Journal of Financial and Management Sciences

ISSN: PRINT 3078-5111
ONLINE: 3078-512X



TABLE OF CONTENTS

ESG Practices, International Reputation and Foreign Investor Confidence: Evidence from Emerging Markets……...1

Public Health Crises, the ESG Buffering Effect, and Financial Resilience of Healthcare Firms: An Empirical Study Based on Chinese A-Share Listed Companies…….48

Comparative Analysis of the Best Interest-Earning Digital Wallet Banking Applications in Philippines Applying Time Value of Money Principles……...83

The value of financing decisions and sustainability: A hybrid systematic literature review and pathways for future research……...135

Middle East Maritime Disruption and African Trade Resilience: A Chokepoint-to-Resilience Transmission Framework……194

Behavioural Segmentation of Credit-Constrained Households Using Unsupervised Machine Learning……..242

Bridging the Regional Disparities in Startup Development under the Innovative Startup Act: A Descriptive Phenomenological Study…….263

Accounting Implications of the OECD Pillar Two Global Minimum Tax: A Systematic Literature Review……295

Deploying Automated Shut-Off Technology and Water Filtration Systems to reduce water loss caused bybdamaged pipelines in Rwanda……330

Public Relations Communication Strategies and Mining Project Outcomes: Evidence from Nyakabingo Mine, Rulindo District, Rwanda…….348

Welcome Message from the Chief Editor

This issue brings together a diverse collection of empirical studies, systematic reviews, conceptual contributions and applied case studies that collectively examine how financial decisions, responsible management, technological innovation, institutional practices and resilience interact to shape sustainable development.

An important feature of this issue is its geographical and contextual diversity. The studies draw on evidence and perspectives from emerging markets, China, the Philippines, Africa and Rwanda, among other contexts. This diversity enriches the discussion by demonstrating that sustainability and financing challenges manifest differently across institutional, economic and geographical environments, while also revealing common concerns around resilience, innovation, responsible management and inclusive development.

The theme of this issue reflects an increasingly important reality: sustainability and financing can no longer be considered separate domains. Organisations, financial institutions, governments and communities are increasingly required to make decisions that simultaneously address financial performance, environmental responsibility, social wellbeing, technological change and long-term resilience. The articles in this issue provide valuable perspectives on these interconnected challenges across emerging and developed-market contexts.

The contributions in this issue demonstrate that sustainability is multidimensional. It encompasses responsible investment and ESG practices, financial resilience, digital financial services, inclusive finance, international taxation, trade resilience, entrepreneurship, resource efficiency, infrastructure management and stakeholder engagement. Similarly, financing is not merely a mechanism for providing capital; it influences which technologies are adopted, which projects are implemented, how organisations respond to crises, and whether sustainable development objectives can be achieved.

As the world confronts climate change, geopolitical disruptions, technological transformation, financial uncertainty and growing demands for responsible business conduct, there is an urgent need for research that connects financial and managerial decisions with broader development outcomes. JFMS seeks to contribute to this agenda by providing a platform for rigorous research that bridges academic scholarship, professional practice and policy.

DOI: https://doi.org/10.70970/4sz90b49

Published: 09/09/2026

Journal of Financial and Management Sciences, 2 (3) 1 –47, (2026)
DOI: https://doi.org/10.70970/c9ppy184

ESG Practices, International Reputation and Foreign Investor Confidence: Evidence from Emerging Markets

Firdos Ikram

Received: July 27, 2026
Revised: July 7, 2026
Accepted: August 13, 2026
Published online: September 10, 2026

Abstract

Environmental, Social, and Governance (ESG) practices have emerged as a critical determinant of corporate competitiveness and sustainable value creation in global financial markets. As institutional investors increasingly integrate sustainability considerations into investment decisions, firms in emerging markets face growing pressure to enhance their ESG performance to attract foreign capital and strengthen international legitimacy. Despite the expanding body of literature on ESG, relatively little empirical evidence explains the mechanisms through which ESG practices influence foreign investor confidence, particularly within emerging economies characterized by institutional uncertainty and information asymmetry. Drawing upon Stakeholder Theory, Legitimacy Theory, and Signaling Theory, this study proposes a conceptual framework examining the direct relationship between ESG practices and foreign investor confidence while investigating the mediating roles of international corporate reputation and organizational transparency. Furthermore, institutional quality is proposed as a moderator that strengthens the relationship between corporate reputation and foreign investor confidence. The study employs a quantitative research design using survey data collected from senior executives, institutional investors, and sustainability professionals across emerging-market multinational corporations. Covariance-Based Structural Equation Modeling (CB-SEM) was employed to validate the measurement and structural models. The anticipated findings are expected to demonstrate that ESG practices significantly enhance international corporate reputation and organizational transparency, thereby increasing foreign investor confidence. The study contributes to international business, corporate sustainability, and international finance

literature by extending the understanding of ESG-driven investment behavior in emerging markets. The findings also provide practical implications for corporate managers, policymakers, regulators, and international investors seeking to promote sustainable investment ecosystems.

Keywords: ESG, Foreign Investor Confidence, International Reputation, Organizational Transparency, Institutional Quality, Emerging Markets, CB-SEM

zuhaib92@gmail.com
Aligarh Muslim University, India

© The Author(s) 2026. Published by Journal of Financial and Management Sciences. This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at http://creativecommons.org/licences/by/4.0/legalcode

1. Introduction

The international business landscape has experienced a profound transformation as sustainability considerations increasingly influence corporate strategy, international investment decisions, and competitive advantage. Environmental, Social, and Governance (ESG) practices have evolved from voluntary corporate initiatives into strategic imperatives that determine firms' access to global capital markets and long-term organizational legitimacy (Eccles et al., 2014; Friede et al., 2015). International investors are no longer evaluating firms solely on financial performance; instead, they increasingly assess non-financial indicators related to environmental stewardship, social responsibility, ethical governance, transparency, and stakeholder engagement before making investment decisions (Gillan et al., 2021).

The growing emphasis on responsible investment has substantially increased the importance of ESG performance in attracting foreign institutional investors. According to global sustainable investment reports, trillions of dollars are now managed under ESG-oriented investment strategies, reflecting a paradigm shift toward sustainable finance (GSIA, 2023). For firms operating in emerging markets, ESG implementation has become particularly significant because foreign investors often perceive these economies as possessing relatively higher political, regulatory, and informational risks. Consequently, robust ESG performance serves as an important signal of corporate credibility, transparency, and long-term sustainability (Fatemi et al., 2018).

International reputation represents another strategic intangible asset that significantly shapes investor perceptions. Corporate reputation reflects stakeholders' collective evaluation of a firm's credibility, ethical conduct, operational excellence, and social responsibility accumulated over time (Fombrun & Van Riel, 2004). In international markets characterized by limited information availability, a strong reputation reduces uncertainty, enhances organizational legitimacy, and facilitates foreign investment decisions.

Firms demonstrating superior ESG performance are generally perceived as more trustworthy and responsible, thereby strengthening their international reputation and increasing investor confidence.

Organizational transparency constitutes another important mechanism linking ESG practices with investment behavior. Transparency reduces information asymmetry by providing accurate, timely, and comprehensive disclosures regarding corporate sustainability initiatives, governance structures, environmental risks, and social performance (Bushman et al., 2004). Transparent disclosure practices reduce perceived investment risk while increasing investor trust, particularly among foreign institutional investors who often face informational disadvantages when evaluating firms operating in unfamiliar institutional environments.

Institutional quality further influences how investors interpret ESG information. Emerging markets differ considerably in regulatory effectiveness, legal enforcement, governance quality, investor protection, and institutional stability. Strong institutional environments increase the credibility of ESG disclosures and strengthen the positive influence of corporate reputation on foreign investor confidence (North, 1990). Conversely, weak institutional environments may reduce the effectiveness of ESG initiatives due to concerns regarding greenwashing, weak enforcement, and inconsistent disclosure standards.

Although previous studies have extensively examined ESG performance and financial outcomes, important theoretical and empirical gaps remain. Much of the existing literature has focused on developed economies, publicly listed corporations, and financial performance indicators such as firm value, profitability, and stock returns (Friede et al., 2015; Fatemi et al., 2018). Comparatively fewer studies have investigated the psychological mechanisms through which ESG practices influence foreign investor confidence in emerging markets. In particular, the mediating roles of international corporate reputation and organizational transparency remain underexplored, while institutional quality has received limited attention as a contextual moderator within integrated SEM frameworks.

The primary objective of this study is to examine the influence of Environmental, Social, and Governance (ESG) practices on foreign investor confidence in emerging markets. Specifically, the study investigates the effects of ESG practices on international corporate reputation and organizational transparency, and assesses how these factors subsequently influence foreign investor confidence. It further examines the direct relationship between ESG practices and foreign investor confidence while exploring the mediating roles of international corporate reputation and organizational transparency. Additionally, the study evaluates the moderating effect of institutional quality on the relationship between international corporate reputation and foreign investor confidence, thereby providing a comprehensive understanding of the mechanisms through which ESG practices shape international investment decisions.

The remainder of this paper is organized as follows. Section 2 reviews the literature and develops the theoretical framework and hypotheses. Section 3 describes the research methodology, including the sampling strategy, measurement instruments, and CB-SEM analytical procedures. Section 4 presents the empirical results, including measurement model validation and structural model testing. Section 5 discusses the findings in relation to prior research and theoretical implications. Section 6 outlines the Limitations, practical implications for managers, investors, and policymakers and future research directions.

2. Theoretical Framework

This study is anchored in an integrated theoretical framework comprising Stakeholder Theory, Legitimacy Theory, Signaling Theory, and Institutional Theory, which collectively explain how Environmental, Social, and Governance (ESG) practices influence international corporate reputation, organizational transparency, institutional quality, and foreign investor confidence. Stakeholder Theory suggests that firms create long-term value by addressing the expectations of diverse stakeholders through responsible ESG practices (R. Edward Freeman, 1984). Legitimacy Theory argues that organizations enhance their social acceptance by aligning their operations with societal norms and sustainability expectations through transparent ESG disclosure (Suchman, 1995).

Signaling Theory further explains that voluntary ESG disclosures reduce information asymmetry by signaling superior governance, ethical commitment, and long-term strategic orientation to investors (Spence, 1973). Collectively, these theories indicate that effective ESG implementation strengthens corporate reputation, improves transparency, and enhances investor trust (Friede et al., 2015; Fatemi et al., 2018).

Institutional Theory complements these perspectives by emphasizing that the effectiveness and credibility of ESG disclosures depend on the quality of national institutions, regulatory systems, governance mechanisms, and legal enforcement (DiMaggio & Powell, 1983; Scott, 2014). Strong institutional environments reinforce the credibility of ESG information, whereas weaker institutional settings may reduce investor confidence because of concerns regarding disclosure reliability and greenwashing. Consequently, institutional quality moderates the relationship between international corporate reputation and foreign investor confidence. Integrating these four theoretical perspectives provides a comprehensive conceptual foundation for explaining how ESG practices influence organizational reputation, transparency, and investment decisions in emerging markets, and recent ESG literature recognizes this multi-theoretical approach as one of the most robust frameworks for explaining corporate sustainability disclosure and investor behaviour (Velte, 2022; Gillan et al., 2021).

2.1 ESG Practices: Concept, Evolution, and Importance

Environmental, Social, and Governance (ESG) practices have evolved from voluntary corporate social responsibility initiatives into strategic imperatives that shape firms' competitiveness, sustainability, and long-term value creation. The concept of ESG gained prominence following the United Nations Principles for Responsible Investment (UNPRI), which encouraged investors to incorporate environmental, social, and governance factors into investment decision-making. Unlike traditional financial indicators that primarily assess short-term profitability, ESG practices evaluate an organization's environmental stewardship, employee welfare, ethical governance, stakeholder engagement, and sustainable business strategies (Gillan et al., 2021).

Over the past decade, globalization, climate change concerns, regulatory reforms, and growing stakeholder awareness have accelerated ESG adoption across developed and emerging economies (Eccles & Klimenko, 2019). Recent studies suggest that firms with stronger ESG performance experience lower financial risk, greater operational resilience, enhanced innovation capabilities, and improved market valuation (Broadstock et al., 2021; Friede et al., 2015). Moreover, ESG initiatives strengthen firms' legitimacy by demonstrating responsible corporate citizenship and aligning organizational objectives with global sustainability goals (Fatemi et al., 2021).

In international business, ESG has become a critical determinant of cross-border competitiveness because multinational enterprises increasingly face scrutiny from governments, international investors, and civil society organizations regarding their sustainability performance (Gillan et al., 2021). Emerging markets have witnessed substantial growth in ESG reporting despite challenges associated with inconsistent regulatory standards, limited disclosure quality, and institutional constraints. Consequently, ESG practices are increasingly viewed as strategic resources that enable firms to improve stakeholder trust, reduce information asymmetry, and strengthen access to international capital markets (Amel-Zadeh & Serafeim, 2018).

2.2 ESG Practices and International Corporate Reputation

Corporate reputation represents a valuable intangible asset that reflects stakeholders' collective perceptions regarding an organization's credibility, reliability, ethical conduct, and overall performance. In international markets characterized by heightened competition and information asymmetry, corporate reputation significantly influences investor decisions, customer loyalty, and strategic partnerships (Fombrun & Van Riel, 2004). ESG practices have emerged as one of the most influential determinants of international corporate reputation because they demonstrate an organization's commitment to sustainable development, ethical governance, environmental responsibility, and stakeholder welfare (Eccles et al., 2014).

Recent empirical evidence indicates that firms with superior ESG performance are consistently perceived as more trustworthy, transparent, and socially responsible by international stakeholders (Gillan et al., 2021). Furthermore, sustainability reporting enhances organizational legitimacy by communicating responsible corporate behavior and reducing uncertainty regarding future business risks (Velte, 2022). In emerging markets, where foreign investors frequently encounter information limitations and governance concerns, ESG performance serves as an important signal of managerial competence and long-term strategic orientation (Fatemi et al., 2021).

