probability of a counterparty defaulting on a loan, which can be done using historical data employed by credit rating agencies or Risk Neutral Valuation Theory (used to calculate excess return demanded by investors for taking on risk) (Koulafetis, 2017). Accurately estimating the probability of a counterparty defaulting on a loan is crucial for financial institutions because regulations require them to use this probability and other factors like loss severity and loan duration to calculate their capital adequacy (Saunders & Allen, 2002). There are two main approaches to measuring credit risk: historical data analysis and market pricing (Koulafetis, 2017).

- **Historical Data Analysis:** This method uses a firm's past financial performance to predict its future likelihood of default; one example is the Z-score model by Altman (1968). The Z-score model analyzes financial ratios related to a company's solvency, liquidity, profitability, and leverage to predict bankruptcy risk; firms with a Z-score below 1.81 are considered high-risk and may be denied loans (Altman, 1968). This

approach and qualitative factors like management expertise provide a valuable assessment tool (Caouette et al., 2008). For instance, Brogi et al. (2022) represented credit risk as the probability of default calculated with Altman's Z score, while Weber et al. (2010, 2015) combined historical and qualitative data to measure credit risk.

- **Market Pricing of Credit Risk:** This approach utilizes the market's perception of credit risk, reflected in instruments like credit default swaps (CDS) spreads (Koulafetis, 2017). Studies by Atif and Ali (2021), Bannier et al.(2022), and Drago et al. (2019) employed CDS spreads to measure credit risk. However, because CDS spreads represent market sentiment, not the actual probability of default, credit rating agencies rely on historical data analysis to obtain more accurate default probabilities (Koulafetis, 2017).

Following previous research (Weber et al., 2010, 2015), this study combined both approaches. It used traditional credit risk assessment variables like solvency, leverage, and profitability ratios (Altman, 1968) alongside qualitative factors like management competence (Caouette et al., 2008) as the conventional credit risk assessment criteria.

### **3.4 The Link Between Sustainability and Credit Risk**

Studies suggest a potential connection between a firm's sustainability performance and creditworthiness. Strong sustainability performance may reduce earnings volatility by mitigating reputational risks, compliance issues, and legal challenges (Capelli et al., 2021). However, researchers have explored the relationship between sustainability and credit risk with varied results (Abdul Razak et al., 2023; Bannier et al., 2022; Caiazza et al., 2023; Drago et al., 2019; Weber et al., 2010, 2015). Some studies, like those by Veltri et al. (2023) and Srivisal et al. (2021), found no significant connection between the two factors. For example, Veltri et al. (2023) observed no impact of ESG performance on European firms' credit risk or corporate efficiency. On the other hand, studies by Caiazza et al. (2023), Abdul Razak et al. (2023), and others suggest a negative correlation. Caiazza et al. (2023) found that a 1-unit increase in US firms' sustainability performance corresponded to a 5.1% decrease in their CDS spread (a credit risk indicator). Similarly, Weber et al. (2010, 2015) observed a reduction in credit prediction errors by banks in Germany (22.7%) and Bangladesh (33%) when incorporating sustainability assessments.

Notably, some studies suggest this relationship might vary across countries. For instance, Srivisal et al. (2021) found that improved sustainability reduced credit risk in Japan (a developed Asian country) but not in China (a developing Asian

country). Similarly, Ferriani (2023) found that the impact of sustainability on credit spreads was stronger in developed economies. Furthermore, Abdul Razak et al.(2020, 2023) suggest a potential interaction of country-level sustainability. Abdul Razak et al. (2020) observed a stronger association between improved sustainability performance and reduced credit risk for firms based in countries with lower national sustainability scores. Contrarily, Abdul Razak et al. (2023) found a more pronounced credit risk reduction effect only in countries with high national sustainability levels.

The limitations of existing studies include focusing on developed economies and developing Asian countries, excluding most African countries like Nigeria. Given the limited research on Nigeria and the African continent and the potential for varying relationships across countries, this study will use primary data to examine the link between sustainability performance and credit risk prediction in Nigerian banks. This will help understand if incorporating sustainability assessments can improve credit risk prediction for Nigerian banks' corporate borrowers.

### **3.5 Hypotheses Development**

Waddock and Graves (1997) propose that well-managed firms have better sustainability performance and will be rewarded with a reduced credit risk. Studies have also found that better sustainability performance results in a reduction in firms' credit risk (Abdul Razak et al., 2023; Caiazza et al., 2023; Ferriani, 2023; Lian et al., 2023; Weber et al., 2010, 2015). Based on the Good

Management Theory, and previous studies, it is expected that well-managed Nigerian banks borrowing clients will have better sustainability performance and less credit risk. Therefore, the following hypothesis is proposed.

Hypothesis 1 (H1): Incorporating sustainability assessments alongside conventional credit risk evaluation criteria will improve Nigerian banks' accuracy in predicting default risk, as corporate borrowers with stronger sustainability practices will exhibit lower default risk.

Researchers have employed various methods to assess sustainability performance. Some, like Caiazza et al. (2023), utilize ESG ratings from providers like Refinitiv. Others, such as Abdul Razak et al. (2023) and Brogi et al. (2022), rely on MSCI ESG ratings. This study will measure sustainability performance as economic, social, and environmental sustainability like Weber et al. (2010, 2015) and Yang et al. (2019) and conventional criteria as leverage, profitability and business risk indicators similar to the Weber et al. (2010, 2015) study. This study will leverage the evaluations of bank credit risk officers like Weber et al. (2010, 2015). These officers assessed the borrowers' economic, environmental, and social sustainability practices using a Likert scale. This approach allows us to measure the sustainability practices relevant to Nigerian businesses and the conventional evaluation criteria employed by Nigerian banks.

While the overall impact of sustainability on credit risk is being explored, some studies delve deeper into the influence of specific sustainability sub-factors

(Bannier et al., 2022; Chodnicka-Jaworska, 2021; Zanin, 2022). Notably, research by Chodnicka-Jaworska (2021) suggests that environmental sustainability has the most substantial effect on credit risk reduction. Similarly, Bannier et al. (2022) observed that strong environmental performance led to a more significant decrease in credit risk across US and European firms despite differing regulatory environments. Zanin (2022) further supports this finding, identifying environmental performance as the most impactful sustainability factor for reducing credit risk in various regions. Building upon Bannier et al. (2022) and Zanin (2022) findings on the relevance of environmental performance to different regions, the following hypothesis is proposed.

Hypothesis 2 (H2): Among the various sustainability indicators, environmental sustainability performance will significantly reduce borrowing clients' credit risk and improve the accuracy of default risk prediction for Nigerian banks.

### **3.5.1 Moderating Variables**

Previous studies examining the relationship between sustainability and credit risk have incorporated moderating variables to account for external influences (Abdul Razak et al., 2023; Caiazza et al., 2023; Weber et al., 2010, 2015). Abdul Razak et al. (2023) moderated for firm size. While Caiazza et al. (2023) moderated for firm size and sector. However, Weber et al. (2015) moderated for loan size, firm sector, and size and found that these moderating variables did not impact the relationship between sustainability performance and credit risk prediction. Some other studies have examined how sector the impact of



sustainability performance on credit risk could differ among industries, implying that a firm's sector can moderate this relationship (Aslan et al., 2021; Caiazza et al., 2023; Li et al., 2022). Following this established practice, our study will moderate loan size, firm sector, and firm size to ensure a more robust analysis. Weber et al. (2015) found that loan size, firm size and firm sector did not impact the relationship between sustainability performance. Based on this, the following hypotheses are proposed.

Hypothesis 3 (H3): Nigerian banks' corporate borrowing clients' loan size impacts the relationship between sustainability performance and credit risk and improves the predictability of default risk.

Hypothesis 4 (H4): Nigerian banks' corporate borrowing client's firm size impacts the relationship between sustainability performance and credit risk and improves the predictability of default risk.

Hypothesis 5 (H5): Nigerian banks' corporate borrowing client's firm sector impacts the relationship between sustainability performance and credit risk and improves the predictability of default risk.

This study will also moderate borrowing from clients' banks because the sample was obtained from various banks. Therefore, the following hypothesis is proposed.

Hypothesis 6 (H6): Nigerian corporate borrowing client's bank impacts the relationship between sustainability performance and credit risk and improves the predictability of default risk.

## **Chapter 4.0 Methodology**

### **4.1 Introduction and Research Questions**

This chapter presents the methodology used to conduct this quantitative study. The purpose of this thesis was to examine if the integration of sustainability performance with conventional credit risk criteria evaluation of borrowing clients lowers their default risk and increases the prediction of credit risk in Nigerian banks and to ascertain which of the sustainability indicators has the most significant impact on their credit risk prediction. This needed a statistical examination of the independent variables, corporate sustainability performance, conventional risk assessment criteria, and the dependent variable loan outcome. The areas of sustainability being investigated are economic sustainability, environmental sustainability, and social sustainability, measured on a likert scale through a survey. The independent and dependent variables data were sourced from primary data from a survey administered to Nigerian banks' credit officers.

The primary research question for this study is: Does integrating the sustainability performance of corporate borrowing clients with conventional rating criteria into the credit risk assessment procedure improve the validity of credit risk prediction in Nigerian Banks? Two sub-questions: Which of the sustainability indicators has the most significant impact on credit risk prediction, and what is

the impact of the loan size, firm size, firm sector, and firm's bank on the relationship of sustainability performance and conventional credit assessment criteria with credit risk prediction? Each of these questions has an associated hypothesis that attempts to predict the nature of the relationship between sustainability performance, conventional risk assessment criteria, and loan outcomes. The Good Management Theory and findings from the literature review have influenced the direction of the relationship.

Overall, this chapter of the thesis explains the research design, research question, data sources for the independent and dependent variables, sampling, data collection, coding, and statistical tests used for the analysis.

## **4.2 Research Design**

This study used a nonexperimental quantitative research design found in previous literature. This section describes the thesis's research design choices. The nonexperimental quantitative approach was chosen for this study because Creswell and Creswell (2018) suggest that it is appropriate because it is used by researchers to deductively test existing theories by assessing the relationship between variables while controlling for other possible explanations for the relationship. The type of nonexperimental quantitative design proposed for this study is a cross-sectional survey design. This inquiry strategy is intended because, according to Creswell and Creswell, (2018) a survey design provides a numeric description of the attitudes of a sample population and examines

the relationship between variables of a population by researching a sample of that population. Therefore, the design would aid in answering the three research questions within the sample population by studying only a sample within that population.

Additionally, standardized predetermined questions are essential in this study to collect relevant information about the sample population's corporate sustainability performance, conventional credit criteria performance, and credit performance characteristics relatively quickly (Blackstone, 2012; Ponto, 2015). Therefore, the cross-sectional survey design was selected for this study because Setia (2016) suggests that this design is suitable when all variables measured are examined at the same period when the outcomes are known, thereby saving time. This design is suitable because the independent variables, sustainability performance, conventional criteria performance, and the dependent variable, loan outcome, will be measured retrospectively when the credit performance outcomes are known. The statistical analysis made it possible to test the relationship between the independent variables and the dependent variable.