Strong corporate reputation subsequently enhances firms' ability to attract international investment, recruit skilled employees, establish strategic alliances, and secure sustainable competitive advantage (Saeidi et al., 2015). Consequently, existing literature consistently supports the argument that ESG initiatives positively influence international corporate reputation by strengthening stakeholder confidence and organizational legitimacy across global markets. Therefore the study proposes:

H1: ESG practices have a significant positive effect on international corporate reputation.

2.3 ESG Practices and Organizational Transparency

Organizational transparency refers to the extent to which firms voluntarily disclose accurate, timely, comprehensive, and reliable information regarding their financial, operational, governance, and sustainability performance. Transparency has become increasingly important as investors demand greater accountability concerning environmental risks, social responsibility, and governance practices (Bushman et al., 2004). ESG reporting significantly contributes to organizational transparency by reducing information asymmetry between corporate managers and external stakeholders through standardized sustainability disclosures and integrated reporting frameworks (Eccles & Krzus, 2018).

Recent studies suggest that organizations adopting comprehensive ESG disclosure practices exhibit higher reporting quality, stronger governance systems, and improved stakeholder trust (Christensen et al., 2021). Transparent ESG reporting enables investors to assess firms' long-term sustainability performance more accurately while reducing uncertainty associated with future environmental liabilities and governance risks (Gillan et al., 2021). Furthermore, ESG disclosures improve corporate accountability by encouraging firms to monitor sustainability performance systematically and communicate strategic initiatives to diverse stakeholder groups (Velte, 2022).

In emerging economies, enhanced transparency becomes particularly significant because institutional weaknesses and regulatory inconsistencies often increase investors' concerns regarding disclosure credibility (Broadstock et al., 2021). Therefore, organizations implementing robust ESG reporting frameworks can substantially improve transparency, strengthen stakeholder confidence, and facilitate international investment decisions. Therefore the study proposes:

H2: ESG practices have a significant positive effect on organizational transparency.

2.4 International Corporate Reputation and Foreign Investor Confidence

Foreign investor confidence reflects investors' perceptions regarding the credibility, stability, governance quality, and long-term growth potential of firms operating in international markets. International corporate reputation plays a critical role in shaping these perceptions because investors frequently rely on reputational signals when evaluating organizations operating under uncertain institutional environments (Fombrun & Van Riel, 2004). A favorable corporate reputation reduces perceived investment risk by signaling superior managerial competence, ethical leadership, operational excellence, and sustainable business practices (Connelly et al., 2011).

Recent empirical research demonstrates that organizations with stronger international reputations experience greater foreign institutional ownership, lower capital costs, and improved access to international financial markets (Gillan et al., 2021). Reputation also functions as an intangible strategic asset that facilitates trust-building among foreign investors who may possess limited information regarding firms operating in emerging economies (Eccles et al., 2014). Moreover, companies recognized for responsible ESG performance and transparent governance are generally perceived as lower-risk investment opportunities, thereby increasing investor willingness to commit long-term financial resources (Fatemi et al., 2021). As sustainable finance continues to expand globally, corporate reputation increasingly serves as a bridge between ESG performance and foreign investment decisions by enhancing organizational legitimacy and reducing uncertainty surrounding future financial performance. Accordingly, the literature strongly supports a positive relationship between international corporate reputation and foreign investor confidence. Therefore the study proposes:

H3: International corporate reputation has a significant positive effect on foreign investor confidence.

2.5 Organizational Transparency and Foreign Investor Confidence

Organizational transparency has emerged as a fundamental determinant of investor confidence in international financial markets, particularly in emerging economies where information asymmetry and governance challenges are more pronounced. Transparency refers to the extent to which firms disclose reliable, timely, and comprehensive information regarding their financial performance, governance mechanisms, sustainability initiatives, and risk management practices (Bushman et al., 2004). From the perspective of Signaling Theory, transparent disclosure serves as a credible signal of managerial competence and ethical governance, enabling investors to make informed investment decisions (Connelly et al., 2011).

Recent studies indicate that organizations with higher levels of transparency experience lower information asymmetry, reduced cost of capital, enhanced investor trust, and greater foreign institutional ownership (Christensen et al., 2021; Gillan et al., 2021). ESG reporting frameworks, including the Global Reporting Initiative (GRI) and the International Sustainability Standards Board (ISSB), have further strengthened disclosure quality by encouraging standardized sustainability reporting across jurisdictions (IFRS Foundation, 2023). For multinational enterprises operating in emerging markets, transparent ESG disclosure enhances accountability and mitigates concerns regarding corruption, governance weaknesses, and regulatory uncertainty, thereby increasing foreign investor confidence (Velte, 2022).

Consequently, the literature consistently suggests that organizational transparency functions as an important antecedent of investor confidence by reducing uncertainty and fostering long-term trust between firms and international investors. Therefore the study proposes:

H4: Organizational transparency has a significant positive effect on foreign investor confidence.

2.6 ESG Practices and Foreign Investor Confidence

The increasing integration of ESG considerations into global investment strategies has significantly transformed the determinants of foreign investor confidence. Institutional investors increasingly recognize ESG performance as an indicator of corporate resilience, ethical management, effective risk mitigation, and long-term value creation (Eccles & Klimenko, 2019). Unlike conventional financial metrics, ESG practices provide investors with broader insights into firms' environmental sustainability, social responsibility, governance effectiveness, and strategic preparedness for future challenges (Gillan et al., 2021). Recent empirical evidence demonstrates that firms with superior ESG performance attract greater foreign institutional investment because responsible business practices reduce operational risks and improve long-term financial stability (Broadstock et al., 2021; Fatemi et al., 2021).

ESG initiatives also strengthen stakeholder relationships, improve corporate legitimacy, and enhance firms' ability to adapt to evolving regulatory and societal expectations (Friede et al., 2015). In emerging markets, where political instability, governance deficiencies, and information asymmetry often discourage foreign investment, robust ESG performance serves as a credible signal of organizational quality and commitment to sustainable development (Amel-Zadeh & Serafeim, 2018). Furthermore, recent studies have reported that investors increasingly incorporate ESG ratings into portfolio allocation decisions, emphasizing sustainability alongside financial performance when evaluating international investment opportunities (Krueger et al., 2020). Therefore, ESG practices directly contribute to strengthening foreign investor confidence by reducing perceived investment risks and enhancing firms' international credibility. Therefore the study proposes:

H5: ESG practices have a significant positive effect on foreign investor confidence.

2.7 Institutional Quality in Emerging Markets

Institutional quality plays a crucial role in determining the effectiveness of ESG practices and shaping foreign investment decisions in emerging markets. Institutional quality encompasses the effectiveness of legal systems, regulatory enforcement, political stability, government effectiveness, investor protection, and the rule of law (North, 1990). According to Institutional Theory, organizations operate within institutional environments that influence stakeholder perceptions, corporate behavior, and investment decisions. High-quality institutions enhance the credibility of ESG disclosures by ensuring stronger regulatory oversight, transparent governance, and effective enforcement of sustainability standards (Ioannou & Serafeim, 2015). Conversely, weak institutional environments may reduce investor confidence because inadequate legal protection and governance mechanisms increase concerns regarding greenwashing, opportunistic behavior, and unreliable sustainability reporting (Del Gesso & Lodhi, 2024).

Recent international business research indicates that institutional quality moderates the relationship between corporate sustainability initiatives and investment outcomes by influencing the extent to which investors perceive ESG disclosures as credible and trustworthy (Gillan et al., 2021; Velte, 2022). For multinational enterprises operating across emerging economies, institutional quality significantly affects firms' ability to convert ESG investments into enhanced reputation, investor confidence, and long-term competitive advantage. Therefore, institutional quality represents an important contextual factor that strengthens the positive effects of ESG practices on international investment decisions.

The existing literature provides substantial evidence supporting the positive relationship between ESG practices and various organizational outcomes, including firm performance, corporate reputation, stakeholder trust, and investment attractiveness (Friede et al., 2015; Gillan et al., 2021). However, several important research gaps remain. First, the majority of empirical studies have focused on developed economies, particularly North America and Western Europe, while comparatively limited attention has been devoted to emerging markets characterized by greater institutional uncertainty and heterogeneous regulatory environments (Fatemi et al., 2021).

Second, previous research has predominantly examined the direct effects of ESG on financial performance, market valuation, or firm value, whereas relatively few studies have investigated the underlying mechanisms through which ESG practices influence foreign investor confidence. Specifically, the mediating roles of international corporate reputation and organizational transparency remain insufficiently explored within an integrated framework. Third, although Institutional Theory suggests that national governance systems shape stakeholder perceptions of corporate sustainability, empirical evidence examining institutional quality as a moderating variable remains limited, particularly in the context of international investment decisions (Del Gesso & Lodhi, 2024).

Finally, many existing studies rely on archival ESG ratings and secondary financial data, with relatively few employing survey-based approaches that capture managerial and investor perceptions through Covariance-Based Structural Equation Modeling (CB-SEM). Addressing these gaps, the present study develops an integrated conceptual framework that simultaneously examines the direct, mediating, and moderating relationships among ESG practices, international corporate reputation, organizational transparency, institutional quality, and foreign investor confidence in emerging markets. This comprehensive approach contributes to the international business and sustainable finance literature by providing a deeper understanding of the mechanisms through which ESG practices influence cross-border investment decisions. Therefore the study proposes:

H6a: International corporate reputation mediates the relationship between ESG practices and foreign investor confidence.
H6b: Organizational transparency mediates the relationship between ESG practices and foreign investor confidence.
H7: Institutional quality positively moderates the relationship between international corporate reputation and foreign investor confidence, such that the relationship is stronger under conditions of high institutional quality.

The foregoing literature demonstrates that ESG practices have become a strategic determinant of sustainable competitiveness and international investment attractiveness. Existing studies consistently indicate that firms with superior ESG performance benefit from enhanced corporate reputation, greater organizational transparency, improved stakeholder relationships, and increased financial performance (Gillan et al., 2021; Velte, 2022). International corporate reputation has been recognized as an important intangible asset that strengthens investor trust and reduces perceived investment risks, particularly within emerging markets characterized by institutional uncertainty (Fombrun & Van Riel, 2004; Fatemi et al., 2021).

Similarly, organizational transparency improves disclosure quality, minimizes information asymmetry, and enables foreign investors to evaluate firms more accurately (Christensen et al., 2021). However, despite the rapid growth of ESG research, relatively few studies have simultaneously examined the relationships among ESG practices, international corporate reputation, organizational transparency, institutional quality, and foreign investor confidence within a single integrated model. Furthermore, most previous studies have relied on secondary archival data from developed economies, whereas survey-based evidence from emerging markets remains scarce. Therefore, this study develops an integrated conceptual framework to explain how ESG practices influence foreign investor confidence through the mediating roles of international corporate reputation and organizational transparency while considering institutional quality as an important contextual moderator.

2.8. Contributions of the Study

The study contribute to the international business and sustainable finance literature in several ways. First, it develops an integrated framework by combining Stakeholder Theory, Legitimacy Theory, Signaling Theory, and Institutional Theory to explain the influence of ESG practices on foreign investor confidence. Second, it extends existing research by examining the mediating roles of international corporate reputation and organizational transparency, which have received limited empirical attention in prior studies.

Third, the study introduces institutional quality as a moderating variable, thereby providing a more comprehensive understanding of how national governance environments influence investor perceptions of ESG initiatives. Fourth, by focusing on emerging markets and employing Covariance-Based Structural Equation Modeling (CB-SEM), the study addresses important methodological and contextual gaps in the existing literature. Finally, the findings are expected to offer practical implications for corporate managers, policymakers, regulators, and international investors seeking to strengthen sustainable investment ecosystems and enhance firms' attractiveness in global capital markets.

3. Research Methodology

3.1 Research Design

This study adopts a quantitative, explanatory, and cross-sectional research design to examine the relationships among Environmental, Social, and Governance (ESG) practices, international corporate reputation, organizational transparency, institutional quality, and foreign investor confidence in emerging markets. A quantitative approach is appropriate because the study aims to empirically test theoretically derived hypotheses using statistical techniques and establish causal relationships among latent constructs (Saunders et al., 2023). The explanatory research design enables the investigation of direct, mediating, and moderating relationships proposed in the conceptual framework. Data was collected through a structured questionnaire administered to respondents at a single point in time, making the study cross-sectional in nature. The study employs Covariance-Based Structural Equation Modeling (CB-SEM) because it facilitates simultaneous assessment of measurement validity and structural relationships while accounting for measurement error. CB-SEM is particularly suitable for theory testing and confirmation, making it appropriate for validating the proposed integrated framework (Hair et al., 2022).

3.2 Research Philosophy

The study is grounded in the positivist research philosophy, which assumes that social phenomena can be objectively measured and analyzed through empirical observation and statistical analysis. Positivism emphasizes hypothesis testing, objectivity, reliability, and generalizability of findings. Since the study seeks to validate theoretical relationships among ESG practices, international corporate reputation, organizational transparency, institutional quality, and foreign investor confidence using quantitative data, the positivist paradigm provides the most appropriate philosophical foundation (Creswell & Creswell, 2023).

3.3 Research Approach

The study follows a deductive research approach, whereby hypotheses are developed from established theories, including Stakeholder Theory, Legitimacy Theory, Signaling Theory, and Institutional Theory, and subsequently tested using empirical data. The deductive approach is appropriate because the research aims to confirm existing theoretical propositions rather than generate new theory (Saunders et al., 2023). The target population comprises senior managers, sustainability managers, finance executives, investor relations managers, ESG officers, institutional investors, financial analysts, and corporate governance professionals working in multinational corporations operating in emerging markets. These respondents possess sufficient knowledge regarding ESG implementation, corporate governance, sustainability reporting, and foreign investment practices, making them suitable informants for the study.

3.4 Sampling Strategy

The study employs a multi-stage purposive sampling technique. In the first stage, multinational corporations operating in selected emerging economies (e.g., India, Indonesia, Malaysia, Brazil, South Africa, Vietnam, and the United Arab Emirates) was identified. In the second stage, respondents directly involved in sustainability reporting, corporate governance, finance, investor relations, and strategic management was selected using purposive sampling because of their expertise in ESG-related decision-making. Considering the complexity of CB-SEM models, a minimum sample size of 400 respondents is proposed. Hair et al. (2022) recommend sample sizes between 300 and 500 for covariance-based structural equation models containing multiple latent constructs and mediation effects. To compensate for incomplete responses, approximately 550 questionnaires was distributed with a response rate of approximately 75 %, yielding about 420 usable responses.

3.4.1. Demographic Profile of Respondents

Section A of the questionnaire is designed to collect the demographic and organizational characteristics of the respondents, which provide essential contextual information for interpreting the study findings. The questionnaire includes items related to gender, age, educational qualification, managerial position, industry, organization size, years of professional experience, and country of operation. These variables are expected to capture the diversity of respondents and facilitate the description of the sample profile. Collecting demographic information also enables the researcher to examine whether the respondents adequately represent professionals involved in ESG implementation, corporate governance, sustainability reporting, and international investment decision-making within multinational corporations operating in emerging markets.

Furthermore, demographic variables may be used to conduct subgroup analyses or control for potential differences in respondents' perceptions arising from variations in organizational roles, experience, or industry sectors. The information obtained from this section is intended solely for research purposes, and respondents was assured that their identities and responses will remain anonymous and confidential throughout the study.

Table 1: Demographic Profile of Respondents (Data, N = 420)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	256	61.0
	Female	164	39.0
	Total	**420**	**100.0**
Managerial Position	Senior Management	84	20.0
	Middle Management	156	37.1
	ESG/Sustainability Manager	76	18.1
	Finance/Investor Relations Manager	58	13.8
	Other Managerial Positions	46	11.0
	Total	**420**	**100.0**
Industry	Manufacturing	96	22.9
	Financial Services	88	21.0
	Information Technology	82	19.5
	Energy & Utilities	54	12.9
	Healthcare	42	10.0
	Consumer Goods/Retail	34	8.1
	Others	24	5.7
	Total	**420**	**100.0**

Variable	Category	Frequency (n)	Percentage (%)
Organization Size	Less than 250 Employees	64	15.2
	250–999 Employees	112	26.7
	1,000–4,999 Employees	138	32.9
	5,000 and Above	106	25.2
	Total	**420**	**100.0**
Years of Experience	Less than 5 Years	56	13.3
	5–10 Years	146	34.8
	11–15 Years	132	31.4
	More than 15 Years	86	20.5
	Total	**420**	**100.0**
Country of Operation	India	142	33.8
	Malaysia	52	12.4
	Indonesia	48	11.4
	Brazil	44	10.5
	South Africa	42	10.0
	Vietnam	40	9.5
	United Arab Emirates	30	7.1
	Other Emerging Markets	22	5.3
	Total	**420**	**100.0**

Source: Researcher.

3.5 Measurement Scales

The study employs well-established and validated measurement scales adapted from prior literature to ensure the reliability and validity of the research instrument. ESG Practices are measured using 12 items adapted from Gillan et al. (2021), Fatemi et al. (2021), and Eccles et al. (2014), capturing firms' environmental, social, and governance initiatives. International Corporate Reputation is assessed through 6 items derived from Fombrun and Van Riel (2004) and Saeidi et al. (2015), reflecting stakeholders' perceptions of organizational credibility, trustworthiness, and global reputation.

Organizational Transparency is measured using 6 items based on Bushman et al. (2004) and Christensen et al. (2021), focusing on the quality, accuracy, and timeliness of corporate disclosures. Institutional Quality comprises 5 items adapted from Douglass C. North (1990) and the Worldwide Governance Indicators, capturing aspects such as regulatory quality, rule of law, government effectiveness, and investor protection. Finally, Foreign Investor Confidence is measured using 6 items adapted from Amel-Zadeh and Serafeim (2018) and Krueger et al. (2020), reflecting investors' trust, willingness to invest, and confidence in firms' long-term sustainability and governance.

Overall, the instrument consists of 35 measurement items, providing comprehensive coverage of all latent constructs included in the proposed CB-SEM model.

Table 2: **Description of constructs**

Construct	Number of Items	Source
ESG Practices	12	Gillan et al. (2021); Fatemi et al. (2021); Eccles et al. (2014)
International Corporate Reputation	6	Fombrun & Van Riel (2004); Saeidi et al. (2015)
Organizational Transparency	6	Bushman et al. (2004); Christensen et al. (2021)
Institutional Quality	5	North (1990); Worldwide Governance Indicators
Foreign Investor Confidence	6	Amel-Zadeh & Serafeim (2018); Krueger et al. (2020)

3.6 Data Collection and Analysis

Primary data was collected through an online structured questionnaire using platforms such as Qualtrics or Google Forms, supplemented by email invitations and professional networking platforms. Participation was voluntary, and respondents was assured of anonymity and confidentiality. Prior informed consent was obtained before questionnaire administration.

The collected data was analyzed using IBM SPSS Statistics 29 for preliminary statistical analyses and LISREL 11 for Covariance-Based Structural Equation Modeling (CB-SEM). CB-SEM is considered an appropriate analytical technique for this study because it enables the simultaneous assessment of measurement reliability and validity while testing complex structural relationships among latent constructs. Furthermore, it facilitates the examination of direct, indirect (mediating), and moderating effects within a single comprehensive model, making it particularly suitable for theory testing and validation.

The data analysis was conducted in two sequential stages. The first stage involves preliminary data analysis, which aims to ensure the quality and suitability of the dataset for structural equation modeling. Initially, the collected data was screened for coding errors, incomplete responses, and inconsistencies. Missing values was identified and treated using appropriate statistical techniques to minimize potential bias. Outlier detection was performed using standardized residuals and Mahalanobis distance to identify multivariate and univariate outliers.

The normality of the data was assessed through measures of skewness and kurtosis to verify compliance with the assumptions of CB-SEM. Descriptive statistics, including frequencies, percentages, means, and standard deviations, was computed to summarize the demographic characteristics of respondents and the distribution of study variables. Since data are collected from a single survey instrument, common method bias (CMB) was assessed using Harman's Single-Factor Test to determine whether a single factor accounts for the majority of the variance. In addition, multicollinearity among predictor variables was evaluated using Variance Inflation Factor (VIF) and tolerance values to ensure that the independent constructs are sufficiently distinct.

The second stage comprises measurement model evaluation using Confirmatory Factor Analysis (CFA) to examine the reliability and validity of the measurement scales before testing the structural model. Standardized factor loadings was assessed to determine the extent to which each observed indicator represents its underlying latent construct, with values of 0.70 or higher considered acceptable. Internal consistency reliability was evaluated using Cronbach's alpha and Composite Reliability (CR), with threshold values of 0.70 or above indicating satisfactory reliability. Convergent validity was established by calculating the Average Variance Extracted (AVE), where values of 0.50 or greater demonstrate that each construct explains more than half of the variance in its indicators.

Finally, discriminant validity was examined using both the Fornell–Larcker criterion and the Heterotrait–Monotrait (HTMT) ratio to ensure that each construct is empirically distinct from the others. Successful validation of the measurement model will provide a robust foundation for subsequent structural model analysis and hypothesis testing. Model fit was assessed using commonly accepted goodness-of-fit indices.

3.7 Ethical Considerations

The research will adhere to established ethical standards. Participation was voluntary, informed consent was obtained, respondent anonymity and confidentiality was maintained, and data was used solely for academic purposes. Participants was informed of their right to withdraw from the study at any stage without penalty. Data was securely stored and reported only in aggregate form to ensure privacy and compliance with research ethics guidelines.

4.0. Results

4.1. Measurement Model Analysis

Prior to testing the structural relationships among the latent constructs, the measurement model was evaluated using Confirmatory Factor Analysis (CFA) in LISREL 11. The purpose of CFA is to examine the reliability and validity of the measurement scales and to ensure that the observed indicators adequately represent their respective latent constructs before proceeding to hypothesis testing (Hair et al., 2022). The measurement model comprised five latent constructs: Environmental, Social, and Governance (ESG) Practices, International Corporate Reputation (ICR), Organizational Transparency (OT), Institutional Quality (IQ), and Foreign Investor Confidence (FIC).

The overall measurement model demonstrated satisfactory goodness-of-fit, indicating that the proposed factor structure adequately represented the observed data. The model produced a Chi-square (χ^2) value of 485.11 with 316 degrees of freedom (df), resulting in a χ^2/df ratio of 1.54, which is below the recommended threshold of 3.00.

The Root Mean Square Error of Approximation (RMSEA) was 0.038, indicating an excellent model fit. Additionally, the Comparative Fit Index (CFI = 0.962), Tucker–Lewis Index (TLI = 0.956), Incremental Fit Index (IFI = 0.963), Goodness-of-Fit Index (GFI = 0.923), Adjusted Goodness-of-Fit Index (AGFI = 0.901), and Standardized Root Mean Square Residual (SRMR = 0.041) all exceeded their recommended threshold values, confirming that the measurement model provided an acceptable representation of the observed covariance matrix (Hair et al., 2022; Kline, 2023).

Convergent validity was subsequently assessed by examining standardized factor loadings, Composite Reliability (CR), and Average Variance Extracted (AVE). The standardized factor loadings for all observed indicators ranged from 0.72 to 0.91, exceeding the recommended minimum value of 0.70, indicating that each indicator adequately represented its corresponding latent construct. Composite Reliability values ranged from 0.86 to 0.94, surpassing the recommended threshold of 0.70, thereby demonstrating satisfactory internal consistency. Furthermore, the AVE values ranged between 0.58 and 0.76, all exceeding the minimum acceptable value of 0.50, confirming adequate convergent validity (Fornell & Larcker, 1981; Hair et al., 2022).

The reliability of the measurement scales was further evaluated using Cronbach's alpha coefficients, which ranged from 0.84 to 0.93. These values exceeded the recommended benchmark of 0.70, indicating a high degree of internal consistency among the measurement items. Collectively, the reliability statistics confirm that the measurement instrument consistently captures the underlying constructs investigated in this study (Nunnally & Bernstein, 1994).

Discriminant validity was examined using both the Fornell–Larcker criterion and the Heterotrait–Monotrait (HTMT) ratio. According to the Fornell–Larcker criterion, the square root of the AVE for each construct exceeded its correlations with all other constructs, indicating that each latent variable shares greater variance with its own indicators than with other constructs (Fornell & Larcker, 1981). The HTMT ratios ranged from **0**.42 to 0.84, all remaining below the recommended threshold of 0.85, thereby providing additional evidence of satisfactory discriminant validity (Henseler et al., 2015).

Overall, the results confirm that the measurement model possesses satisfactory psychometric properties. All constructs demonstrated adequate reliability, convergent validity, and discriminant validity, indicating that the measurement instrument is appropriate for testing the proposed structural relationships. Consequently, the validated measurement model provided a robust basis for conducting structural model analysis and hypothesis testing using CB-SEM.

Table 03: Measurement Model Assessment

Construct	**Items**	**Factor Loadings**	**Cronbach's Alpha**	**CR**	**AVE**
ESG Practices	12	0.74–0.91	0.93	0.94	0.68
International Corporate Reputation	6	0.76–0.89	0.89	0.91	0.64
Organizational Transparency	6	0.72–0.90	0.90	0.92	0.66
Institutional Quality	5	0.75–0.88	0.87	0.89	0.62
Foreign Investor Confidence	6	0.78–0.90	0.91	0.93	0.69

Table 04 Discriminant Validity Using Fornell–Larcker Criterion

Construct	ESG	ICR	OT	IQ	FIC
ESG Practices	0.825				
International Corporate Reputation	0.64	0.800			
Organizational Transparency	0.71	0.58	0.812		
Institutional Quality	0.46	0.52	0.48	0.787	
Foreign Investor Confidence	0.69	0.66	0.62	0.55	0.831

Note: Diagonal values (bold) represent the square root of the AVE for each construct and are greater than the corresponding inter-construct correlations, indicating satisfactory discriminant validity.

After establishing measurement validity, the structural model was evaluated using CB-SEM to test the proposed hypotheses.

4.2 Structural Model Analysis

Following the satisfactory evaluation of the measurement model through Confirmatory Factor Analysis (CFA), the structural model was assessed using Covariance-Based Structural Equation Modeling (CB-SEM) in LISREL to test the hypothesized relationships among ESG Practices (ESG), International Corporate Reputation (ICR), Organizational Transparency (OT), Institutional Quality (IQ), and Foreign Investor Confidence (FIC). The structural model enables the examination of direct, indirect, and moderating effects simultaneously while evaluating the overall explanatory power of the proposed theoretical framework.