The primary purpose of this study is to empirically evaluate whether integrating corporate sustainability performance with conventional credit risk assessment criteria increases the predictability of corporate borrowing clients' credit risk.

### **4.3 Sample selection parameters**

The population for this study is the corporate borrowing clients of Nigerian banks. However, Babbie (2016) observed that it is impossible to study all population members. Therefore, the study identified a sample of corporate borrowing clients of Nigerian banks. A probability sampling technique was used for the study because Acharya et al. (2013) suggest that the probability sampling technique aids the generalizability of findings to the target population because every member of the population has an equal chance of being selected. The probability sampling technique selected for this study is the stratified probability sampling technique because the loans were segmented into groups according to their shared characteristics default and non-default loans. The stratified probability sampling technique is suitable when the population needs to be grouped by their shared characteristics (Acharya et al., 2013). The range of loans used for this analysis will be the most recent loans with known outcomes, and there was adequate information on their sustainability performance. The stratified random sampling technique was used to understand if the relationship between sustainability, conventional criteria, and loan outcome differed across the default and non-default sub-groups.

#### **4.4 Data Collection**

The data on Nigerian banks' corporate borrowing clients, namely small, medium and large companies, were obtained from five (5) Nigerian banks with an ESG team willing to participate in the study through a cross-sectional survey. The credit risk officers of these banks completed the survey. This is because credit officers of the banks are deemed to have the required skills, information, and objectivity to assess these organizations' corporate sustainability performance, conventional performance, and credit performance (Weber et al., 2015a). This aligns with the survey design used in similar previous studies (Weber et al., 2010, 2015). 84% of the credit officers who completed the survey had over 2 years of credit assessment experience. The cross-sectional survey was also suitable from a logistic standpoint because it is less costly. The credit officers were asked to select their most recent loans, for which they had adequate information about their sustainability performance and knew the loan outcomes. The collection of survey responses was from November 2023 to March 2024. The engagement with the credit officers revealed that they are familiar with sustainability assessment. The newly designed survey instrument used by the credit officers to assess the sustainability performance, conventional criteria performance, and loan performance is described in the following section.

## **4.5 Instrumentation and Coding**

The survey instrument and how it was coded for the statistical analysis are described below.

### **4.5.1 Instrumentation**

The survey measured the performance of the Nigerian banks' corporate borrowing clients, namely: small, medium and large companies, on the first independent variable, sustainability measures, which were detailed as economic, social, and environmental sustainability indicators. The second independent variable is conventional credit risk assessment criteria, which are detailed as leverage, profitability, and business risks. On the other hand, the only dependent variable was the loan performance of these borrowing clients, which was measured as default or non-default. The independent variables, sustainability performance, and conventional criteria performance were measured using a Likert scale, while the dependent variable was rated as default or non-default, similar to previous studies by Weber et al. (2010, 2015). The relevant sustainability indicators, namely economic, environmental, and social performance, were obtained from Mengistu and Panizzolo's (2021) study, which designed the sustainability indicators for Italian firms using the Global Reporting Initiative (GRI) framework. These sustainability indicators were adapted to the Nigerian business environment through two steps. The first step was to ask sustainable finance researchers at the University of Waterloo who had knowledge of the Nigerian business environment to identify relevant

indicators from a pre-test survey presented to them based on the indicators identified from Mengistu and Panizzolo's (2021) study. The second step was to present the identified indicators to the credit risk officers of Nigerian banks by sharing the survey link and having telephone conversations for them to choose the sustainability indicators relevant to their business environment. The indicators in the pre-test survey were modified based on the credit officers' recommendations.

The leverage, profitability, and business risk indicators for the conventional criteria were designed based on Nigerian banks' credit assessment checklist that aligns with the Central Bank of Nigeria's recommendation. The survey was administered through Qualtrics applications to multiple credit officers of 5 Nigerian banks to rate the sample corporate borrowing clients in a post hoc view when loan outcomes are known. The dependent variable, loan default and non-default, and the control variables (firm size, loan size, and sector) will be measured on a nominal scale while the remaining questions measuring economic, environmental, social, leverage, profitability, and business risk performance indicators will be measured on a 5-point Likert scale of 1 =very bad to 5 =very good (Bhattacharjee, 2012). The credit officers were trained on how to consistently use the survey instrument, specifying what level of performance should be rated 1 and what should be rated 5 using the financial information, non-financial information and their knowledge of their corporate borrowing clients.



### **4.5.2 Coding Procedure**

The dependent variable was coded 0 for default loans and 1 for non-default loans. For the independent variables, sustainability, and conventional credit risk criteria on a 5-point Likert scale, 1 was coded to represent poor performance, 2 =low performance, 3 = average performance, 4 =Good performance, and 5 = Excellent performance. The questions, namely Q6, Q7, Q26, Q40, Q41, Q18, Q24, Q25, Q30, Q31, Q32, Q33, Q34, and Q36, where low ratings represented better performance were recoded to align with the coding system above. See question labelling in Appendix J.

### **4.6 Data Analysis**

This section of the thesis presents the data analysis methodology. This phase aimed to ascertain the statistical tests to assess the relationship between the independent variables, sustainability performance, conventional credit assessment criteria, and the dependent variable loan outcomes. Pandis (2015) suggests that the independent sample t-test could be used to ascertain the relevance of each indicator to group membership by assessing the statistical difference in the mean of each group. In line with this, an independent sample t-test was carried out to ascertain if there was a statistically significant difference in the mean of the default and non-default group due to a change in each of the indicators and the direction of the relationship. A Cronbach alpha and factor analysis were also carried out to ascertain the reliability and

validity of the scale. The independent sample t-test, Cronbach Alpha, and factor analysis were conducted to determine which variables to include in the binary logistic regression model. The binary logistic regression statistical method was used to test the relationship between the independent and dependent variables using IBM SPSS statistical software. This statistical test is suitable because it is used to ascertain the relationship between categorical and numeric independent variables and a dichotomous dependent variable (Fritz & Berger, 2015). Therefore, testing the relationship between sustainability performance, conventional credit assessment criteria, and loan outcomes with binary logistic regression is appropriate. The binary logistic regression showed the impact of the independent variables on the correct prediction of loan outcomes.

#### **4.7 Chapter Summary**

This chapter explains why the non-experimental quantitative design, a cross-sectional survey design, was used in this thesis. It also explains why the stratified random sampling technique was selected to identify the sample of the Nigerian corporate borrowing clients for the study, how the survey instrument was developed and adapted to Nigerian firms, and why the binary logistic regression model was selected to analyze the relationship between the independent and dependent variable. The following section presents the statistical test results.

## **Chapter 5: Statistical Test Results**

This chapter presents the frequencies, descriptive statistics, and binary logistic results tool for the survey instrument responses.

### **5.1 Frequency of dependent variable**

The frequency table 3 below categorizes survey responses according to the dependent variable (loan performance), with 0 representing default loans and 1 for non-default loans. The total number of loans in the table below differs because the credit officers did not complete some of the survey questions; because of this, loans that had only information about their loan default, firm sector, and firm size were excluded from further analysis. The table reveals that 19.8% of the survey responses were from small business borrowing clients' data, 27.9% were from medium-sized borrowers, and 52.3% were from large corporate borrowing clients. The classification by loan type revealed that 48.8% were term loans, 26.8% were overdraft/working capital, and 24.4% were other loan types such as import finance facilities and advanced payment guarantees. The credit officers had adequate experience as 59% of the respondents had over 4 years of experience while 25.3% had between 2 and 4 years of credit rating experience. Most responses were from Bank D and Bank A, providing 37.3% and 30% of the 83 complete responses. Most borrowers

belonged to the manufacturing sector (30.6%) and the oil and gas sector (22.4%).

Table 3: Frequencies of Dependent Variable

	Firm_size											Total
	Small	Medium	Large									
Default	6	8	22									36
Non-default	11	16	23									50
Total	17	24	45									86
	Loan_type											
	Overdraft/Working Capital	Term Loan	Others									
Default	7	16	12									35
Non-default	15	24	8									47
Total	22	40	20									82
	Credit_officers_experience											
	0 - 2years	2 - 4 years	4 - 6 years	6 years and above								
Default	4	14	17	0								35
Non-default	5	7	32	4								48
Total	9	21	49	4								83
	Credit_officers_bank											
	Bank A	Bank B	Bank C	Bank D	Bank E							
Default	12	1	10	9	3							35
Non-default	13	3	5	22	5							48
Total	25	4	15	31	8							83
	Sector											
	Agro-Allied	Construction	Health	Manufacturing	Oil & Gas	Others	Power	Real Estate	Service	Entertainment & Tourism		
Default	1	3	1	7	11	2	4	3	2	1	35	
Non-default	7	5	0	19	8	1	0	2	8	0	50	
Total	8	8	1	26	19	3	4	5	10	1	85	

## **5.2 Descriptive statistic of independent variables**

The minimum, maximum, mean, standard deviation, skewness, and kurtosis statistics in table 4 below revealed that for the economic sustainability variable, Q8\_Economic\_susty (improvement of job creation through the supply chain) had the highest mean at 3.29, indicating that the borrowing clients performed well in creating jobs through their supply chain. The economic sustainability indicators were mostly rightly skewed, with only two indicators (impact of climate regulation on profit and adherence to minimum wage) exhibiting left skewness. Kurtosis is mostly negative and low for this variable, with one indicator (impact of weather change on profit) with relatively high kurtosis. For the environmental sustainability variable, Q4\_Environment\_susty (incidents of business disruption due to non-compliance with environmental laws) had the highest mean at 4.78, indicating that borrowing clients had low disruption to their business due to non-compliance with environmental laws. The environmental sustainability indicators were mostly rightly skewed, with only one indicator (incidents of business disruption due to non-compliance with environmental laws) that exhibited left skewness because not having disruption incidence represented an excellent performance, and the kurtosis was all low. The social sustainability variable Q11\_Social\_susty (fines issued by regulators) and Q13\_Social\_susty (Incidents of the company's customer data breach) had the highest mean at 4.87, signifying that the borrowing clients had low incidence of fines and customer data breaches. 44% of the social

sustainability indicators were rightly skewed, while 56% were left-skewed. The kurtosis for the social indicators was mostly low except for Q11, Q12, Q13, and Q15. The statistics for the conventional criteria variable indicate that Q10 (level of demand for company products and services) had the highest mean at 3.99, and the indicators were mostly negatively skewed with low kurtosis. The sample size (N) in the table below varied because the credit officers did not respond to some questions.