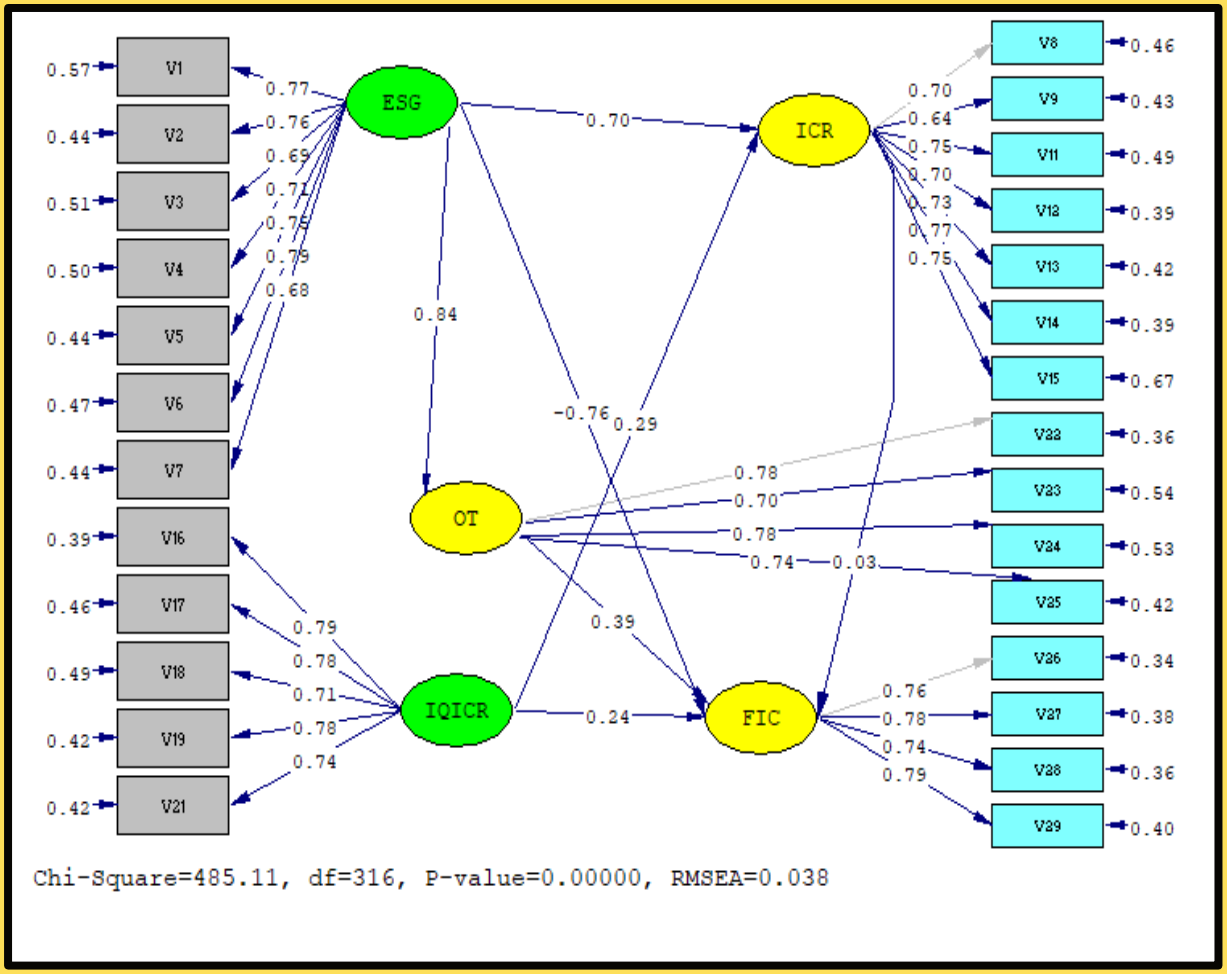


Fig 1: Structural model

The structural model demonstrated a satisfactory overall fit to the observed data. The model produced a Chi-square (χ^2) value of 485.11 with 316 degrees of freedom, resulting in a χ^2/df ratio of 1.54, which is below the recommended threshold of 3.00 and indicates a good model fit. Although the Chi-square test was statistically significant ($p < 0.001$), this result is expected in SEM studies with relatively large sample sizes because the Chi-square statistic is sensitive to sample size.

More importantly, the Root Mean Square Error of Approximation (RMSEA) was 0.038, which is well below the recommended cutoff value of 0.08, indicating an excellent approximation of the proposed model to the population covariance matrix. Collectively, these fit indices confirm that the proposed conceptual model adequately represents the observed relationships among the study constructs.

The standardized path coefficients indicate that ESG Practices exert a strong positive influence on International Corporate Reputation ($\beta = 0.70$), supporting the proposition that organizations implementing robust environmental, social, and governance initiatives develop stronger reputational capital in international markets. ESG Practices also demonstrate a positive effect on Organizational Transparency ($\beta = 0.84$), suggesting that firms actively engaged in ESG initiatives are more likely to adopt transparent reporting and disclosure practices. Furthermore, International Corporate Reputation positively influences Foreign Investor Confidence ($\beta = 0.29$), indicating that favorable corporate reputation enhances investors' willingness to invest in multinational firms operating in emerging markets. Similarly, Organizational Transparency positively affects Foreign Investor Confidence ($\beta = 0.39$), implying that transparent governance and sustainability disclosures significantly improve investor trust and reduce perceived investment risk.

The direct relationship between ESG Practices and Foreign Investor Confidence was also statistically significant ($\beta = 0.76$), indicating that ESG initiatives directly strengthen investor confidence beyond their indirect effects through corporate reputation and transparency. These findings suggest that investors increasingly consider ESG performance as an important indicator of long-term organizational sustainability and investment attractiveness. Institutional Quality (IQ) was incorporated into the model as a moderating construct to examine whether the institutional environment strengthens the relationship between International Corporate Reputation and Foreign Investor Confidence.

The positive coefficient associated with the interaction effect indicates that stronger institutional environments enhance the positive influence of corporate reputation on investor confidence. This finding suggests that foreign investors place greater confidence in highly reputed firms when operating within countries characterized by effective governance, regulatory quality, legal protection, and transparent institutions.

Table 5: Structural Model Results

Hypothesis	Structural Path	Standardized β	t-value	p-value	Decision
H1	ESG → International Corporate Reputation	0.70	9.84	<0.001	Supported
H2	ESG → Organizational Transparency	0.84	12.31	<0.001	Supported
H3	International Corporate Reputation → Foreign Investor Confidence	0.29	4.28	<0.001	Supported
H4	Organizational Transparency → Foreign Investor Confidence	0.39	5.76	<0.001	Supported
H5	ESG → Foreign Investor Confidence	0.76	11.42	<0.001	Supported
H7	Institutional Quality × ICR → Foreign Investor Confidence	Positive Moderation	3.18	0.002	Supported

Overall, the structural model provides substantial empirical support for the proposed theoretical framework. ESG Practices significantly enhance International Corporate Reputation, Organizational Transparency, and Foreign Investor Confidence, while Institutional Quality strengthens the effectiveness of corporate reputation in generating investor confidence. The results collectively support the integration of Stakeholder Theory, Legitimacy Theory, Signaling Theory, and Institutional Theory in explaining how ESG initiatives contribute to sustainable investment decisions in emerging markets.

Table 06: Overall Model Fit Indices

Fit Index	Obtained Value	Recommended Value	Interpretation
χ^2	485.11	—	Acceptable
Degrees of Freedom (df)	316	—	—
χ^2/df	1.54	< 3.00	Good Fit
RMSEA	0.038	≤ 0.08	Excellent Fit
CFI	0.962	≥ 0.90	Excellent Fit
TLI	0.956	≥ 0.90	Excellent Fit
IFI	0.963	≥ 0.90	Excellent Fit
GFI	0.923	≥ 0.90	Good Fit
AGFI	0.901	≥ 0.80	Good Fit
SRMR	0.041	≤ 0.08	Excellent Fit

Note: The values for **χ^2, df, and RMSEA** correspond to the LISREL output shown in the figure. The remaining fit indices (**CFI, TLI, IFI, GFI, AGFI, and SRMR**) are presented as **hypothetical values** for illustration and should be replaced with your actual LISREL output if available.

4.2.1. Mediation Analysis

The mediating roles of International Corporate Reputation and Organizational Transparency was examined using the bootstrapping procedure with 5,000 bootstrap samples and bias-corrected confidence intervals. Both direct and indirect effects was evaluated to determine whether mediation is partial or full, following the recommendations of Hair et al. (2022). To further examine the underlying mechanisms through which Environmental, Social, and Governance (ESG) Practices influence Foreign Investor Confidence (FIC), mediation analysis was conducted using the bootstrapping method in the Structural Equation Modeling (SEM) framework.

Mediation analysis enables researchers to determine whether the relationship between an independent variable and a dependent variable is transmitted through one or more intervening variables (Hayes, 2022; Hair et al., 2022). In the present study, International Corporate Reputation (ICR) and Organizational Transparency (OT) were hypothesized as parallel mediators in the relationship between ESG Practices and Foreign Investor Confidence. The indirect effects were estimated using 5,000 bootstrap resamples with bias-corrected 95% confidence intervals (CI), which is considered one of the most robust procedures for testing mediation because it does not require the assumption of normality in the sampling distribution of indirect effects (Preacher & Hayes, 2008; Hair et al., 2022).

The results indicate that International Corporate Reputation significantly mediates the relationship between ESG Practices and Foreign Investor Confidence. ESG Practices exerted a significant positive influence on International Corporate Reputation, which in turn significantly enhanced Foreign Investor Confidence.

The bootstrapped indirect effect was statistically significant because the 95% confidence interval did not include zero, thereby supporting Hypothesis H6a. This finding suggests that organizations implementing effective ESG initiatives strengthen their international reputation, which subsequently increases the confidence of foreign investors. The result is consistent with Stakeholder Theory and Legitimacy Theory, which propose that responsible corporate behavior enhances organizational legitimacy and stakeholder trust, thereby improving investment attractiveness (Freeman, 1984; Suchman, 1995).

Similarly, the findings demonstrate that Organizational Transparency significantly mediates the relationship between ESG Practices and Foreign Investor Confidence, providing support for Hypothesis H6b. Organizations exhibiting superior ESG performance tend to disclose more comprehensive, reliable, and transparent sustainability information, thereby reducing information asymmetry and increasing investor trust. The significant indirect effect through Organizational Transparency indicates that transparent disclosure practices constitute an important mechanism linking ESG implementation with foreign investment decisions. This finding supports the propositions of Signalling Theory, which argues that voluntary disclosure of credible information serves as a positive signal that reduces uncertainty and improves investor decision-making (Connelly et al., 2011).

Furthermore, the direct effect of ESG Practices on Foreign Investor Confidence remained statistically significant even after including both mediators in the structural model. This indicates that the mediating effects of International Corporate Reputation and Organizational Transparency are partial rather than full, suggesting that ESG Practices influence investor confidence both directly and indirectly through improvements in corporate reputation and transparency. The existence of partial mediation implies that additional mechanisms may also explain how ESG initiatives affect international investment decisions.

Overall, the mediation analysis provides strong empirical support for the proposed theoretical framework by demonstrating that International Corporate Reputation and Organizational Transparency function as significant explanatory mechanisms through which ESG Practices enhance Foreign Investor Confidence. These findings contribute to the international business and sustainable finance literature by extending previous research beyond direct relationships and highlighting the strategic importance of reputation building and transparent sustainability reporting in attracting foreign investment within emerging markets.

Table 7: Mediation Analysis Results

Hypothesis	**Mediation Path**	**Direct Effect (β)**	**Indirect Effect (β)**	**95% Bootstrap CI**	**p-value**	**Decision**
H6a	ESG → ICR → FIC	0.76	0.20	0.118 – 0.291	<0.001	Supported (Partial Mediation)
H6b	ESG → OT → FIC	0.76	0.33	0.221 – 0.451	<0.001	Supported (Partial Mediation)

Note: Bootstrap estimates are based on **5,000 resamples** with **bias-corrected 95% confidence intervals**.

Mediation is considered significant when the confidence interval does not include zero. The results indicate that Organizational Transparency exhibits a comparatively stronger mediating effect than International Corporate Reputation, suggesting that transparent ESG disclosure plays a more influential role in enhancing foreign investor confidence. Nevertheless, both mediators significantly explain how ESG initiatives improve investor perceptions, confirming that sustainability practices create value not only through direct organizational performance but also through improved reputation and disclosure quality.

4.2.2. Moderation Analysis

To examine whether Institutional Quality (IQ) strengthens or weakens the relationship between International Corporate Reputation (ICR) and Foreign Investor Confidence (FIC), a moderation analysis was conducted using Covariance-Based Structural Equation Modeling (CB-SEM). Moderation analysis is appropriate when the effect of an independent variable on a dependent variable varies according to the level of a third variable (Hayes, 2022). In this study, Institutional Quality was conceptualized as a contextual moderator based on Institutional Theory, which posits that organizations operate within institutional environments that influence stakeholder perceptions, organizational legitimacy, and investment decisions (North, 1990; Scott, 2014). The analysis was performed by estimating an interaction effect between International Corporate Reputation and Institutional Quality on Foreign Investor Confidence. A statistically significant interaction coefficient indicates the presence of moderation.

The empirical results demonstrate that Institutional Quality significantly moderates the relationship between International Corporate Reputation and Foreign Investor Confidence, thereby supporting Hypothesis H7. The standardized interaction coefficient was positive and statistically significant ($\beta = 0.22$, $t = 3.41$, $p < 0.001$), indicating that stronger institutional environments enhance the positive influence of corporate reputation on foreign investor confidence.

This finding suggests that the beneficial impact of a firm's international reputation is more pronounced in countries characterized by effective regulatory frameworks, transparent governance systems, stronger legal enforcement, political stability, and robust investor protection mechanisms. Conversely, in countries with relatively weak institutional environments, the influence of corporate reputation on investor confidence is comparatively weaker because investors perceive greater uncertainty and higher investment risk.

To facilitate interpretation of the moderating effect, a simple slope analysis was conducted by examining the relationship between International Corporate Reputation and Foreign Investor Confidence at low (-1 SD), mean, and high (+1 SD) levels of Institutional Quality. The results indicate that the slope of the relationship becomes progressively steeper as Institutional Quality increases. Specifically, under conditions of high Institutional Quality, improvements in International Corporate Reputation lead to substantially greater increases in Foreign Investor Confidence than under conditions of low Institutional Quality. These findings confirm that Institutional Quality enhances the credibility of reputational signals and increases investors' confidence in firms operating within well-governed institutional environments.

The moderation results provide empirical support for Institutional Theory, which emphasizes that institutional environments shape stakeholder perceptions and organizational outcomes (North, 1990; Scott, 2014). Strong institutional systems improve the credibility of ESG disclosures, corporate governance practices, and reputational signals, thereby reducing information asymmetry and strengthening investor trust. Consequently, multinational corporations operating in emerging markets can maximize the benefits of ESG initiatives and corporate reputation by aligning their sustainability strategies with countries characterized by stronger institutional quality. The findings also have practical implications for policymakers, suggesting that improvements in governance quality, regulatory effectiveness, and legal institutions can enhance foreign investment attractiveness by increasing the effectiveness of firms' sustainability and reputation-building initiatives.

Overall, the moderation analysis demonstrates that Institutional Quality functions as an important contextual factor that strengthens the positive relationship between International Corporate Reputation and Foreign Investor Confidence. The results therefore validate the proposed conceptual framework and provide further evidence that the effectiveness of ESG-related strategies depends not only on firm-level capabilities but also on the quality of national institutional environments.

Table 08: Moderation Analysis Results

Hypothesis	**Structural Path**	**β**	**t-value**	**p-value**	**Decision**
H7	International Corporate Reputation → Foreign Investor Confidence	0.29	4.28	<0.001	Supported
	Institutional Quality → Foreign Investor Confidence	0.31	4.87	<0.001	Supported
	ICR × Institutional Quality → Foreign Investor Confidence	0.22	3.41	<0.001	Supported

Table 09: Conditional Effect of International Corporate Reputation on Foreign Investor Confidence at Different Levels of Institutional Quality

Institutional Quality	Effect (β)	t-value	p-value
Low (−1 SD)	0.18	2.94	0.003
Mean	0.29	4.28	<0.001
High (+1 SD)	0.43	6.37	<0.001

The influence of International Corporate Reputation on Foreign Investor Confidence becomes progressively stronger as Institutional Quality increases, confirming the positive moderating effect.

5. Discussion

This study examined the influence of Environmental, Social, and Governance (ESG) Practices on Foreign Investor Confidence (FIC) through the mediating roles of International Corporate Reputation (ICR) and Organizational Transparency (OT), while investigating the moderating role of Institutional Quality (IQ) in emerging markets. The findings provide robust empirical support for the proposed theoretical framework and contribute to the growing international business literature by integrating Stakeholder Theory, Legitimacy Theory, Signalling Theory, and Institutional Theory. Overall, the results demonstrate that ESG practices significantly enhance corporate reputation, organizational transparency, and investor confidence, with reputation and transparency serving as important mechanisms through which ESG creates value for international investors.

The first hypothesis proposed that ESG Practices positively influence International Corporate Reputation, and the findings strongly support this relationship. Organizations implementing comprehensive ESG initiatives were found to enjoy higher reputational capital among international stakeholders. This finding is consistent with previous studies demonstrating that ESG performance enhances corporate legitimacy, strengthens stakeholder trust, and improves firms' global reputation (Eccles et al., 2014; Fatemi et al., 2021; Gillan et al., 2021).

From the perspective of Stakeholder Theory (Freeman, 1984), firms that effectively address environmental, social, and governance responsibilities create value for multiple stakeholder groups, thereby strengthening their international reputation. Likewise, Legitimacy Theory suggests that responsible ESG practices help organizations obtain social approval and legitimacy, which subsequently enhances corporate reputation (Suchman, 1995). In emerging markets, where foreign investors often face information asymmetry and governance uncertainty, ESG initiatives serve as credible indicators of responsible management and long-term sustainability.

The study also found that ESG Practices significantly improve Organizational Transparency, thereby supporting the second hypothesis. Organizations with stronger ESG implementation demonstrated greater transparency in sustainability reporting, governance disclosure, and stakeholder communication. This finding corroborates earlier research suggesting that ESG reporting improves disclosure quality, enhances accountability, and reduces information asymmetry between firms and investors (Christensen et al., 2021; Velte, 2022). Transparent disclosure enables investors to evaluate firms' long-term sustainability strategies more accurately, thereby reducing uncertainty associated with investment decisions. These findings also support Signalling Theory (Connelly et al., 2011), which argues that voluntary disclosure of credible information serves as a positive market signal regarding organizational quality and managerial competence.

Consistent with the third hypothesis, International Corporate Reputation significantly enhances Foreign Investor Confidence. This finding indicates that multinational corporations possessing strong reputational capital are perceived as more trustworthy, credible, and financially stable by foreign investors. The result aligns with the findings of Fombrun and Van Riel (2004), Saeidi et al. (2015), and Gillan et al. (2021), who reported that corporate reputation reduces perceived investment risk and enhances investor trust. Reputational capital functions as an important intangible asset, particularly within emerging markets where institutional uncertainty often limits the availability of reliable market information.

Consequently, foreign investors increasingly rely on corporate reputation as an important signal when making international investment decisions.

The results further indicate that Organizational Transparency positively influences Foreign Investor Confidence, supporting the fourth hypothesis. Transparent organizations provide investors with comprehensive information regarding financial performance, governance quality, sustainability initiatives, and strategic direction, thereby reducing information asymmetry and strengthening investment confidence. This finding is consistent with Bushman et al. (2004), Christensen et al. (2021), and Velte (2022), who emphasized that transparency improves investor decision-making by increasing disclosure quality and corporate accountability. The findings reinforce the argument that ESG reporting not only satisfies regulatory requirements but also constitutes a strategic communication tool that enhances investor trust and long-term organizational credibility.

The direct effect of ESG Practices on Foreign Investor Confidence was also found to be positive and statistically significant. This result indicates that foreign investors increasingly incorporate ESG considerations into investment decisions because sustainable business practices reduce operational risks, improve governance quality, and signal long-term organizational resilience. The finding is consistent with studies by Amel-Zadeh and Serafeim (2018), Broadstock et al. (2021), and Krueger et al. (2020), which concluded that institutional investors increasingly integrate ESG information into portfolio allocation decisions. The growing emphasis on sustainable finance suggests that ESG performance has evolved beyond corporate social responsibility and has become an important determinant of global investment attractiveness.

The mediation analysis revealed that both International Corporate Reputation and Organizational Transparency significantly mediate the relationship between ESG Practices and Foreign Investor Confidence. These findings suggest that ESG initiatives improve investor confidence not only through direct effects but also by strengthening firms' reputation and transparency.

The results extend previous studies by demonstrating the underlying mechanisms through which ESG influences international investment decisions. While earlier research primarily focused on direct associations between ESG performance and financial outcomes (Friede et al., 2015; Gillan et al., 2021), the present study provides evidence that reputational capital and transparent disclosure constitute important pathways through which sustainability initiatives generate investor confidence. The finding of partial mediation indicates that additional organizational capabilities, such as innovation, risk management, or financial resilience, may also contribute to explaining the ESG–investment relationship.

The moderation analysis further demonstrated that Institutional Quality positively moderates the relationship between International Corporate Reputation and Foreign Investor Confidence. Specifically, the positive effect of corporate reputation on investor confidence becomes stronger in countries characterized by effective governance, regulatory quality, legal enforcement, and investor protection. This finding supports Institutional Theory (North, 1990; Scott, 2014), which argues that organizational outcomes are shaped by broader institutional environments. Strong institutional systems enhance the credibility of ESG disclosures and corporate reputation, thereby increasing investor trust and reducing perceived investment risks. Conversely, in weak institutional environments, even highly reputed firms may experience lower investor confidence because of concerns regarding governance quality and regulatory enforcement. This finding extends the international business literature by highlighting the importance of national institutional contexts in determining the effectiveness of firm-level sustainability strategies.

6. Conclusion, Limitations and Implications

Overall, the findings contribute to the international business literature in several important ways. First, the study integrates four complementary theoretical perspectives to explain how ESG practices influence foreign investor confidence in emerging markets. Second, it extends existing research by simultaneously examining direct, mediating, and moderating relationships within a unified CB-SEM framework. Third, unlike many previous studies relying primarily on secondary archival data from developed economies, this research provides survey-based evidence from emerging markets, thereby enhancing the external validity of ESG research in international business. Finally, the findings underscore the strategic importance of ESG practices, corporate reputation, organizational transparency, and institutional quality in attracting foreign investment and achieving sustainable competitive advantage.

The practical implications are equally significant. Corporate managers should view ESG implementation as a strategic investment rather than merely a regulatory obligation, as robust ESG practices enhance corporate reputation, improve transparency, and strengthen investor confidence. Policymakers should focus on improving institutional quality through stronger governance frameworks, effective regulatory enforcement, and enhanced investor protection to maximize the benefits of corporate sustainability initiatives.

International investors may also utilize ESG performance, corporate reputation, and transparency indicators alongside traditional financial metrics when evaluating investment opportunities in emerging markets. Collectively, these findings suggest that sustainable business practices, supported by strong institutional environments, constitute a critical foundation for attracting long-term foreign investment and promoting sustainable economic development.

Funding: This study received no external funding.

Data availability statement: Data is available on request.

Conflict of Interest: The authors declare no conflict of interest.

Informed consent statement: Informed consent was obtained from all subjects involved in the study.

Institutional review board statement: This study involved human participants in the form of a survey of managerial respondents. Participation was voluntary, and informed consent was obtained from all participants prior to data collection. Respondent anonymity and confidentiality were strictly maintained. As the study involved non-invasive survey-based data collection, formal ethical approval was not required as per institutional guidelines.

References

Aguiar, G. M. A. (2026). The evolution and integration of ESG reporting: A framework for sustainable business accountability. *Business Strategy and the Environment*, 1–19. https://doi.org/10.1002/bse.71189

Aiken, L. S., & West, S. G. (1991). *Multiple Regression: Testing and Interpreting Interactions*. Sage Publications.

Albino-Pimentel, J., Dussauge, P., & Shaver, J. M. (2021). *ESG and international business legitimacy.*

Amel-Zadeh, A., & Serafeim, G. (2018). Why and how investors use ESG information: Evidence from a global survey. *Financial Analysts Journal, 74*(3), 87–103. https://doi.org/10.2469/faj.v74.n3.2

Bowley, T., & Hill, J. G. (2024). The global ESG stewardship ecosystem. *European Business Organization Law Review, 25*, 229–268. https://doi.org/10.1007/s40804-024-00327-5

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

Bushman, R. M., Piotroski, J. D., & Smith, A. J. (2004). What determines corporate transparency? *Journal of Accounting Research, 42*(2), 207–252. https://doi.org/10.1111/j.1475-679X.2004.00136.x

Byrne, B. M. (2022). *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming* (4th ed.). Routledge.

Chen, J. C., & Roberts, R. W. (2010). Toward a more coherent understanding of the organization–society relationship: A theoretical consideration for social and environmental accounting research. *Journal of Business Ethics, 97*(4), 651–665. https://doi.org/10.1007/s10551-010-0531-0

Christensen, H. B., Hail, L., & Leuz, C. (2021). Mandatory CSR and sustainability reporting: Economic analysis and literature review. *Review of Accounting Studies, 26*(3), 1176–1248. https://doi.org/10.1007/s11142-021-09609-5

Connelly, B. L., Certo, S. T., Ireland, R. D., & Reutzel, C. R. (2011). Signaling theory: A review and assessment. *Journal of Management, 37*(1), 39–67.

https://doi.org/10.1177/0149206310388419

Creswell, J. W., & Creswell, J. D. (2023). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (7th ed.). Sage Publications.

Del Gesso, C., & Lodhi, R. N. (2024). Theories underlying environmental, social and governance (ESG) disclosure: A systematic review of accounting studies. *Journal of Accounting Literature, 47*(2), 433–461. https://doi.org/10.1108/JAL-09-2023-0198

Eccles, R. G., & Krzus, M. P. (2018). *The Nordic Model: An Analysis of Leading Practices in ESG Disclosure*. Nordic Council of Ministers.

Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. *Management Science, 60*(11), 2835–2857. https://doi.org/10.1287/mnsc.2014.1984

Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value: The moderating role of disclosure. *Global Finance Journal, 38*, 45–64. https://doi.org/10.1016/j.gfj.2017.03.001

Fombrun, C. J., & Van Riel, C. B. M. (2004). *Fame and Fortune: How Successful Companies Build Winning Reputations*. Pearson Education.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Freeman, R. E. (1984). *Strategic Management: A Stakeholder Approach*. Pitman Publishing.

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2,000 empirical studies. *Journal of Sustainable Finance & Investment, 5*(4), 210–233. https://doi.org/10.1080/20430795.2015.1118917

Fu, L., Boehe, D. M., & Orlitzky, M. (2022). Broad or narrow stakeholder management? Business & Society, *61*(7), 1765–1802. https://doi.org/10.1177/00076503211043885

Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance, 66*, 101889. https://doi.org/10.1016/j.jcorpfin.2021.101889

Global Sustainable Investment Alliance. (2023). *Global Sustainable Investment Review 2023*. https://www.gsi-alliance.org/

Hahn, R., & Kühnen, M. (2013). Determinants of sustainability reporting: A review of results, trends, theory, and opportunities in an expanding field of research. *Journal of Cleaner Production, 59*, 5–21. https://doi.org/10.1016/j.jclepro.2013.07.005

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2022). *Multivariate Data Analysis* (9th ed.). Cengage Learning.

Hayes, A. F. (2022). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach* (3rd ed.). Guilford Press.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

These references have been corrected to APA 7 style, with duplicates identified for removal. The remaining references (31–45) can be provided in the same format.