*Table 4 : Descriptive statistics of Independent variables*

Variable	Indicators	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Economic sustainability	Operating cost to revenue	83	1	5	2.95	0.82	0.089	0.555
	Salaries to revenue	83	2	5	3.02	0.698	0.408	0.358
	Physical climate impact on profit	83	1	5	1.95	0.642	1.175	5.404
	Climate market reaction on profit	80	1	4	2.37	0.786	0.668	0.034
	Climate regulation on profit	83	2	5	3.2	0.866	-0.068	-1.056
	Minimum wage	83	1	5	3.27	1.17	-0.443	-0.683
	Local staff employment	83	1	5	3.04	1.005	0.443	-0.736
	Job creation through value chain	83	2	5	3.29	1.153	0.239	-1.402
	Sourcing from local suppliers	83	1	5	2.95	1.168	0.708	-0.94
Environmental sustainability	Renewable energy use	83	1	4	1.87	0.866	0.954	0.493
	Recycled material use	83	1	5	1.86	0.885	1.263	1.81
	Environmental Innovations	83	1	5	2.12	0.968	0.746	0.077
	Business disruption for environmental non-compliance	83	4	5	4.78	0.415	-1.399	-0.043
	Investment in environmental innovations	83	1	4	1.94	0.874	0.792	0.115
	Energy consumption cost	83	1	4	1.93	0.908	0.747	-0.199
	Environmental sustainability criteria in supplier onboarding	83	1	5	2.19	0.969	0.756	0.054
Social sustainability	Human rights criteria in supplier onboarding	83	1	5	2.16	0.93	1.169	1.78
	Human rights criteria in employee onboarding	83	1	5	2.66	0.954	0.297	-0.068
	Suppliers' child labor risk	83	2	5	4.06	1.119	-0.763	-0.893
	Supplier forced labor risk	83	2	5	4.2	0.934	-0.7	-0.866
	Employee turnover	83	1	5	3.48	0.875	0.113	-0.097

	Women in management positions	83	1	4	2.1	0.759	0.179	-0.465
	Equitable pay among gender	83	1	5	4.28	1.074	-1.728	2.276
	Labor practices in supplier onboarding	83	1	5	2.46	1.119	0.885	-0.014
	Salary discrepancies for permanent & contract staff	83	1	5	3.05	0.81	-0.512	0.466
	Work related injuries	83	3	5	4.11	0.733	-0.172	-1.099
	Regulatory fines	83	3	5	4.87	0.435	-3.427	11.256
	Negative press	83	1	5	4.7	0.676	-3.191	12.779
	Customer data breach	83	3	5	4.87	0.375	-2.891	8.331
	Anti-corruption policies	83	1	5	2.46	1.262	0.34	-1.127
	Lawsuits	83	2	5	4.8	0.512	-3.074	11.435
	Social responsibility criteria in supplier onboarding	83	1	5	1.94	0.992	1.121	1.01
Conventional criteria	Net profit to sales/Industry average	83	1	5	2.84	0.804	0.005	-0.116
	Current Ratio/ Industry Average	83	1	4	2.87	0.745	-0.142	-0.404
	Debt-to-asset ratio/Industry average	83	1	5	3.14	0.751	-0.599	1.088
	Debt-to-Equity Ratio/Industry average	83	1	5	3.16	0.757	-0.271	-0.236
	Debt Service Coverage/Industry average	83	1	4	2.72	0.786	-0.39	-0.07
	Sales turnover/Industry average	26	2	5	3.19	0.634	0.856	1.927
	Asset turnover/Industry average	83	1	4	2.9	0.655	-0.432	0.745
	Industry experience	83	1	5	3.9	0.709	-1.122	3.29
	Management reputation/experience	83	2	5	3.89	0.749	-0.533	0.384
	Level of demand for products/services	83	3	5	3.99	0.707	0.017	-0.961
	Valid N (listwise)	25						

### 5.3 Independent t-test

An independent-sample t-test was run to determine if the higher performance of borrowing clients on the sustainability and conventional criteria was effective at determining the membership of the loans in the default category

coded as 0 and the non-default category coded as 1. The results in table 5 below, showed that for the sustainability and conventional criteria variables, the borrower with higher means belonged to the non-default group except for Q2-economic\_susty (ratio of employee wages and benefits to revenue compared to the industry average) and Q13-social\_susty (number of incidences of customer data breaches). The results showed that for the Q2-economic\_susty, non-default loans (M= 2.81, SD=0.532) reported lower rating levels than default loans (M= 3.31, SD= 0.796). This difference was statistically significant ( $t(55.511) = 3.239, p = .002$ ) with a difference of 0.502 (95% CI, 0.191 to 0.812). Similarly, for Q13-social\_susty, non-default loans (M =4.85, SD =0.412) reported lower levels of rating than default loans (M =4.89, SD = 0.323). This difference was not statistically significant ( $t(81) = 0.376, p = .708$ ), with a difference of 0.032 (95% CI, -0.135 to 0.198).

Table 5: Independent T-Test

Variables	Indicators	Default _Or_no ndefau lt_loans	N	Mean	Std. Deviation	F	Sig.	t	df	Two- Sided p significance	Mean Difference	
Economic sustainability	Q1_Economic_susty	0	35	2.83	0.822	0.754	0.388	-1.172	82	0.245	-0.212	
		1	49	3.04	0.815							
	Q2_Economic_susty	0	35	3.31	0.796	9.343	0.003	3.239	55.511	0.002	0.502	
		1	48	2.81	0.532							
	Q3_Economic_susty	0	35	1.91	0.562	0	0.99	-0.452	81	0.652	-0.065	
		1	48	1.98	0.699							
	Q4_Economic_susty	0	34	2.35	0.734	0.801	0.374	-0.215	78	0.831	-0.038	
		1	46	2.39	0.829							
	Q5_Economic_susty	0	35	2.89	0.758	2.495	0.118	-3.003	81	0.004	-0.552	
		1	48	3.44	0.873							
	Q6_Economic_susty	0	35	3.09	1.292	1.341	0.25	-1.196	81	0.235	-0.31	
		1	48	3.4	1.067							
			0	35	2.69	0.9	0.656	0.42	-2.824	81	0.006	-0.606



	Q7_Economic_susty	1	48	3.29	1.01						
	Q8_Economic_susty	0	35	2.83	1.014	1.72	0.193	-3.288	81	0.001	-0.796
		1	48	3.63	1.142						
	Q9_Economic_susty	0	35	2.6	0.946	9.009	0.004	-2.519	80.888	0.014	-0.608
		1	48	3.21	1.254						
Environmental sustainability	Q1_Environment_susty	0	35	1.69	0.758	0	0.988	-1.649	81	0.103	-0.314
		1	48	2	0.923						
	Q2_Environment_susty	0	35	1.57	0.558	2.61	0.11	-2.58	81	0.012	-0.491
		1	48	2.06	1.019						
	Q3_Environment_susty	0	35	1.66	0.639	9.214	0.003	-4.358	79.197	<.001	-0.801
		1	48	2.46	1.031						
	Q4_Environment_susty	0	35	4.71	0.458	6.52	0.013	-1.258	64.423	0.213	-0.119
		1	48	4.83	0.377						
	Q5_Environment_susty	0	35	1.54	0.561	5.948	0.017	-4.116	77.996	<.001	-0.686
		1	48	2.23	0.951						
	Q6_Environment_susty	0	35	1.51	0.562	10.111	0.002	-4.153	76.823	<.001	-0.715
		1	48	2.23	0.994						
	Q7_Environment_susty	0	35	1.83	0.857	2.362	0.128	-3.072	81	0.003	-0.63
		1	48	2.46	0.967						
Social sustainability	Q1_Social_susty	0	35	1.91	0.781	5.063	0.027	-2.146	80.534	0.035	-0.419
		1	48	2.33	0.996						
	Q2_Social_susty	0	35	2.4	0.914	0.095	0.759	-2.192	81	0.031	-0.454
		1	48	2.85	0.945						
	Q3_Social_susty	0	35	3.8	1.106	0	0.998	-1.835	81	0.07	-0.45
		1	48	4.25	1.101						
	Q4_Social_susty	0	35	3.97	0.923	0.001	0.981	-1.978	81	0.051	-0.404
		1	48	4.38	0.914						
	Q5_Social_susty	0	35	3	0.767	3.691	0.058	-4.837	81	<.001	-0.833
		1	48	3.83	0.781						
	Q6_Social_susty	0	35	1.89	0.53	17.517	<.001	-2.375	78.977	0.02	-0.364
		1	48	2.25	0.863						
	Q7_Social_susty	0	35	3.8	1.302	10.749	0.002	-3.405	48.431	0.001	-0.825
		1	48	4.63	0.703						
	Q8_Social_susty	0	35	2.09	0.887	9.119	0.003	-2.811	80.972	0.006	-0.643
		1	48	2.73	1.198						
	Q9_Social_susty	0	35	3	0.97	3.125	0.081	-0.461	81	0.646	-0.083
		1	48	3.08	0.679						
	Q10_Social_susty	0	35	4.03	0.707	1.596	0.21	-0.846	81	0.4	-0.138
1		48	4.17	0.753							
Q11_Social_susty	0	35	4.83	0.514	1.989	0.162	-0.693	81	0.49	-0.067	
	1	48	4.9	0.371							
Q12_Social_susty	0	35	4.66	0.482	0.012	0.913	-0.477	81	0.635	-0.072	
	1	48	4.73	0.792							
Q13_Social_susty	0	35	4.89	0.323	0.656	0.42	0.376	81	0.708	0.032	
	1	48	4.85	0.412							
		0	35	2.43	1.145	1.948	0.167	-0.179	81	0.858	-0.051

	Q14_Social_susty	1	48	2.48	1.353						
	Q15_Social_susty	0	35	4.74	0.611	2.282	0.135	-0.793	81	0.43	-0.09
		1	48	4.83	0.429						
	Q16_Social_susty	0	35	1.49	0.612	7.028	0.01	-4.179	76.731	<.001	-0.785
		1	48	2.27	1.086						
	Conventional criteria	Q1_Conventional_criteria	0	35	2.4	0.651	0.009	0.924	-4.844	81	<.001
1			48	3.17	0.753						
Q2_Conventional_criteria		0	35	2.46	0.657	0.64	0.426	-4.832	81	<.001	-0.71
		1	48	3.17	0.663						
Q3_Conventional_criteria		0	35	3.03	0.954	3.873	0.053	-1.205	81	0.232	-0.201
		1	48	3.23	0.555						
Q4_Conventional_criteria		0	35	2.89	0.9	5.64	0.02	-2.714	53.142	0.009	-0.468
		1	48	3.35	0.565						
Q5_Conventional_criteria		0	35	2.26	0.817	10.117	0.002	-5.031	56.597	<.001	-0.805
		1	48	3.06	0.561						
Q6_Conventional_criteria		0	7	2.86	0.378	3.438	0.076	-1.698	24	0.103	-0.459
		1	19	3.32	0.671						
Q7_Conventional_criteria		0	35	2.49	0.612	6.956	0.01	-5.715	64.468	<.001	-0.723
		1	48	3.21	0.504						
Q8_Conventional_criteria		0	35	3.6	0.553	0.398	0.53	-3.56	81	<.001	-0.525
		1	48	4.13	0.733						
Q9_Conventional_criteria		0	35	3.51	0.658	1.125	0.292	-4.319	81	<.001	-0.652
		1	48	4.17	0.694						
Q10_Conventional_criteria	0	35	3.57	0.608	0.152	0.698	-5.282	81	<.001	-0.72	
	1	48	4.29	0.617							

## 5.4 Reliability and Validity Test

### 5.4.1 Cronbach Alpha

The Cronbach alpha was used to test the internal reliability of the scale, as suggested by Cronbach (1951), to ensure that the survey questions consistently measure the variables they were designed to measure. The Cronbach alpha computed for the economic sustainability variable revealed an alpha of 0.411. However, the analysis suggested that removing questions 1, 2, and 3 could

increase the alpha. Only question 2 reduced the alpha for the environmental sustainability criteria and was removed. Regarding the social sustainability criteria, question 9 was removed to increase the alpha. The conventional criteria had no questions that lowered the alpha. However, question 6 was removed due to 67 missing cases. The economic sustainability subscale consisted of 6 items ( $\alpha = .618$ ), the environmental sustainability subscale consisted of 6 items ( $\alpha = .883$ ), the social sustainability subscale consisted of 15 items ( $\alpha = .803$ ), and the conventional criteria subscale consisted of 9 items ( $\alpha = .813$ ). Taber (2018) suggests that an alpha above 0.6 is considered satisfactory, which indicates that the survey instrument reliably measured the intended variables and that the questions were consistently answered across the 5 banks. See the table 6 below.

*Table 6 : Cronbach Alpha*

Variables	Cronbach's Alpha	N of Items	Alpha reducing items removed
Economic sustainability	0.618	6	Q1,2,3
Environmental sustainability	0.883	6	Q4
Social sustainability	0.803	15	Q9
Conventional criteria	0.813	9	None (Q6 removed for missing cases)

### 5.4.2 Factor Analysis

Tavakol and Wetzel (2020) suggest that factor analysis can be used to determine if the items in a survey instrument measure the intended constructs. An initial factor analysis was conducted on the indicators of each

independent variable: economic sustainability, environmental sustainability, social sustainability, and conventional criteria. Principal axis factoring with varimax rotation was used for the analysis. Questions 1, 2, and 3 for economic sustainability were excluded from the factor analysis based on the Cronbach alpha results. The initial analysis also identified question 4 as having low pattern coefficients ( $<0.30$ ) and question 6 loading on a different factor. The independent t-test showed that question 6 was not statistically significant, so it was removed. Like economic sustainability, question 4 of the environmental sustainability variable was excluded based on the Cronbach alpha results. This indicator was also not statistically significant, with a p-value greater than 0.05 in the independent t-test. Question 9 was excluded for social sustainability based on the Cronbach alpha results. The initial factor analysis of the remaining indicators loaded on four factors. This suggested potential issues with construct validity, and the indicators might not be measuring the social sustainability variable. Consequently, indicators Q3, Q4, Q10, Q11, Q12, Q13, Q14, and Q15 were excluded due to having p-values greater than 0.05 in the independent t-test. The results showed that the remaining indicators loaded on one factor, but question 5 was excluded due to low pattern coefficients ( $<0.30$ ). Regarding conventional criteria, question 6 was excluded due to 67 missing cases. Question 3 was also excluded with an insignificant p-value in the independent t-test, while question 4 was removed because it loaded with low coefficients, all remaining conventional criteria indicators loaded on one factor.

The factor analysis results for all the conventional criteria and sustainability variables revealed that the indicators for most sustainability and conventional criteria loaded together, as shown in table 7 below. However, Q7-Social Susty ("on equal pay to male and female employees") was loaded with the conventional criteria and was removed. This suggests a high correlation between financial performance and equitable pay. Additionally, Q7-Environmental-Susty ("Does the company include environmental criterion in supplier onboarding?") was loaded with the social sustainability criteria and was retained as a social sustainability indicator. The final factor loadings are presented in the table below, while the final list of indicators for each variable is in Appendix D.

*Table 7 : Factor Analysis*

Variable	Indicators	Factor			
		1	2	3	4
Social sustainability	Q1_Social_susty	0.858		0.32	
	Q7_Environment_susty	0.772			
	Q8_Social_susty	0.765			
	Q2_Social_susty	0.756			
	Q16_Social_susty	0.708	0.421		
	Q6_Social_susty	0.421		0.406	
Conventional criteria	Q2_Conventional_criteria		0.768		
	Q1_Conventional_criteria		0.672		
	Q9_Conventional_criteria	0.313	0.603		0.335
	Q7_Conventional_criteria		0.555		
	Q5_Conventional_criteria		0.538		
	Q10_Conventional_criteria		0.511		0.448

	Q8_Conventional_criteria		0.404		0.357
Environmental sustainability	Q3_Environment_susty	0.528		0.708	
	Q5_Environment_susty	0.472		0.628	
	Q6_Environment_susty	0.422		0.608	
	Q2_Environment_susty			0.527	
Economic sustainability	Q7_Economic_susty	0.4			0.698
	Q8_Economic_susty				0.565
	Q9_Economic_susty			0.342	0.47
	Q5_Economic_susty				0.45

### 5.4.3 Multicollinearity

As Kim (2019) suggested, the multicollinearity of the independent variables was tested using linear regression to ensure they were not highly correlated and suitable for regression analysis. The results, presented in Appendix E, indicate no multicollinearity. All variance inflation factors (VIFs) for the indicators are below 10, all tolerance levels are above 0.10, and no variance proportions have two or more values exceeding 0.50 on any dimension.

## 5.5 Logistic regression model (Enter Method)

### 5.5.1 Model fit

This study used binary logistic regression to analyze the relationship between conventional criteria and loan performance and the impact of adding sustainability criteria on loan default or non-default prediction. Binary logistic

regression was chosen because, as suggested by Fritz and Berger (2015), it is suitable for investigating the relationship between a dichotomous dependent variable (like loan performance) and categorical or continuous independent variables (like the criteria used in this study). This model was designed to predict the binary outcome of loan performance -0 for default loans and 1 for non-default loans based on the independent variables of economic sustainability, environmental sustainability, social sustainability, and conventional criteria measured by bank credit officers on a Likert scale. See Appendix I for indicators in logistic regression. The logistic regression model is presented below:

$$\text{CreditRisk} = \beta_1 * \text{Coventional} + \beta_2 * \text{Econ.Sust} + \beta_3 * \text{Env.Sust} + \beta_4 * \text{Soc.Sust}$$

Where  $\beta_1$  = log odds of conventional criteria

$\beta_2$  = log odds of economic sustainability performance

$\beta_3$  = log odds of environmental sustainability performance, and

$\beta_4$  = log odds of social sustainability performance

The first binary logistic model was used to predict the impact of economic sustainability performance on loan default or non-default. The overall model was statistically significant when compared to the null model ( $\chi^2(4) = 18.987$ ,  $p < .001$ ), explaining a 27.5% variation in loan outcomes (Nagelkerke R<sup>2</sup>). Column Exp(B), i.e., odds ratio (OR), showed that the OR for Q5\_Economic\_susty (impact of climate regulations on company profits) was the highest at 1.945 with a 95% confidence interval of (1.059, 3.574), indicating that borrowing clients with the more substantial positive influence of potential of climate regulation on company profit is 1.945 times more likely to fall into the

non-default loan category. The OR for this model were all greater than one, indicating a positive relationship between economic sustainability and loan performance.

The second model was used to predict the impact of environmental sustainability on loan outcomes. This model was statistically significant in comparison to the null model ( $\chi^2(4) = 18.558, p < .001$ ), explaining a 26.9% variation in loan outcomes (Nagelkerke R<sup>2</sup>). The OR for all the variables was above 1, showing a positive association between environmental performance and non-default loans.

The third model predicted the impact of social sustainability on loan performance. The model was statistically significant in comparison to the null model ( $\chi^2(6) = 18.872, p = .004$ ), explaining a 27.3% variation in loan outcomes (Nagelkerke R<sup>2</sup>). The OR for most of the variables was above 1 except Q1\_social\_susty and Q8\_social\_susty, which had OR of 0.458 with a 95% confidence interval (0.157, 1.335) and 0.882 with a 95% confidence interval (0.406, 1.916) respectively. The result indicates that borrowing clients who included human rights and good labor practices criteria in supplier onboarding were likelier to default on their loans.

The fourth model was used to predict the impact of all the sustainability variables (economic, environmental, and social sustainability) on predicting loan outcomes. Model 5 was statistically significant and was superior to all the



previous models in terms of the overall model fit ( $\chi^2(14) = 45.643$ ,  $p < .001$ ), explaining a 56.9% variation in loan outcomes (Nagelkerke R<sup>2</sup>). The OR was above 1 for most of the variables except for Q5\_economic\_susty with OR= 0.691 at 95% confidence interval (0.141, 3.387), Q1\_social\_susty OR = 0.198 at 95% confidence interval (0.045, 0.877).

The fifth model used to predict the impact of conventional criteria on loan outcomes was statistically significant and superior to the sustainability model in terms of overall model fit ( $\chi^2(7) = 51.032$ ,  $p < .001$ ), explaining a 61.7% variation in loan outcomes (Nagelkerke R<sup>2</sup>). The OR was above 1 for most variables except for Q2\_Conventional\_criteria with OR = 0.995 at a 95% confidence interval (0.284, 3.485). This indicates that companies with current ratios above the industry average were likelier to default on their loans.

The final model, which combined the sustainability and conventional criteria to predict loan outcomes, had the best overall model fit ( $\chi^2(21) = 76.514$ ,  $p < .001$ ), explaining an 81% variation in loan outcomes (Nagelkerke R<sup>2</sup>). The OR was above 1 for 14 variables while 7 variables namely Q2\_Conventional\_criteria, OR= 0.367 (95% C.I at 0.052, 2.592), Q8\_Conventional\_criteria, OR= 0.114 (95% C.I at 0.003, 4.77), Q9\_Economic\_susty, OR= 0.34 (95% C.I at 0.059, 1.948), Q5\_Environment\_susty, OR= 0.418 (95% C.I, at 0.019, 8.988), Q1\_Social\_susty, OR= 0.09 (95% C.I at 0.003, 2.487) Q7\_Environment\_susty, OR = 0.878 ( 95% C.I at 0.143, 5.369) and Q16\_Social\_susty, OR= 0.178 ( 95% C.I at 0.002, 13.979) signifying that there is a higher performance on

these will increase the odds of the borrowing clients belonging to the default loan category. See table 8 below.