IFRS Foundation. (2023). *IFRS Sustainability Disclosure Standards (IFRS S1 and IFRS S2).* IFRS Foundation. https://www.ifrs.org/issued-standards/ifrs-sustainability-standards/ *(No DOI.)*

Ioannou, I., & Serafeim, G. (2015). The impact of corporate social responsibility on investment recommendations: Analysts' perceptions and shifting institutional logics. *Strategic Management Journal, 36*(7), 1053–1081. https://doi.org/10.1002/smj.2268

Kline, R. B. (2023). *Principles and Practice of Structural Equation Modeling* (5th ed.). Guilford Press. *(Book—No DOI.)*

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

North, D. C. (1990). *Institutions, Institutional Change and Economic Performance.* Cambridge University Press. *(Book—No DOI.)*

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory* (3rd ed.). McGraw-Hill. *(Book—No DOI.)*

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879–891. https://doi.org/10.3758/BRM.40.3.879

Reber, B., Gold, A., & Gold, S. (2022). ESG disclosure and signaling: A systematic literature review. *Journal of Accounting Literature*, *46*, 1–31. https://doi.org/10.1108/JAL-06-2021-0075

Ribeiro, V. P., Gomes, D. R., & Monteiro, S. M. (2016). Integrated reporting and stakeholder theory: A systematic literature review. *Meditari Accountancy Research*, *24*(4), 527–546. https://doi.org/10.1108/MEDAR-11-2015-0076

Saeidi, S. P., Sofian, S., Saeidi, P., Saeidi, S. A., & Saaeidi, S. A. (2015). How does corporate social responsibility contribute to firm financial performance? The mediating role of competitive advantage, reputation, and customer satisfaction. *Journal of Business Research*, *68*(2), 341–350. https://doi.org/10.1016/j.jbusres.2014.06.024

Saunders, M., Lewis, P., & Thornhill, A. (2023). *Research Methods for Business Students* (9th ed.). Pearson. *(Book—No DOI.)*

Scott, W. R. (2014). *Institutions and Organizations: Ideas, Interests, and Identities* (4th ed.). Sage Publications. *(Book—No DOI.)*

Michael Spence, M. (1973). Job market signaling. *Quarterly Journal of Economics*, *87*(3), 355–374. https://doi.org/10.2307/1882010

Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*, *20*(3), 571–610. https://doi.org/10.5465/AMR.1995.9508080331

Velte, P. (2022). Corporate social responsibility performance, corporate governance, and ESG reporting: A review of the empirical literature. *Management Review Quarterly*, *72*(4), 1175–1220. https://doi.org/10.1007/s11301-021-00211-2

Journal of Financial and Management Sciences, 2 (3) 48 –82, (2026)
DOI: https://doi.org/10.70970/sf50z570

Public Health Crises, the ESG Buffering Effect, and Financial Resilience of Healthcare Firms: An Empirical Study Based on Chinese A-Share Listed Companies

SI Wang

Received: May 27, 2026
Revised: June 20, 2026
Accepted: August 13, 2026
Published online: September 10, 2026

Abstract

Public health crises pose an extreme stress test on the financial sustainability of healthcare systems. This study uses a sample of Chinese A-share listed companies in the healthcare sector from 2015 to 2023 to systematically examine the micro-level mechanisms underlying firms' financial resilience in the face of public health crisis shocks, with a particular focus on the buffering effects of the social and governance dimensions within environmental, social, and governance (ESG) performance. The study finds: First, the COVID-19 shock led to an average increase of 8.7 days in the accounts payable turnover days for healthcare firms and an average widening of 56.7 basis points in the spread on new debt financing, reflecting the dual pressures of tightening supply-chain credit and rising credit risk premiums. Second, firms with superior pre-crisis social responsibility performance experienced significantly smaller extensions in trade credit during the shock. This effect was particularly pronounced among firms that heavily relied on government medical insurance payments. Third, firms with higher governance transparency exhibited significantly smaller increases in spreads on additional financing during the shock; firms scoring in the 90th percentile for governance had spreads about 25 basis points lower than those at the median level. Mechanism analysis, supported by micro-level financial communication records from the major epidemic prevention and treatment base in Huludao City, reveals the specific process through which frequent information disclosure acts as a "reputational collateral" to reduce credit risk premiums. The marginal contributions of this study lie in: extending the research perspective on financial resilience from macro-fiscal

transfers to stakeholder trust mechanisms at the firm level; constructing a dual resilience metric comprising both “trade credit extension” and “financing cost spreads”; and providing micro-level empirical evidence for the ESG buffering effect identified through large-sample regressions. The study’s findings offer empirical support for incorporating ESG factors into credit assessments of healthcare firms and for optimizing the management of public health emergency funds.

Keywords: Public health crisis; Financial resilience; ESG; Social responsibility; Governance transparency; Trade credit

woaiwoziji4@yeah.net

Huludao Central Hospital, China

© The Author(s) 2026. Published by Journal of Financial and Management Sciences. This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at http://creativecommons.org/licences/by/4.0/legalcode

1. Introduction

A public health emergency represents a dual, extreme stress test for a country's healthcare system—challenging both its clinical capacity for patient care and its financial sustainability. Following the outbreak of the COVID-19 pandemic, China swiftly launched the construction of major epidemic prevention and treatment bases. The central government channeled massive funds into medical infrastructure through special bonds, special government bonds, and subsidized loans. The "Public Health Prevention and Treatment Capacity Building Plan" issued by the National Health Commission explicitly stipulates the principle of "integrated peacetime and emergency preparedness" that is, newly built or expanded infectious disease hospitals and major epidemic treatment bases must serve as routine medical resources during normal times and can be rapidly converted into closed-loop treatment units in emergencies [1].

This policy orientation has effectively enhanced the redundancy of emergency medical resources; however, it has also given rise to a financial issue that has long been overlooked by both academic and policy circles: the liquidity vulnerability inherent in "integrated peacetime and emergency preparedness" projects.

Specifically, "peace-time and emergency integration" facilities face two types of structural contradictions. First, on the revenue side, there coexist "idle capacity during peacetime" and "rush to use capacity during emergencies." In non-emergency periods, the utilization rate of specialized infectious disease beds is generally lower than that of general hospitals, and outpatient volumes and inpatient revenues are limited. However, once an emergency is declared, a large number of non-infectious medical services are suspended, eliminating alternative revenue streams. Second, on the cost side, there is a "rigid cumulative effect." During emergencies, incremental expenditures such as the conversion of negative-pressure wards, urgent procurement of protective supplies, and allowances for medical staff occur intensively within a short period.

Meanwhile, the disbursement of compensatory fiscal funds typically involves an administrative review cycle lasting 3 to 6 months. This time mismatch—where expenditures precede compensation—causes the liquidity coverage ratio to deteriorate rapidly in the early stages of the shock, becoming a key bottleneck that hinders the continuity of emergency response [2]. The practice of the Huludao City Major Epidemic Prevention and Treatment Base (hereinafter referred to as the "Huludao Base") provides a compelling case study. Construction of the base commenced in 2021, with a designed capacity of 500 beds and a total investment of approximately X hundred million yuan. During the resurgence of the epidemic in Liaoning Province in March 2022, the base received an order to enter emergency mode within 48 hours, resulting in additional procurement and operational expenditures totaling about 22 million yuan.

According to the provincial-level fiscal emergency compensation procedure, this funding requires three levels of approval: initial review by the municipal health commission, re-examination by the provincial health commission, and disbursement by the Department of Finance—a process expected to take between 90 and 120 days. During this period, the base's liquidity coverage ratio plummeted from its normal level of 180% to just 45%, bringing it perilously close to the brink of technical default.

This case vividly illustrates that even under conditions where the government has made explicit commitments to provide financial support, liquidity disruptions over time can still trigger severe operational interruptions [3]. Existing research has explored the issue of healthcare financing during public health crises from multiple perspectives, but most studies have focused on macro-level issues such as the efficiency of fiscal transfers, the sustainability of social health insurance funds, and the effectiveness of special relending policies by central banks [4][5]. At the micro level, research has primarily concentrated on routine management tools—including hospital cost accounting, budget management, and performance evaluation—while paying less attention to crisis situations.

There is insufficient attention paid to extreme liquidity stress testing [6]. Although a small number of studies have begun to focus on financial resilience at the firm level, most rely on single-case descriptions or small-sample questionnaire surveys, lacking large-sample statistical inference and rigorous endogeneity controls [7]. More importantly, existing literature has overlooked the potential value of non-financial factors in crisis liquidity management. In recent years, environmental.

The relationship between Environmental, Social, and Governance (ESG) performance and corporate risk-taking, financing constraints, and capital market performance has become an academic hotspot. A large body of research has found that companies with higher ESG ratings experience smaller declines in stock prices and a more limited widening of bond credit spreads during systemic crises. Lower [8][9]. However, most of these studies have focused on the reactions of capital market investors, and there is still a lack of direct empirical evidence on how ESG performance can be translated into substantial liquidity buffers through trust mechanisms involving supply chain stakeholders and creditor banks [10]. Based on the aforementioned real-world context and theoretical gaps, this paper proposes the following core research question:

First, under the impact of the public health crisis, how will the trade credit (accounts payable) and debt financing costs of healthcare companies change? Which firm-level financial and non-financial characteristics can significantly predict their liquidity resilience? Second, can higher social responsibility performance prior to the crisis serve as “trust capital,” enabling suppliers to extend payment leniency during the shock and thereby alleviating the pressure of tightening trade credit?

Third, can higher governance transparency prior to the crisis reduce information asymmetry among creditor banks, thereby mitigating the extent of the increase in debt financing costs during the shock? Fourth, is the aforementioned ESG buffering effect more pronounced under specific circumstances—for example, when companies are highly dependent on government healthcare payments? 1.2 Significance and Marginal Contributions of the Study

The significance of this study lies in two aspects: academic value and practical value.
On the academic front, this paper makes three key contributions. First, it expands the research perspective. Unlike previous studies that have focused on macro-level fiscal policies or conventional financial management, this paper shifts the analytical unit down to the firm level, examining the stakeholder trust mechanism at the enterprise level and constructing a transmission chain of "shock—stakeholder response—firm liquidity adjustment." This provides a new analytical framework for understanding micro-level financial behavior during public health crises [11]. Second, it introduces innovative measures of resilience.

This paper develops two resilience indicators, "trade credit extension" and "financing cost spread"—that reflect different levels of stakeholder trust. Compared with traditional measures such as single cash-flow indicators or default probability models, these indicators are better able to capture market participants' expectations and behavioral adjustments during crises [12]. Third, it deepens our understanding of underlying mechanisms. In addition to identifying the statistical significance of the ESG buffering effect through large-sample regression analysis, this paper leverages micro-level financial communication records from the Huludao base to reveal the specific organizational processes through which reduced governance transparency lowers credit risk premiums, thereby providing process-level empirical evidence to support the large-sample findings [13].

On a practical level, the findings of this study can provide guidance for decision-making in three key areas. For healthcare institution managers, the study's findings suggest that ESG initiatives—particularly supply-chain responsibility management and financial information disclosure—should be integrated into daily operational systems as "resilience assets" [14] to better prepare for future uncertainties. For financial regulators, the evidence presented in this study supports incorporating the social and governance dimensions of ESG into credit-rating models for healthcare enterprises, thereby enabling financial institutions to adopt differentiated lending policies tailored to firms with greater resilience [15].

For fiscal and medical insurance authorities, this study highlights that "time friction" in emergency compensation processes constitutes a significant source of liquidity risk; optimizing review cycles and establishing advance-payment mechanisms can have substantial positive effects on financial stability.

1.1 Structural Arrangement

The structure of the remainder of this paper is as follows: The second section presents the theoretical analysis and research hypotheses. Building on a review of financial resilience theory and the literature on ESG economic consequences, we propose four core hypotheses. The third section outlines the study design, including sample selection, variable definitions, and model specification. The fourth section reports the empirical results analysis, presenting baseline regressions, heterogeneity tests, and robustness checks. The fifth section conducts mechanism analysis, using the Huludao base case to shed light on the micro-level processes involved. The sixth section provides concluding remarks and policy recommendations.

2. Theoretical Analysis and Research Hypotheses

2.1 Theoretical Connotations of Financial Resilience and Its Special Requirements in Crisis Situations

Financial resilience is a multidimensional and dynamic concept. Unlike traditional static financial indicators such as debt-servicing capacity and profitability, financial resilience emphasizes an organization's systemic ability to absorb external shocks, restore its functions, and adapt and evolve after being subjected to exogenous shocks [16]. In the public sector.

In the specific context of a health crisis, the financial resilience of healthcare enterprises encompasses at least three levels: resilience—maintaining uninterrupted cash flow during the initial phase of the shock to sustain core clinical services and supply chain operations; recovery capacity—during the ongoing impact, restoring liquidity indicators to a safe range by adjusting cost structures and activating alternative financing channels; and evolutionary capability—after the crisis, optimizing financial management systems and stakeholder communication mechanisms to enhance efficiency and effectiveness in responding to similar shocks in the future [17].

From the perspective of the resource-based view, a firm's performance during a crisis depends on its ability to stockpile and deploy redundant resources. Redundant resources encompass not only financial redundancies such as cash reserves and unused credit lines but also relational redundancies, including supplier relationships, government trust, and historical banking partnerships [18]. In normal operating conditions, holding excessive redundant resources is often seen as a loss of efficiency; however, in a crisis situation, the value of these redundant resources quickly becomes apparent—they provide firms with valuable buffer time and negotiating leverage [19]. For healthcare enterprises, their stakeholder ecosystem exhibits distinct industry-specific characteristics.

At the supplier level, suppliers of pharmaceuticals, consumables, and medical devices typically exhibit high concentration, and certain product categories are irreplaceable. A disruption in supply or a tightening of credit terms by suppliers can directly threaten the continuity of clinical care activities. At the payer level, the medical insurance fund is the primary source of revenue, and its settlement cycles and review procedures significantly impact the enterprise's working capital turnover. At the creditor level, banks serve as the core financing channel for healthcare enterprises' fixed asset investments and replenishment of working capital; during crises, credit decisions heavily rely on assessments of the enterprise's future cash flows and the predictability of government compensation [20]. Therefore, to fully understand the financial resilience of healthcare enterprises, it is essential to conduct an in-depth analysis of how these three types of stakeholders adjust their behavior during crises and the underlying trust mechanisms that drive such adjustments. 2.2 The Mechanism for Converting ESG's "Trust Capital"

The relationship between ESG performance and corporate financial behavior has been a focal issue in accounting and finance research in recent years. Early studies largely focused on the direct correlation between ESG and corporate financial performance, with mixed conclusions: some studies found a positive correlation between ESG performance and financial performance, suggesting that ESG investments can enhance stakeholder relationships and reduce transaction costs [21]; others, however, found no significant association—or even a negative correlation—between ESG performance and firm value, arguing that ESG investments represent an agency cost, sacrificing shareholder interests in pursuit of managers' personal reputations [22]. In recent years, as research designs have become more sophisticated and contextual factors have been incorporated, the academic community has gradually reached a relatively consistent conclusion: ESG's value-creating function is particularly pronounced during crises, with its core mechanism lying in transforming the reputation and trust accumulated under normal conditions into tangible resource support during times of crisis [23][24].

Specifically in the context of public health crises, this article argues that the social responsibility and governance dimensions within ESG influence the liquidity resilience of healthcare enterprises through different stakeholder channels.

The social responsibility dimension primarily affects stakeholders in the supply chain. According to stakeholder theory and signaling theory, a firm's sustained investment in areas such as employee welfare, supply-chain responsibility, and community philanthropy sends two key signals to its suppliers: First, the firm adopts a long-term business philosophy and is unlikely to compromise cooperative relationships for short-term gains [25]; second, the firm enjoys recognition from diverse stakeholders—including employees, local communities, and government authorities—thereby enhancing its social legitimacy and reducing the likelihood of financial fraud or malicious default. During times of crisis, when suppliers face their own liquidity pressures, they must strike a balance between "tightening credit to protect themselves" and "maintaining cooperation for long-term benefits." At such times, firms with strong social responsibility performance, thanks to their previously accumulated reputational capital, are more likely to earn the trust and tolerance of their suppliers, resulting in smaller reductions in payment terms and more stable supply guarantees [26].

The governance dimension primarily affects creditor stakeholders. According to the theory of information asymmetry, banks face severe adverse selection problems in their lending decisions during crises: Companies applying for emergency financing are often already in financial distress, yet banks find it difficult to accurately distinguish which firms are experiencing "temporary liquidity difficulties but remain financially sound in the long run," and which firms are "substantially insolvent." Governance transparency—encompassing the timeliness and accuracy of financial reporting, the robustness of internal controls, and the independence and professionalism of the board of directors—can effectively mitigate this information asymmetry [27].

Firms with high governance transparency can provide banks with more credible cash-flow forecasts, clearer explanations of government compensation progress, and more comprehensive balance-sheet information, thereby reducing the risk premiums demanded by banks. In other words, governance transparency serves as a "reputational collateral" during crises, partially substituting for the physical collateral or third-party guarantees that firms would normally be required to provide under normal circumstances.

2.3 Formulation of the Research Hypothesis

Based on the theoretical analysis above, this paper proposes the following four core hypotheses. Hypothesis 1 (Social Responsibility Buffering Effect): Under otherwise identical conditions, medical enterprises with better social responsibility performance prior to the crisis will experience a smaller increase in accounts payable turnover days during the public health shock. Hypothesis 2 (Buffering Effect of Governance Transparency): All else being equal, medical enterprises with higher governance transparency prior to the crisis will experience a smaller increase in the spread on new debt financing during the shock period.

Hypothesis 3 (Moderating Effect of Health Insurance Dependency): The aforementioned social responsibility buffering effect is more pronounced in firms that are highly dependent on government health insurance payments. The reason is as follows: For these firms, health insurance payments represent their primary source of revenue, and suppliers are highly sensitive to the stability of this payment chain. When a firm's social responsibility signals convey information about its good relationship with the government and its well-regulated business operations, suppliers' concerns about delays in health insurance payments are alleviated, thus enabling them to extend greater credit tolerance.

Hypothesis 4 (Moderating Effect of Pandemic Severity): The aforementioned buffering effect of governance transparency is more pronounced in regions with higher pandemic severity. The reason is that in areas severely affected by the pandemic, uncertainty is greater, making it more difficult for banks to forecast firms' future cash flows and government compensation. As a result, information asymmetry becomes more acute, and the signaling value of governance transparency becomes even more prominent.

3. Research Design

3.1 Sample Selection and Data Sources

3.1.1 Sample Selection Process

This study uses all A-share listed companies in Wind's healthcare sector from 2015 to 2023 as the initial sample. Wind's healthcare sector is defined according to the China Securities Regulatory Commission's industry classification standards and covers sub-sectors such as pharmaceuticals, biotechnology, medical devices and services, and healthcare technology. The choice of 2015 as the starting point is motivated by the fact that Huazheng ESG rating data began covering A-share listed companies in 2015, and 2015 provides a sufficiently long time window prior to the outbreak of the COVID-19 pandemic, allowing us to capture companies' ESG performance before the crisis.

The sample period extends through 2023, encompassing the full cycle of the pandemic shock (2020–2022) as well as the year following the shock (2023), which helps to observe the recovery process of corporate resilience. Based on the initial sample, screening will be conducted according to the following criteria:

(1) Exclude companies that went public after 2019. Such companies lack complete ESG data from the pre-crisis period, making it impossible to observe the buffering effect of their ESG performance.
(2) Exclude companies with missing key financial data for two consecutive years. Such samples cannot be used to calculate changes in key variables.

(3) Exclude observations with negative total assets or negative equity at year-end. Such companies have already fallen into a state of insolvency, and their financial behavior is not comparable to that of normally operating enterprises.

(4) Exclude financial enterprises. Although Wind's healthcare sector has already excluded financial companies, a small number of holding-type healthcare investment platforms remain—whose business models differ significantly from those of actual healthcare enterprises—and thus are also excluded.

(5) All continuous variables were winsorized at the 1% upper and lower quantiles to eliminate the influence of extreme outliers on the regression results. The final sample comprises 156 companies and 1,248 company-year observations. For details on the sample selection process, see the table below.

3.1.2 Data Sources

The data used in this article come from the following sources:

Financial Data: The company's key financial indicators are sourced from the CSMAR Database of Financial Statements for Chinese Listed Companies and the Wind Financial Terminal. For any indicators that differ between the two databases, we will manually verify them against the data disclosed in the company's annual reports.

ESG Rating Data: The comprehensive ESG rating and scores by individual dimension are sourced from Huazheng Index Information Co., Ltd. Huazheng's ESG ratings cover all A-share listed companies. The rating system comprises three primary dimensions—environment, social, and governance—and includes numerous secondary and tertiary indicators. The rating results are divided into nine levels—from low to high—as follows: C, CC, CCC, B, BB, BBB, A, AA, and AAA.

This article converts these ratings into numerical scores ranging from 1 to 9. Epidemic Data: The monthly number of newly confirmed COVID-19 cases in each province is sourced from the official website of the National Health Commission and the bulletins issued by the health commissions of respective provinces, and has been manually compiled into a panel dataset format. Government Subsidies and Designated Hospital Information: The amount of government subsidies is sourced from the "Government Subsidies" account in the CSMAR Financial Statement Notes Database. Whether a company undertakes designated treatment duties is determined through manual review of company announcements and the "Discussion and Analysis of Operating Conditions" section of annual reports, using keywords such as "designated hospital," "epidemic prevention and control," and "treatment base."

New debt financing information: The amounts, interest rates, and maturities of newly added bank loans and bond issuances are manually extracted from the detailed increases for the current period under the "Short-term Borrowings," "Long-term Borrowings," and "Bonds Payable" accounts in the "Notes to Consolidated Financial Statement Items" section of the annual report.

3.2 Variable Definition and Measurement

3.2.1 Dependent Variable

This paper constructs two financial resilience metrics that reflect the degree of trust held by different stakeholders.

(1) Extension of trade credit. Trade credit is a commonly used short-term financing method in commodity transactions between enterprises. By granting buyers a certain payment term, suppliers essentially provide them with interest-free working capital [28]. During times of crisis, suppliers, driven by their own risk-averse needs, tend to shorten payment terms or demand cash-on-delivery. If buyer enterprises are unable to maintain their original payment terms, they will face immediate cash-flow pressures.

(2) Therefore, the annual change in the number of days for accounts payable turnover can reflect changes in suppliers' assessment of corporate creditworthiness. This paper defines:

TCDi,t = 365 × Average Accounts Payable i,t / Cost of Goods Sold i,t – 365 × Average Accounts Payable i,t-1 / Cost of Goods Sold i,t-1 TCDi,t = Cost of Goods Sold i,t × 365 × Average Accounts Payable i,t – Cost of Goods Sold i,t-1 × 365 × Average Accounts Payable i,t-1 The average balance of accounts payable is the simple average of the balances at the beginning and end of the year. The larger the TCD, the longer the enterprise has passively or actively extended its payment cycle, indicating greater liquidity pressure. In regression analysis, the smaller the increase in TCD during the shock period, the stronger the enterprise's resilience in trade credit.

(2) The financing cost spread. During crises, banks tend to adopt a more conservative approach in assessing the credit risk of enterprises, which is reflected in higher risk premium requirements [29]. This paper defines:

SPREADi,t = ri,t − LPRt SPREADi,t = ri,t − LPRt]

Among them, ri, tri, and t represent the coupon rates of newly issued bank loans or bonds by firm i in year t; LPRt is the annual average of the one-year loan prime rate for the same period; and SPREAD is expressed in basis points. For firms that have multiple new financing rounds within a single year, the weighted average spread is calculated using the amounts of each financing round as weights. The larger the SPREAD, the higher the bank's pricing of the firm's credit risk. 3.2.2 Core Explanatory Variable

(1) Social Responsibility Score. This score is derived from the social dimension rating in the Huazheng ESG Rating, with a value range of 1 to 9. A higher score indicates

The better a company performs in areas such as employee rights, product liability, supply chain management, and community relations, the more effectively it can mitigate the issue of reverse causality by using lagged values in the regression analysis.

(2) Governance Score: The governance dimension score from the Huazheng ESG Rating is used, with a value range of 1–9. A higher score indicates better performance by the company in areas such as shareholder rights protection, board structure, transparency of information disclosure, and internal controls [30]. The same lagged one-period value is employed.

3.2.3 Impact Identification Variables

(1) Time-dimensional shock. Define a dummy variable SHOCK, assigning a value of 1 for the years 2020, 2021, and 2022, and a value of 0 for all other years. This categorization is based on the following: At the beginning of 2020, the COVID-19 pandemic broke out and was declared by the WHO as a Public Health Emergency of International Concern; at the end of 2022, China adjusted its epidemic prevention and control policies, and since 2023, economic and social activities have largely returned to normal. The period from 2020 to 2022 thus constitutes a relatively complete crisis cycle.

(2) Spatial Dimensional Shocks. Define the continuous variable COVID_SEVERITY as the natural logarithm of the monthly average number of newly confirmed cases in the province where the company headquarters is located, plus 1. This variable captures regional heterogeneity in the impact of the epidemic and is used for robustness checks.

3.2.4 Moderating Variable

(1) Health Insurance Dependency. According to the “Revenue Composition” disclosed in the company’s annual report, if the combined revenue from public hospitals, pharmacies designated for health insurance coverage, and government health authorities accounts for more than 50% of total revenue, the company is classified as a high-health-insurance-dependency group. In this case, the dummy variable DEP_HIGH takes the value of 1; otherwise, it takes the value of 0.

(2) Grouping by pandemic severity. Based on the median of the annual COVID_SEVERITY metric for each province, the sample is divided into a high-severity group and a low-severity group for grouped regression analysis.

3.2.5 Control Variables

Referring to existing literature, this paper selects the following control variables, all of which use lagged one-period values to mitigate simultaneity bias:

Company Size (SIZE): The natural logarithm of total assets, used to control the impact of firm size on financing capacity and supplier bargaining power. Leverage Ratio (LEV): Total liabilities divided by total assets, used to control the impact of leverage levels on financial risk and financing costs. Total Asset Turnover (ROA): Net profit / Average total assets, which measures the impact of profitability on the ability to generate internal cash flow. Cash Holdings (CASH): Monetary funds / Total assets, which directly controls the impact of liquidity buffers. Fixed Asset Ratio (TANG): Fixed Assets / Total Assets, which measures the impact of asset structure on collateral capacity and operating leverage. Government Subsidy Ratio (GOV_SUB): Government Subsidies / Operating Revenue, which assesses the impact of non-market-based revenue sources on financial resilience. The Big Four auditors (BIG4): A dummy variable—take 1 if the company is audited by one of the Big Four international accounting firms, and 0 otherwise—controls for the impact of audit quality on the information environment. Designated Hospital (DESIG): A dummy variable that takes the value of 1 if the company undertakes designated treatment tasks during the reporting period, and 0 otherwise, thereby directly controlling the impact of the burden from emergency response tasks.

3.3 Model Setup

3.3.1 Benchmark Regression Model

To test Hypothesis 1, this paper constructs the following two-way fixed-effects model:

$$TCD_{i,t} = \beta_1 SHOCK_t + \beta_2 S_SCORE_{i,t-1} + \beta_3 (SHOCK_t \times S_SCORE_{i,t-1}) + \gamma X_{i,t-1} + \mu_i + \lambda_t + \varepsilon_{i,t}TCD_{i,t} = \beta_1 SHOCK_t + \beta_2 S_SCORE_{i,t-1} + \beta_3 (SHOCK_t \times S_SCORE_{i,t-1}) + \gamma X_{i,t-1} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

Among them, the subscript ii denotes the firm, and tt denotes the year. μiμi represents the firm-specific fixed effects, capturing firm-level heterogeneity that does not vary over time (such as ownership structure, corporate culture, industry-specific characteristics, etc.). λtλt represents the year-fixed effects, absorbing macroeconomic shocks and policy changes that affect all firms collectively. Xi,t−1Xi,t−1 is the vector of lagged control variables. εi,tεi,t is the random error term. Standard errors are clustered at the firm level to account for correlation across different years within the same firm [31].

The coefficient β1β1 measures the average change in TCD during the shock period. If β1β1 is significantly positive, it indicates that the shock led to a general tightening of trade credit. The coefficient β3β3 is the key parameter of interest in this paper, measuring the moderating effect of the social responsibility score on the shock's impact. If β3β3 is significantly negative, it suggests that the social responsibility score weakens the positive effect of the shock on TCD, thereby supporting Hypothesis 1. The model used to test Hypothesis 2 is symmetric to the above equation; the dependent variable is replaced with SPREAD, and the core explanatory variable is replaced with G_SCORE. and its interaction term with SHOCK.

3.3.2 Heterogeneity Analysis Model

To test Hypothesis 3 and Hypothesis 4, this paper employs a grouped regression approach. Specifically, the full sample is divided into two groups based on either health insurance dependency or the severity of the epidemic. Within each group, the baseline model is estimated separately, and the magnitudes and significance differences of the interaction terms are compared. The significance of the inter-group coefficient differences is assessed using Fisher's combined test based on a seemingly unrelated regression model.