*Table 8: Logistic regression model*

<b>Variables</b>	<b>Indicators</b>	<b>B</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Exp(B)</b>
Economic sustainability	Q5_Economic_susty	0.665	0.31	0.032	1.945
	Q7_Economic_susty	0.278	0.3	0.354	1.32
	Q8_Economic_susty	0.48	0.26	0.065	1.616
	Q9_Economic_susty	0.228	0.247	0.356	1.256
	Constant	-4.805	1.391	<.001	0.008
Environmental sustainability	Q2_Environment_susty	0.201	0.377	0.594	1.223
	Q3_Environment_susty	0.496	0.574	0.387	1.642
	Q5_Environment_susty	0.304	0.603	0.615	1.355
	Q6_Environment_susty	0.514	0.443	0.245	1.672
	Constant	-2.527	0.831	0.002	0.08
Social sustainability	Q7_Environment_susty	0.651	0.44	0.139	1.918
	Q1_Social_susty	-0.78	0.545	0.153	0.458
	Q2_Social_susty	0.168	0.381	0.659	1.183
	Q6_Social_susty	0.217	0.384	0.572	1.242
	Q8_Social_susty	-0.126	0.396	0.75	0.882
	Q16_Social_susty	1.182	0.475	0.013	3.262
	Constant	-2.16	0.958	0.024	0.115
All sustainability	Q7_Economic_susty	0.038	0.471	0.935	1.039
	Q8_Economic_susty	0.45	0.369	0.222	1.568
	Q9_Economic_susty	0.361	0.351	0.304	1.434
	Q5_Economic_susty	1.423	0.572	0.013	4.148
	Q3_Environment_susty	1.244	0.888	0.161	3.469
	Q5_Environment_susty	-0.37	0.811	0.649	0.691
	Q6_Environment_susty	0.74	0.652	0.256	2.096
	Q2_Environment_susty	0.651	0.658	0.322	1.918
	Q1_Social_susty	-1.617	0.758	0.033	0.198

	Q7_Environment_susty	0.274	0.509	0.591	1.315
	Q8_Social_susty	0.186	0.535	0.728	1.205
	Q2_Social_susty	0.724	0.495	0.143	2.064
	Q6_Social_susty	0.119	0.53	0.822	1.126
	Q16_Social_susty	0.944	0.649	0.146	2.57
	Constant	-12.26	3.329	<.001	0
Conventional criteria	Q1_Conventional_criteria	0.662	0.564	0.24	1.938
	Q2_Conventional_criteria	-0.005	0.639	0.994	0.995
	Q9_Conventional_criteria	0.179	0.564	0.751	1.196
	Q7_Conventional_criteria	1.727	0.831	0.038	5.624
	Q5_Conventional_criteria	0.989	0.562	0.078	2.689
	Q10_Conventional_criteria	1.035	0.611	0.09	2.814
	Q8_Conventional_criteria	0.33	0.505	0.513	1.391
	Constant	-15.088	3.363	<.001	0
Sustainability and Conventional criteria	Q1_Conventional_criteria	2.747	1.561	0.079	15.588
	Q2_Conventional_criteria	-1.003	0.998	0.315	0.367
	Q9_Conventional_criteria	0.063	2.15	0.977	1.065
	Q7_Conventional_criteria	3.211	1.989	0.106	24.793
	Q5_Conventional_criteria	2.041	1.308	0.119	7.7
	Q10_Conventional_criteria	2.888	1.95	0.139	17.965
	Q8_Conventional_criteria	-2.168	1.903	0.255	0.114
	Q7_Economic_susty	0.291	1.284	0.821	1.338
	Q8_Economic_susty	0.739	0.764	0.333	2.094
	Q9_Economic_susty	-1.079	0.891	0.226	0.34
	Q5_Economic_susty	6.561	3.342	0.05	707.142
	Q3_Environment_susty	5.006	3.166	0.114	149.367
	Q5_Environment_susty	-0.872	1.565	0.578	0.418
	Q6_Environment_susty	0.473	1.041	0.65	1.605
	Q2_Environment_susty	1.745	1.513	0.249	5.728
	Q1_Social_susty	-2.41	1.695	0.155	0.09

	Q7_Environment_susty	-0.131	0.924	0.888	0.878
	Q8_Social_susty	2.573	1.616	0.111	13.102
	Q2_Social_susty	1.521	1.423	0.285	4.576
	Q6_Social_susty	1.913	1.468	0.193	6.771
	Q16_Social_susty	-1.725	2.226	0.438	0.178
	Constant	-60.105	27.368	0.028	0

### 5.5.2 Classification table

Table 9 below presents the percentage of accurate prediction of economic, environmental, social, and all sustainability variables, conventional credit rating criteria, and the combination of the sustainability and conventional variables logistic regression models. The results show that social sustainability had the highest percentage of sustainability indicators, predicting 62.9% of default loans accurately, 79.2% for non-default loans, and an overall accuracy of 72.3%. The overall prediction accuracy of social sustainability was 3.6% higher than that of environmental and economic sustainability criteria, and both had an overall prediction accuracy of 68.7%. The model with all sustainability criteria had a higher prediction accuracy of 75.9%; this was 3.6% higher than the social sustainability model. The model that tested the impact of the conventional criteria alone had a better prediction accuracy than the conventional criteria at 82.9% for default loans and 87.5% for non-default loans, achieving an overall prediction accuracy of 85.5%. Combining the conventional and sustainability criteria increased default loan prediction by 2.8%, non-default loan prediction by 4.2%, and overall loan outcome prediction by 3.7%.

Table 9: Correct classification percentage

	Convention al criteria	Economic Sustainabilit y	Environment al Sustainabilit y	Social Sustainabilit y	Sustainabilit y criteria	Sustainabilit y and Convention al criteria	Loa n size	Firm secto r	Fir m size	Ban k Typ e
Defaul t	82.9	54.3	60	62.9	71.4	85.7	85.7	97.1	88. 6	85.7
Non- defaul t	87.5	79.2	75	79.2	79.2	91.7	91.7	97.9	91. 7	87.5
Total	85.5	68.7	68.7	72.3	75.9	89.2	89.2	97.6	90. 4	86.7

## 5.6 Moderating Variables

Following similar studies, robustness tests were conducted to ascertain if the loan size, firm's sector, firm size, and borrowing clients' bank affected the relationship between sustainability performance and credit risk of the Nigerian bank's corporate borrowing clients. The results of the tests are detailed below.

### 5.6.1 Independent T-tests of Loan Size

An independent-sample t-test was run to determine if the loan amount was effective at determining the membership of the loans in the default category coded as 0 and the non-default category coded as 1. The results showed that the borrowers with the higher loan amount belonged to the non-default

category (M= ~~N~~6573885391, SD=~~N~~15443054617) than those in the default category (M=~~N~~5855800000, SD= ~~N~~8534936310). This difference was not statistically significant ( $t(83) = 0.249$ ,  $p = 0.804$ ) with a difference of 718085391 (95% CI, 5007891036 to 6444061818).

### 5.6.2 Chi-square test of borrower's sector

The chi-square test and crosstabs of the sector were run to determine if the borrower's sector impacts loan outcomes. The crosstab of the loan outcome and sector in the table below shows that borrowing clients in the manufacturing sector had a significantly lower number of default loans than expected. In comparison, the oil sector and power sector had a higher number of default loans than expected. The Pearson Chi-Square test also revealed that the relationship was statistically significant with ( $\chi^2(9) = 19.093$ ,  $p = 0.024$ ). See details in table 10 below.

Table 10: Cross tab: Loan Outcome/Sector

Loan outcome	Category	Agro-Allied	Construction	Health	Manufacturing	Oil & Gas	Others	Power	Real Estate	Service	Entertainment & Tourism
Default	Count	1	3	1	7	11	2	4	3	2	1
	Expected Count	3.3	3.3	0.4	10.7	7.8	1.2	1.6	2.1	4.1	0.4
Non-default	Count	7	5	0	19	8	1	0	2	8	0
	Expected Count	4.7	4.7	0.6	15.3	11.2	1.8	2.4	2.9	5.9	0.6
Total	Count	8	8	1	26	19	3	4	5	10	1
	Expected Count	8	8	1	26	19	3	4	5	10	1

### 5.6.3 Chi-square test of borrowing firm's size

The chi-square test and crosstabs of the firm size, as shown in table 11, were run to determine if the borrowing firm's size impacts loan outcomes. The crosstab in the table below did not reveal a significant difference between the expected default and non-default loans across small, medium, and large firms. The Pearson Chi-Square test revealed that the relationship was not statistically significant with ( $\chi^2(2) = 1.932, p=0.381$ )

Table 11: Crosstab: Loan Outcome/Firm Size

Loan outcome	Category	Small	Medium	Large	Total
Default	Count	6	8	22	36
	Expected Count	7.1	10	18.8	36
Non-default	Count	11	16	23	50
	Expected Count	9.9	14	26.2	50
Total	Count	17	24	45	86
	Expected Count	17	24	45	86

### 5.6.4 Chi-square test of borrowing firm's bank

The chi-square test and crosstabs of the borrowing firm's bank, as shown in table 12, were run to determine if the borrowing firm's bank impacts loan outcomes. The crosstab did not reveal a significant difference between banks

A, B, C, D, and E. The Pearson Chi-square test revealed that the relationship was not statistically significant with ( $\chi^2(2) = 6.789, p=0.147$ ).

Table 12: Loan Outcome/Bank

Loan outcome		Bank A	Bank B	Bank C	Bank D	Bank E	Total
Default	Count	12	1	10	9	3	35
	Expected Count	10.5	1.7	6.3	13.1	3.4	35
Non-default	Count	13	3	5	22	5	48
	Expected Count	14.5	2.3	8.7	17.9	4.6	48
Total	Count	25	4	15	31	8	83
	Expected Count	25	4	15	31	8	83

## 5.6.5 Logistic regression including moderating variables

### 5.6.5.1 Enter method: Loan size

Using the Enter Method on IBM SPSS, a logistic regression model was run with the conventional criteria, sustainability criteria, and moderating variables (loan size, firm size, firm sector, and firm's bank). The model fit of the logistic regressions with firm size and sector pseudo-R-square (Nagelkerke R-squared) values of 1 indicate overfitting of the models. However, the model with loan size had an overall significant model fit, ( $\chi^2(22) = 76.752, p < .001$ ) and a Nagelkerke R-squared explaining 81.1% variation. The prediction accuracy of the default loan remained the same at 85.7%, and the non-default loan prediction was 91.7%, while the overall prediction accuracy did not change from 89.2. The result revealed that the loan size did not influence the



predictability of loan outcomes based on sustainability and conventional criteria.

### **5.6.5.2 Stepwise regression**

The forward stepwise likelihood ratio method was used to determine the impact of borrowing clients' sector and size on sustainability performance and conventional criteria on the prediction of loan outcomes.

#### **5.6.5.2.1 Firm sector**

The model was statistically significant when the firm sector and its interaction with the indicators were included in the logistic regression using the stepwise method  $\chi^2(15) = 105.380, p < .001$  and a Nagelkerke R-squared explaining 96.7% of variation at step 7. The Nagelkerke R-squared was significantly higher than the model with only sustainability and conventional criteria, with R<sup>2</sup> explaining 81%. The prediction accuracy improved to 97.6% overall, 97.1% for default, and 97.9 for non-default, as shown in table 8. The results indicate that the sector influences the relationship between sustainability, conventional criteria, and loan outcomes. See Appendix F.

#### **5.6.5.2.2 Firm size**

The model was statistically significant when the firm size and interaction were included using a stepwise logistic regression method,  $\chi^2(6) = 70.256, p < .001$  and a Nagelkerke R-squared explaining 76.8% variation at step 6; this was lower than the 81% variation in the model without the moderating variable. This

indicates that the model without the firm size moderator is stronger; however, the overall correct prediction accuracy was 90.4%, as shown in table 8, which was not significantly higher compared to the firm sector. See Appendix G.

#### **5.6.5.2.3 Borrowers Bank**

The model was statistically significant when the firm size and interaction were included using a stepwise logistic regression method,  $\chi^2(5) = 63.023$ ,  $p < .001$ ) and a Nagelkerke R-squared explaining 71.5% variation at step 5; this was significantly lower than the 81% variation in the model without the moderating variable. This indicates that the model without the borrowers' bank is stronger; however, the overall correct prediction accuracy was 86.7%, as shown in table 8. The impact on prediction accuracy was not as significant as the firm sector. See Appendix H for variables in the equation.

### **5.7 Chapter Summary**

This section presented the statistical analysis results and provided insights into the impact of sustainability on the default risk of Nigerian banks' corporate borrowing clients, how it impacts the predictability of credit, and how integrating sustainability performance into credit risk assessment impacts credit risk prediction. The population parameter revealed that most surveys were based on information from large corporate borrowers, followed by medium-sized and small businesses. Advancing to the statical tests conducted, many

of the thesis hypotheses were supported. Overall, assessing sustainability performance with conventional credit assessment criteria increased the predictability of credit risk. Interestingly, the social sustainability indicators have the most significant impact on default risk prediction. For the moderating variables, although firm size, firm sector, and firm's bank changed the prediction accuracy, the firm sector had the best model fit and significantly impacted the relationship between the independent and dependent variables.

The following chapter discusses results through the lens of the Good Management Theory and previous literature.

## **Chapter 6: Discussion of Results**

### **6.1 Introduction**

With the consistent need to drive an increase in business sustainability, varying findings on the impact of sustainability on credit risk, inadequate research using primary data, and lack of research on this subject in Nigeria, this research investigated to answer the question: Does integrating the sustainability performance of corporate borrowing clients with conventional rating criteria into the credit risk assessment procedure improve the validity of credit risk prediction in Nigerian Banks? Overall, this study found that integrating sustainability assessment improves the prediction of default risk of Nigerian banks' corporate borrowing clients, confirming the results of previous studies (Weber et al., 2010, 2015). This study enriches the Good Management Theory that was used in the study. Using this Good Management Theory allowed this study to ascertain if sustainability performance causes a reduction in default risk and if assessing sustainability performance can improve credit risk prediction. At the time of this thesis, no previous studies have examined this relationship using the Good Management Theory focused on Nigerian companies.

This chapter discusses the results of this quantitative study and describes their possible theoretical explanation.

## **6.2 Descriptive Statistics Results**

The descriptive statistics of the survey (Chapter 5: Statistical Test Results) showed that over fifty percent of the responses were for large borrowing clients. The potential explanation for the low responses for small and medium-sized firms is the need for more information to assess their sustainability performance. The analysis also revealed that most credit officers who completed the survey had adequate experience in credit risk assessment. Overall, Nigerian corporate borrowing clients performed better in terms of social sustainability. Similarly, previous studies such as Kvasničková Stanislavská(2023) have found that while firms in developed economies focus on environmental sustainability, firms in emerging economies report more on social sustainability.

Two explanations can be suggested from the descriptive statistics: It is difficult to obtain a report on the sustainability performance of small businesses, which Setyaningsih et al. (2024) emphasized. The Nigerian bank's corporate borrowing client focuses more on social sustainability performance.

## **6.3 Interpretation of Statistical Results**

Statistical procedures were used to examine the association between integrating sustainability performance with conventional credit risk assessment

criteria and the prediction of loan outcomes. The following is an interpretation of the results through the lens of the Good Management Theory. First, from the comparative standpoint, the results revealed that the conventional credit risk assessment criteria have a higher impact on predicting credit risk, and borrowing clients with higher performance on this variable were less likely to fall into the default loan category. A potential explanation for the impact of conventional criteria on loan outcome is that it measures financial capability, which is crucial to loan repayment. This aligns with the findings of Weber et al. (2010, 2015) that conventional credit risk criteria had the highest impact on credit risk prediction in Germany and Bangladesh.

Interestingly, for the conventional indicators, the industry average current ratio was associated with an increase in loan default when only conventional criteria were assessed and when integrated with sustainability criteria. However, for years in the industry, it was associated with reduced loan default when conventional criteria were assessed but increased loan default when integrated with sustainability criteria. A possible explanation for the finding on the current ratio is that maintaining high liquid assets could reduce firms' profitability, cashflows, and loan repayment capability. On the other hand, the results on the impact of a firm's industry experience could be because sustainability performance is more effective at reducing the credit risk of growing firms than mature and older firms. After all, growing firms can increase their market share better due to their sustainability performance and benefit from sustainability-related investments than mature firms. Similarly, Wang and

Yang (2023) found in a study of a developing economy, China, that better sustainability performance had a more significant negative correlation with the credit rating of growing firms than mature or older firms. Also, from a comparative point of view, social sustainability improved credit risk prediction for the sustainability variable better than environmental and economic sustainability, which were at par. A possible explanation for this is that improving social performance is better valued in a developing economy, as Stanislavská (2023) found; this has a higher risk prediction impact in Nigeria. Similarly, Anand et al. (2023) and Palmieri et al. (2023) found social performance to have a more significant risk-reducing impact than other sustainability measures.

Regarding the impact of integrating sustainability performance with conventional criteria on credit risk prediction, the cause-effect relationship proposed by Waddock and Graves (1997) in the Good Management Theory has been confirmed for Nigerian borrowing clients. The study found that integrating sustainability assessment in evaluating borrowing clients improved correct credit risk prediction by 3.7%. This finding aligns with Weber et al. (2010, 2015) findings in Germany and Bangladesh. Other studies have also found that better sustainability performance reduces credit risk (Abdul Razak et al., 2023; Caiazza et al., 2023; Li et al., 2022; Wang & Yang, 2023). Waddock and Graves's (1997) Good Management Theory provided a possible explanation, stating that improved sustainability performance reduces financial risks such as credit risk because it improves a firm's reputation, reduces fines and conflicts,

and reduces the volatility of their cash flows. Similarly, Chollet and Sandwidi (2018) posit that sustainability issues are essential in risk evaluation because they are risk indicators. Although, overall, firms with better sustainability performance had lower default risk, sourcing products from local companies, increased investments in innovations to reduce environmental impact, and inclusion of human rights criteria were associated with increased default risk. One possible explanation for increased credit risk when using local supplies is the low quality of supplies from some local companies, which results in increased costs, which could reduce profitability.

The possible explanation for investments in environmental innovation is a redirection of cashflows from loan repayment to investments in environmental innovation. Interestingly, Palmieri et al. (2023) found that for firms in the European manufacturing and health sectors, increased innovation to improve environmental performance was associated with increased credit risk because it reduces the cashflows available to meet their loan obligations. A possible explanation for increased credit risk due to the inclusion of human rights criteria in supplier onboarding was found by Hoejmose et al. (2013) that it is expensive to purchase from socially responsible suppliers. The increase in supply cost could result in a reduction in cashflows, thereby increasing credit risk. The findings on the impact of purchases from socially responsible firms suggest that these firms are more expensive and not competitive. The Barney (1991) Resource Based Theory provides a possible explanation for this finding that for social responsibility to create value for an organization, the firm must be able to strategically combine it with other resources to reduce its operating



cost and increase revenue. This suggests that the socially responsible suppliers have been unable to gain a competitive advantage because they have not strategically combined their social responsibility with other resources to improve their efficiency and effectiveness.

The results, however, revealed that in Nigeria, firm size, loan size, and firm's bank did not significantly impact the association between integrating sustainability performance with conventional criteria and credit risk, as found by Weber et al. (2015a) in a developing economy. However, unlike Weber et al. (2015a), the firm sector was found to impact this relationship in Nigeria. This study found a significant increase in the overall prediction accuracy when the evaluation of the firm sector was included. Studies in developed economies have also found that the firm sector impacts the relationship between sustainability performance and credit risk because the impact of corporate sustainability performance on credit risk differs across sectors (Aslan et al., 2021; Caiazza et al., 2023).

#### **6.4 Chapter Summary**

This chapter discussed the results from the descriptive statistics and interpreted the statistical results of the thesis. Overall, Nigerian banks' corporate borrowing clients with better sustainability performance had lower default risk, which was associated with increased predictability of their credit risk. This result is as expected in the Good Management Theory and also contributes to the

Resource Based Theory. However, it is evident that of the sustainability indicators, social sustainability performance has the most significant impact on credit risk prediction. This study adds the following to existing literature: growing firms have reduced loan defaults by improving sustainability performance in Nigeria, supply chain-related sustainability performance increases the credit risk of Nigerian firms, and the firm sector impacts the relationship between sustainability performance and credit risk in Nigeria.

## **Chapter 7: Conclusion, Contributions, and Recommendations**

Nigeria has a significant SDG achievement gap due to inadequate funding. However, banks can aid in the reduction of this funding gap. Therefore, it is essential to ascertain if it is beneficial for Nigerian banks to incorporate sustainability considerations in their asset allocation, thereby funding sustainable business. However, although the literature has found that integrating sustainability in credit assessment improves credit risk prediction, studies have yet to examine this relationship in Nigeria at the time of this study. This study sought to investigate the impact of integrating sustainability performance with conventional credit risk criteria on the credit risk prediction of the banks. Using a newly developed survey instrument, the loan outcomes and performance of the corporate borrowing clients on sustainability and conventional risk assessment criteria were evaluated. A binary logistic regression was carried out to ascertain the impact of the independent variables on the dependent variable.

The previous chapter discussed the findings through the lens of Good Management Theory and previous academic literature. This chapter discusses this study's contribution to academia and practitioners, its limitations, and recommendations for future research.

## **7.1 Contributions of the Research**

### **7.1.1 Contributions to Academic Literature**

This thesis has three contributions to academic literature. Firstly, it designed a survey instrument based on the Global Reporting Framework to assess Nigerian businesses' sustainability performance. While previous studies have designed sustainability survey instruments in other countries (Mengistu & Panizzolo, 2021; Weber et al., 2010), there have been no studies to the best of our knowledge when writing this thesis that designed survey instruments to measure three sustainability dimensions: economic, social, and environmental of Nigerian bank corporate borrowing clients. Therefore, this thesis developed an instrument to measure the sustainability performance of Nigerian companies.

This thesis's second contribution to academic literature is that it is the first to test the Good Management Theory to ascertain the cause-effect association between the sustainability performance of corporate borrowing clients and credit risk prediction in Nigeria. Overall, the results showed that better sustainability performance reduces the default risk of Nigerian corporate borrowing clients and increases the predictability of credit risk for Nigerian Banks. The borrowing client's sector was found to increase the impact of these variables on credit risk prediction.

The third contribution of this thesis to academic literature is to the Resource Based Theory suggesting that it was not beneficial for Nigerian banks borrowing clients to purchase from socially responsible firms because they did not effectively combine their strategic resources to gain a competitive advantage. The results showed purchases from socially responsible firms were associated with default loans.

The final contribution to the academic literature is that this study used primary data and included the evaluation of small and medium firms, which are often excluded from previous investigations such as Huang et al. (2023) and Li et al. (2022) into the relationship between sustainability and credit risk in developing economies. This is important because it is important to know if sustainability performance reduces the financial risk of small and medium firms.

Overall, this study made three contributions to academic literature: the development of a survey instrument to measure the sustainability performance of Nigeria's corporate borrowing clients, the test of the Good Management Theory in a different context, and the inclusion of unlisted firms in the sample of this study.

### **7.1.2 Contributions and Recommendations to Practitioners**

This thesis provides three contributions to practice. First, the survey instrument presents a valuable tool that Nigerian banks can use to integrate sustainability performance evaluation in credit risk prediction. Second, the results of the statistical test offer valuable information that integrating sustainability performance into credit risk assessment can improve credit risk prediction. Improved sustainability performance was associated with lower default risk. However, the firm sector significantly improved the relationship. Third, the results indicate that social sustainability had the most significant impact on credit risk reduction in Nigeria.

The results show three broad recommendations for banks, corporate borrowing clients, and regulators. First, Nigerian banks should integrate sustainability assessment, especially social sustainability, into their credit risk assessment with the survey instrument designed in this study to improve their credit risk prediction. Another recommendation is that Nigerian firms improve their sustainability performance because it reduces their credit risk. Thirdly, Nigerian regulators should incentivize sustainability reporting in Nigerian businesses to aid in incorporating sustainability in banks' credit risk assessment to improve their credit risk prediction.

## **7.2 Limitations of the research**

Like previous research, this thesis has its innate limitations. First, the sample was limited to eighty-three (83) complete responses on Nigerian corporate borrowing clients, and the responses were obtained from five Nigerian banks' credit officers. Therefore, examining the association between sustainability and credit risk could be limited based on the sample size. A related limitation is the reliance on the evaluation of credit risk officers. It could be argued that there could be some subjectivity in their assessment. To overcome this limitation, the credit officers were trained on how to use the survey for the evaluation. Nevertheless, previous studies by Weber et al. (2015a) have examined this relationship in a different context using a similar sample size relying on credit officers' evaluation.

## **7.3 Recommendations for future research**

The results of this thesis indicated two recommendations for future research. The first recommendation entails expanding the scope of this thesis through a qualitative study to ascertain the reasons for the significance of social subfactors over other sustainability indicators on credit risk prediction. The second recommendation is to use the survey instrument developed to conduct a similar study in different African countries with a similar business environment.

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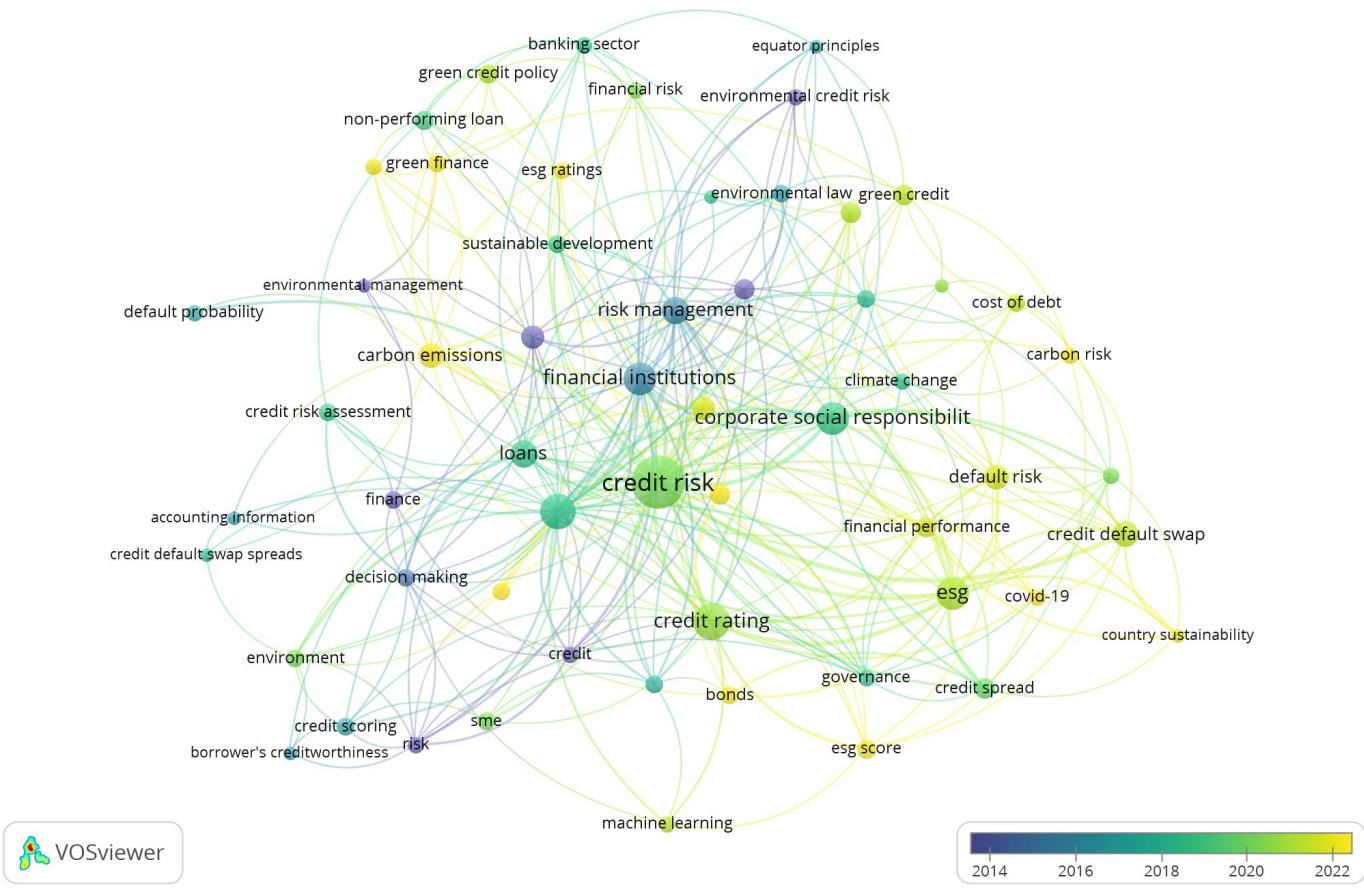


## Appendices

### Appendix A: Keyword Standardization

S/N	Description of Standardisation steps
1	Extracted three important keywords by reading the Title, and Abstract of articles with missing authors keywords (Carè et al., 2023; Ding et al., 2001).
2	Merged synonyms. For instance banking industry was converted to banking sector, credit risk evaluation was converted to credit risk assessment etc. (Carè et al., 2023; Castriotta et al., 2021; Dehdarirad et al., 2014).
3	Converted some abbreviations into full words. For instance "CDS spread" to "credit default swap spread" etc. (Carè et al., 2023; Choi et al., 2011)
4	Removed all irrelevant keywords. For instance, statistical methods, and country related keywords e.g. China, logistic regression model (Carè et al., 2023; Castriotta et al., 2021; Ding et al., 2001).
5	Consolidated singular and plural tenses of keywords. For instance “carbon risks” was converted to “carbon risk”, “environmental laws” was converted to “environmental law” (Carè et al., 2023; Castriotta et al., 2021; Dehdarirad et al., 2014)

# Appendix B: Overlay Visualization



### Appendix C: Keyword Details

Cluster	Cluster color	Keywords	Theme
1	Red	banking sector; credit risk assessment; decision making; environmental management; esg ratings; finance; financial institutions performance; financial risk; green credit policy; green finance; non-performing loan; risk assessment; sustainability; sustainable development;	The role of banks and green credit policy in promoting environmental sustainability.
2	Green	Accounting information; borrower's creditworthiness; carbon emissions; credit default swap spreads; credit scoring; default probability; environment; esg performance; loans; risk;	Relationship between environmental performance and credit risk.
3	Deep blue	carbon risk; climate change; collateral; cost of debt; default risk; environmental law; environmental performance; environmental risk; esg disclosure; green credit;	Sustainability performance; environmental, social, economic, and governance impact credit risk
4	Yellow	bonds; corporate social responsibility; corporate sustainability; country sustainability; credit default swap;	Impact of country-level sustainability on the impact of sustainability performance and corporate

		credit risk; credit spread; esg; financial performance; governance;	social responsibility (CSR), on credit risk.
5	Purple	climate risk; credit; environmental credit risk; equator principles; esg risk; financial institutions; risk management; sustainable finance;	The environmental credit risk management practices in banks
6	Light blue	covid-19; credit rating; credit risk management; esg score; machine learning; sme;	The impact of COVID-19 on the ESG-credit risk relationship, and machine learning techniques for credit risk assessment

## Appendix D: Indicators in Final Factor Analysis for the Logistic Regression Analysis

Economic sustainability	Environmental sustainability	Social sustainability	Conventional criteria
Local staff employment	Environmental Innovations	Human rights criteria in supplier onboarding	Current Ratio/ Industry Average
Job creation through value chain	Investment in Environmental innovations	Environmental sustainability criteria in supplier onboarding	Net profit to sales/Industry average
Sourcing from local suppliers	Energy consumption cost	Good labor practices in supplier onboarding	Management reputation/experience
Climate regulation on profit	Recycled material use	Human rights criteria in employee onboarding	Asset turnover/Industry average
		Social responsibility criteria in supplier onboarding	Debt Service Coverage/Industry average
		Number of women in management positions	Level of demand for products/services
			Industry experience

### Appendix E: Multicollinearity Test

Indicators	Unstandardized Coefficients		Standardized Coefficients		t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta				Tolerance	VIF
(Constant)	-1.799	0.404			-4.452	<.001		
Q7_Economic_susty	-0.014	0.064	-0.028		-0.218	0.828	0.427	2.344
Q8_Economic_susty	0.017	0.051	0.04		0.337	0.738	0.506	1.975
Q9_Economic_susty	-0.004	0.048	-0.008		-0.074	0.942	0.567	1.763
Q5_Economic_susty	0.171	0.064	0.298		2.671	0.01	0.576	1.735
Q3_Environment_susty	0.159	0.109	0.309		1.46	0.149	0.16	6.238
Q5_Environment_susty	-0.125	0.112	-0.22		-1.117	0.269	0.185	5.403
Q6_Environment_susty	0.013	0.087	0.024		0.151	0.88	0.286	3.493
Q2_Environment_susty	0.049	0.064	0.087		0.753	0.454	0.544	1.838
Q1_Social_susty	-0.047	0.111	-0.088		-0.425	0.672	0.168	5.968
Q7_Environment_susty	0.065	0.077	0.126		0.843	0.403	0.323	3.1
Q8_Social_susty	0.029	0.07	0.064		0.407	0.685	0.288	3.478
Q2_Social_susty	0.033	0.081	0.063		0.405	0.687	0.298	3.359
Q16_Social_susty	-0.039	0.095	-0.077		-0.406	0.686	0.2	5.007
Q6_Social_susty	-0.022	0.074	-0.034		-0.302	0.764	0.558	1.792
Q2_Conventional_criteria	-0.042	0.093	-0.063		-0.449	0.655	0.367	2.725
Q1_Conventional_criteria	0.142	0.082	0.229		1.739	0.087	0.413	2.421
Q9_Conventional_criteria	-0.031	0.097	-0.047		-0.317	0.752	0.334	2.994
Q7_Conventional_criteria	0.158	0.091	0.208		1.734	0.088	0.497	2.012
Q5_Conventional_criteria	0.115	0.07	0.181		1.632	0.108	0.582	1.717
Q10_Conventional_criteria	0.148	0.091	0.21		1.63	0.108	0.431	2.32
Q8_Conventional_criteria	0.004	0.085	0.006		0.052	0.959	0.487	2.055

### Appendix F: Variables in Firm sector stepwise regression

Step	Indicators	B	S.E.	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Step 7g	Q7_Conventional_criteria	138.556	3923.633	1	0.972	1.49E+60	0	.
	Q10_Conventional_criteria	125.631	3596.234	1	0.972	3.64E+54	0	.
	Q5_Economic_susty	151.491	4293.688	1	0.972	6.19E+65	0	.
	Q3_Environment_susty	52.411	1683.049	1	0.975	5.78E+22	0	.
	Q2_Environment_susty	1744.185	50157.45	1	0.972	.	0	.
	Sector			9	1			
	Sector(1)	-415.08	40528.64	1	0.992	0	0	.
	Sector(2)	77.916	47071.01	1	0.999	6.90E+33	0	.
	Sector(3)	105.583	24563.2	1	0.997	7.15E+45	0	.
	Sector(4)	198.7	25136.57	1	0.994	1.97E+86	0	.
	Sector(5)	691.173	80730.79	1	0.993	1.49E+300	0	.
	Sector(6)	284.992	30176.58	1	0.992	5.90E+123	0	.
	Sector(7)	739.377	794766.6	1	0.999	.	0	.
	Sector(8)	941.228	36798.85	1	0.98	.	0	.
	Sector(9)	863.446	53593.22	1	0.987	.	0	.
	Q2_Enviroxsector	-79.319	2300.87	1	0.972	0	0	.
	Constant	-1932.381	59945.06	1	0.974	0		



### Appendix G: Variables in Firm Size Stepwise Regression

Step	Indicator	B	S.E.	Sig.	Exp(B)	95% C.I. for EXP(B)	
						Lower	Upper
Step 6f	Q7_Conventional_criteria	2.312	0.804	0.004	10.093	2.088	48.787
	Q10_Conventional_criteria	3.283	1.055	0.002	26.655	3.371	210.75
	Q5_Economic_susty	4.67	1.429	0.001	106.723	6.483	1756.985
	Q3_Environment_susty	1.71	0.876	0.051	5.53	0.993	30.788
	Q5_EconXsize	-0.845	0.297	0.004	0.43	0.24	0.769
	Q2_EnvironXsize	0.616	0.296	0.037	1.852	1.038	3.306
	Constant	-32.836	8.464	<.001	0		

## Appendix H: Variables in the Equation Firm's bank stepwise regression

Step	Indicators	B	S.E.	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
Step 5e	Q1_Conventional_criteria	1.353	0.687	0.049	3.87	1.006	14.884
	Q7_Conventional_criteria	1.455	0.917	0.112	4.287	0.71	25.864
	Q10_Conventional_criteria	1.267	0.641	0.048	3.549	1.01	12.462
	Q5_Economic_susty	1.945	0.686	0.005	6.997	1.825	26.822
	Q3_Environment_susty	2.108	0.808	0.009	8.235	1.689	40.15
	Constant	-22.551	5.377	<.001	0		

## Appendix I: Survey Questions

<b>Economic Sustainability</b>	<b>Environmental Sustainability</b>	<b>Social Sustainability</b>	<b>Conventional Criteria</b>
Operating cost to revenue/Industry average	Renewable energy use	Human rights criteria in supplier onboarding	Net profit to sales/Industry average
Salaries to revenue/Industry average	Recycled material use	Human rights criteria in employee onboarding	Current Ratio/ Industry Average
Physical climate impact on profit	Environmental Innovations	Suppliers child labor risk	Debt-to-asset ratio/Industry average
Climate market reaction on profit	Business disruption for environmental non-compliance	Supplier forced labor risk	Debt-to-Equity Ratio/Industry average
Climate regulation on profit	Investment in Environmental innovations	Employee turnover	Debt Service Coverage/Industry average
Minimum wage	Energy consumption cost	Number of women in management positions	Sales turnover/Industry average
Local staff employment	Environmental sustainability criteria in supplier onboarding	Equitable pay among gender	Asset turnover/Industry average
Job creation through value chain		Good labor practices in supplier onboarding	Industry experience
Sourcing from local suppliers		Salary discrepancies for permanent & contract staff	Management reputation/experience
		Work related injuries	Level of demand for products/services
		Regulatory fines	
		Negative press	
		Customer data breach	
		Anti-corruption policies	
		Lawsuits	
		Social responsibility criteria in supplier onboarding	

## Appendix J: Question Labelling

QUESTIONS	SHORT FORM
Q1: Was the loan classified as a performing or non-performing loan at the end of its tenor?	Default_Or_nondefault_loans
Q2: What is the firm size?	Firm_size
Q3: What is the loan type?	Loan_type
Q3b: If Others? Write the loan type	Other_Loan_type
Q4: What is the loan size in Naira?	Loan_size_Naira_Amount
Q5: What is the sector of the company? - Selected Choice	Sector
Q5_11: What is the sector of the company? - Others - Text	Other_sectors
Q6: Efficient use of resources	Q1_Economic_susty
Q7: Wages, salaries, and benefits paid to employees	Q2_Economic_susty
Q8: What is the potential impact of changes in weather patterns, and extreme weather events such as floods on company profits?	Q3_Economic_susty
Q9: What is the potential impact of changes in market reaction due to climate risk on company profits?	Q4_Economic_susty
Q10: What is the potential impact of government regulations to combat climate change on company profits?	Q5_Economic_susty
Q11: What is the company's level of adherence to payment of minimum wage to entry-level staff?	Q6_Economic_susty
Q12: Does the company employ qualified staff from the region(state) of the company's primary operations?	Q7_Economic_susty
Q13: Does the company's growth improve job creation through its supply and distribution chains?	Q8_Economic_susty
Q14: Does the company source its products/services from local companies?	Q9_Economic_susty
Q15: Does the company use renewable energy? (Examples of renewable energy sources include wind power, solar power, bioenergy (organic matter burned as a fuel), and hydroelectric energy.)	Q1_Environment_susty
Q16: Does the company use recycled materials? (e.g. iron and steel scrap, aluminum cans, glass bottles, paper, wood, and plastics Note: not scarce natural resources such as petroleum, natural gas, coal, mineral ores, and trees)	Q2_Environment_susty
Q17: Are there innovations by the company to reduce the environmental impacts of company products/services? (Use of new materials, and technology that reduces the environmental impact of products and services)	Q3_Environment_susty

Q18: Were there incidents of business disruption due to non-compliance with environmental laws in the past 5 years?	Q4_Environment_susty
Q19: Did the company invest in innovation to reduce the environmental impact of its product/service?	Q5_Environment_susty
Q20: Were there reductions in the company's energy consumption cost?	Q6_Environment_susty
Q21: Does the company include environmental responsibility as a criterion for the selection of its suppliers?	Q7_Environment_susty
Q22: Does the company include the level of adherence to human rights as a criterion for supplier onboarding?	Q1_Social_susty
Q23: Level of company's inclusion of human rights clauses in its policies and employment documentation?	Q2_Social_susty
Q24: Does the company have suppliers with high child labor risks?	Q3_Social_susty
Q25: Does the company have suppliers with high forced labor risk?	Q4_Social_susty
Q26: Does the company have a high employee turnover rate?	Q5_Social_susty
Q27: Does the company have a significant number of women in management positions?	Q6_Social_susty
Q28: Does the company pay equal salaries to male and female employees?	Q7_Social_susty
Q29: Are good labor practices included as a criterion in company suppliers' onboarding policy/process?	Q8_Social_susty
Q30: Are there salary and benefits differences between permanent and contract employees in the company?	Q9_Social_susty
Q31: Were there work-related injuries to company employees in the past 5 years?	Q10_Social_susty
Q32: Were there fines issued to the company from its regulators (e.g Standard Organization of Nigeria, NAFDAC, NIMASA, NMDPRA, NUPRC)	Q11_Social_susty
Q33: Does the company sell disputed products or services?	Q12_Social_susty
Q34: Were there any incidents of the company's customer data breach in the past 5 years?	Q13_Social_susty
Q35: Are there Anti-corruption policies/procedures in the company?	Q14_Social_susty
Q36: Were there lawsuits against the company in the past 5 years?	Q15_Social_susty
Q37: Were there social responsibility performance indicators in the company's supplier onboarding policy/processes?	Q16_Social_susty
Q38: What was the company's Net Profit Margin (Net profit/Sales *100) compared to the industry average?	Q1_Conventional_criteria
Q39: What was the company's Current Ratio (Current assets to current liabilities) compared to the industry average?	Q2_Conventional_criteria
Q40: What was the company's Debt-to-asset ratio (Total Debt / Total Assets) compared to the industry average?	Q3_Conventional_criteria

Q41: What was the company's Debt-to-Equity Ratio (Total Debt / Total Equity) compared to industry average?	Q4_Conventional_criteria
Q42: What was the company's Debt Service Coverage (EBITDA/Interest + Principal) compared to the industry average? (Where EBITDA = (Net profit + interest + taxes + depreciation and amortization))	Q5_Conventional_criteria
Q43: What was the company's Sales Turnover (Total Sales Revenue / Average Inventory) compared to the industry average?	Q6_Conventional_criteria
Q44: What was the company's Assets turnover ratio (Total Sales Revenue / Average assets) compared to the industry average?	Q7_Conventional_criteria
Q45: How strong is the company's experience in the industry? (Number of years in the industry)	Q8_Conventional_criteria
Q46: How strong is the company's management reputation and experience?	Q9_Conventional_criteria
Q47: What is the level of demand for the client, 's product or service?	Q10_Conventional_criteria
Q48: How many years of experience do you (respondent) have in the credit risk department?	Credit_officers_experience
Q51: What Bank's credit officer are you?	Credit_officers_bank