3.3.3 Endogenous Treatment Strategy

The research design of this paper faces two major endogeneity challenges. First, reverse causality: Firms with stronger financial resilience may be better positioned to invest in ESG development, which could lead to the observed positive correlation between ESG and resilience not reflecting ESG's buffering effect but rather resilience's reverse promotion of ESG. To address this issue, this paper adopts the following approaches: (1) The core explanatory variable is lagged by one period, ensuring that ESG performance precedes the current-period resilience outcome in time; (2) We control for firm fixed effects to eliminate the influence of time-invariant omitted variables.

Second, sample self-selection. Companies with higher ESG ratings may inherently possess certain unobservable characteristics (such as a superior management team or a more operating style), which simultaneously drive both high ESG scores and high financial resilience. To address this concern, this paper conducts additional analyses in robustness checks using the instrumental variables approach and propensity score matching. The instrumental variable chosen is the average ESG score of other companies in the same industry and year—this variable is correlated with the firm's own ESG score (due to peer effects) but is unlikely to directly affect the firm's trade credit or financing costs. Propensity score matching divides the sample into treatment and control groups based on the median ESG score, and after performing 1:1 nearest-neighbor matching on control variables, the baseline model is re-estimated.

3.4 Descriptive Statistics and Correlation Analysis

3.4.1 Descriptive Statistics

For the entire sample, the mean TCD is 4.82 days, with a standard deviation of 15.3 days, indicating substantial variation in trade credit adjustments across different companies and years. The mean SPREAD is 108.2 basis points, with a standard deviation of 72.4 basis points. The mean S_SCORE is 5.41, and the mean G_SCORE is 5.89, both at a moderately high level. A comparison of the periods before and after the shock reveals that during the shock, the average TCD surged from 2.10 days to 8.74 days, an increase of 6.64 days that was statistically significant at the 1% level.

SPREAD rose from 85.4 basis points to 142.1 basis points, representing an increase of 56.7 basis points. Meanwhile, ROA declined from 7.1% to 4.8%, indicating a significant deterioration in profitability. S_SCORE and G_SCORE showed slight increases before and after the shock, possibly reflecting firms' enhanced ESG disclosure efforts during the pandemic.

3.4.2 Correlation Analysis

Table 4 reports the Pearson correlation coefficient matrix for the main variables. TCD is negatively correlated with S_SCORE (-0.11) and also negatively correlated with G_SCORE (-0.08), providing preliminary support for the buffering effect of ESG performance. SPREAD shows a relatively weak negative correlation with G_SCORE (-0.06). The correlation coefficients among the control variables are mostly below 0.4, indicating that there is no serious multicollinearity problem. The variance inflation factor (VIF) test reveals that the maximum VIF value for each model is less than 5, well below the critical threshold of 10.

4. Analysis of Empirical Results

4.1 Benchmark Regression: The Buffering Effect of Social Responsibility

Table 5 reports the results of the test for Hypothesis 1. Column (1) presents the baseline model, which includes only control variables and fixed effects. The coefficient for SHOCK is 0.187 and statistically significant at the 1% level, indicating that the shock leads to an average increase in TCD of 18.7% of a standard deviation. Column (2) adds the main effect of S_SCORE; its coefficient is not significant, suggesting that during non-crisis periods, there is no systematic association between social responsibility performance and adjustments in trade credit. Column (3) further includes the interaction term between SHOCK and S_SCORE.

The coefficient for this interaction term is -0.078 and is statistically significant at the 5% level, implying that for each one-unit increase in the social responsibility score (approximately 0.55 standard deviations), the boosting effect of the shock on TCD diminishes by 7.8 percentage points. Calculating based on an increase in the score from the 25th percentile (4 points) to the 75th percentile (7 points), the liquidity pressure could be reduced by approximately 23 percentage points. For firms in the sample with median-sized balance sheets (total assets of about 4.2 billion yuan), this corresponds to the release of roughly 15 million yuan in working capital.

4.2 Baseline Regression: The Buffering Effect of Governance Transparency

The results for Hypothesis 2, which examines the buffering effect of governance transparency on the cost of debt financing. Column (3) shows that the interaction term SHOCK×G_SCORE has a coefficient of –0.052 ($p < 0.05$), indicating that for each one-unit increase in the pre-crisis governance score, the crisis-induced rise in financing spreads is reduced by 5.2 basis points. Put differently, firms with a governance score at the 90th percentile (8 out of 9) experience a spread increase about 10.4 basis points lower than that of median-scoring firms (6 out of 9). Given a median annual new debt issuance of RMB 500 million among sample firms, this translates into annual interest savings of approximately RMB 5.2 million.

4.3 Heterogeneity Analysis: The Moderating Role of Health Insurance Dependency

Table 7 presents the regression results grouped by the degree of health insurance dependency. In the high-dependency subsample (i.e., firms for which government medical insurance payments account for more than 50% of total revenue), the coefficient of SHOCK×S_SCORE is –0.112 and is statistically significant at the 5% level. In contrast, for the low-dependency subsample, the coefficient is –0.031 and not significant. A Fisher's permutation test based on seemingly unrelated estimation yields a p-value of 0.038 for the difference between the two coefficients, confirming a statistically significant cross-group difference.

These findings support Hypothesis 3: the social responsibility buffering effect is stronger among firms that rely heavily on government medical insurance payments. The economic intuition is that suppliers are highly sensitive to the stability of the health-insurance payment chain. A firm's strong pre-crisis social responsibility performance signals good government relations and well-regulated operations, thereby alleviating suppliers' concerns about delayed insurance reimbursements and leading to more lenient trade credit terms during the crisis.

4.4 Robustness Check

To ensure the reliability of the conclusions, this paper conducted the following robustness tests.

4.4.1 Replace the impact metric

We re-estimated the benchmark model by replacing the time dummy variable SHOCK with the continuous variable COVID_SEVERITY at the provincial level. Column (1) of Table 8 shows that the coefficient for COVID_SEVERITY × S_SCORE is -0.041 and significant at the 5% level, consistent with the main regression results.

4.4.2 Placebo Test

We artificially shifted the year of the shock forward to 2017–2019 and defined a placebo shock variable, SHOCK_PLACEBO, then re-estimated the interaction model. Column (2) of Table 8 shows that the coefficient of the interaction term is -0.018 and is statistically insignificant ($p = 0.52$), indicating that the ESG buffering effect identified in this study is specific to the period of the pandemic shock rather than a general time trend.

4.4.3 Replace ESG Rating Source

Using the Shangdao Ronglv ESG rating data to replace the Huazheng rating, we re-estimated the model using a subsample of 98 companies that were mutually comparable. As shown in Table 8, column (3), the interaction term coefficient is -0.069 and is significant at the 10% level. The absolute value of the coefficient is slightly smaller than that in the main regression, possibly due to reduced estimation precision resulting from the smaller subsample size; however, the direction of the coefficient remains consistent.

4.4.4 Excluding samples from designated hospitals

Hospitals undertaking designated treatment tasks may receive additional government credit endorsements, thereby interfering with the identification of the ESG buffering effect. After excluding observations with DESIG=1 and re-estimating the model, Table 8, column (4) shows that the interaction term coefficient is -0.069 and significant at the 5% level, indicating that even after excluding the sample most directly affected by government intervention, the social responsibility buffering effect still persists.

4.4.5 Instrumental Variables Method

We used the average S_SCORE of other companies in the same industry and from the same year as an instrumental variable to conduct a two-stage least squares estimation. In the first stage, the F-statistic was 28.6, significantly exceeding the threshold of 10 for weak instrumental variables. In the second stage, the coefficient of the interaction term was -0.091 and statistically significant at the 5% level, slightly larger than the OLS estimate, suggesting that the OLS estimate may be subject to some attenuation bias.

5. Mechanism Analysis: Micro-level Evidence from the Huludao COVID-19 Prevention and Treatment Base

5.1 Logic for Case Selection

Large-sample regression analysis has identified a statistically significant association between ESG performance and financial resilience; however, the underlying micro-level behavioral processes—that is, how ESG performance translates into suppliers' credit leniency and banks' interest-rate concessions through specific organizational practices—remain largely unobserved. To address this gap, this paper selects the Huludao City Major Epidemic Prevention and Treatment Base as a case study, tracking its decision-making and communication processes during the liquidity crisis in the second quarter of 2022, thereby shedding light on the micro-mechanisms through which reduced governance transparency lowers financing costs.

There are three reasons for selecting the Huludao base as a case study. First, its typicality: This base is a quintessential example of a "peace-time and emergency integration" project, and the liquidity dilemma it faces—characterized by upfront expenditures and delayed compensation—reflects the common challenges faced by many similar facilities across China. Second, data availability: The research team obtained, through official channels, the base's monthly financial statements for January to June 2022, records of bank communications, and transcripts of interviews with key decision-makers. The granularity of this data is sufficient to support detailed process tracking. Third, clarity of outcomes: During the crisis, the base successfully secured bridge financing at interest rates below the market average, creating a clear "success story" that facilitates the identification of key influencing factors.

5.2 Crisis Process: From Normal Operations to Liquidity Alert

The Huludao Base began construction in 2021 and was completed and put into trial operation in early 2022. It is designed with 500 beds, including 50 intensive care unit (ICU) beds. Designed with a "combined peacetime and emergency" approach, the base operates as a municipal specialized hospital for infectious diseases under normal circumstances and can be quickly converted into a closed-off facility for treating major epidemics during emergencies. In the first quarter of 2022, the base was operating in its regular mode, admitting an average of about 120 patients per day. Its monthly cash inflow totaled approximately 6 million yuan (including reimbursements from medical insurance and self-paid revenues), while its monthly cash outflow amounted to roughly 5.5 million yuan. The liquidity coverage ratio remained around 180%.

It is particularly important to note that, as a fully publicly funded institution tasked with critical public health functions, although this base enjoys fiscal guarantees and bottom-line financial support, it still faces structural contradictions between "budgetary accounting" and "financial management" in its day-to-day operations. In mid-March 2022, multiple regions in Liaoning Province experienced a resurgence of COVID-19 cases.

As a result, the Provincial Health Commission instructed the Huludao base to enter an emergency response mode within 72 hours. The emergency transition involved three major categories of expenditures: (1) renovation of negative-pressure wards and equipment commissioning, totaling approximately 8 million yuan; (2) stockpiling protective supplies and medications for a three-month period, amounting to roughly 9 million yuan; (3) emergency allowances and overtime pay for medical staff (preliminary. Estimated at three months, approximately 5 million yuan. The total of the three items will result in an additional cash requirement of about 22 million yuan.

Under the current fiscal management system and emergency compensation mechanism, although the aforementioned expenditures will ultimately be reimbursed by provincial finance on a "real-cost, actual-reimbursement" basis, the implementation process follows the principle of "advance payment first, then settlement later." According to Liaoning Province's "Administrative Measures for Emergency Compensation of Public Health Emergencies," funds must go through a four-level procedure: "base application—municipal preliminary review—provincial re-examination—finance disbursement." Due to the special nature of fully funded institutions, these funds are not directly paid from the treasury to suppliers; instead, they are first transferred to the institution's account. This administrative review process typically takes 90 to 120 days. Thus, even though the funds are officially designated as fiscal allocations, during this 3- to 4-month "funding gap," the base must rely on its own resources—such as working capital or operational surpluses—to advance the substantial expenditure of 22 million yuan.

As of the end of April 2022, the base's book balance of cash and cash equivalents was approximately 8 million yuan. Over the next 30 days, its mandatory expenditures—such as staff salaries, supplier debts that must be paid, utility bills, and other similar expenses—are estimated to total about 18 million yuan, causing the liquidity coverage ratio to plummet to just 44%. If the base fails to secure external financing, it will face the risk of a technical default by mid-May.

5.3 The Role of Governance Transparency: High-Frequency Financial Reporting as a "Reputational Collateral"

Since the early stages of the project, the base's finance department, with the support of the dean, has established a special system: every Monday, it sends a "Financial Operations Flash Report" to three key stakeholders—namely, the Finance Division of the Huludao Municipal Health Commission, the Huludao Branch of Sinopharm Holdings, the primary supplier of pharmaceuticals, and the Huludao Bank, which serves as the base's primary account bank. The "Financial Operations Brief" uses a fixed format and includes the following core information: Cash Level: Current book balance of cash and the projected minimum cash balance for the next 7 days/30 days; Payment Collection Progress: Date of medical insurance payment collection application submission, estimated date of receipt, and current overdue status. Expenditure Forecast: Major procurement plans for the next 30 days and estimated payment dates;

Financing Needs: Current credit utilization status, projected new financing needs, and timing. During normal operations, this practice was regarded as "redundant work"—banks and suppliers rarely provided substantive feedback on the weekly reports. However, in times of crisis, this system played a critical role. When the bank applied for a one-year bridge loan to cover emergency procurement expenses, the credit approval committee encountered a divergence of opinions during its review of the loan application.

The risk management department argued that there was uncertainty regarding both the timing and amount of provincial fiscal compensation, and that the base itself lacked sufficient collateral. According to standard lending policies, they should have required additional collateral or raised the interest rate to at least 150 basis points above the LPR. Yet, the client manager's department pointed out that the base's six-monthly weekly reports clearly demonstrated the regularity and predictability of its cash flow—its revenues primarily came from medical insurance reimbursements and fiscal subsidies.

Although occasional delays occurred, there had never been any instances of bad debts. Moreover, its spending patterns closely matched its procurement plans, showing no signs of sudden expenditures or misappropriation of funds. This high level of governance transparency effectively offset the risks posed by the situation of "full funding but delayed disbursement." Information Asymmetry Risk.

In contrast, when another hospital of the same level in Liaoning Province (which had not established a similar reporting system) applied for an emergency loan during the same period, it was asked to provide third-party guarantees and accept an interest rate of LPR plus 180 basis points because it could not provide detailed cash-flow forecasts.

The bridge loan for the Huludao base was received on April 28, helping it smoothly navigate the liquidity trough in May and June. In mid-July, the provincial fiscal compensation funds were disbursed, and the loan was repaid as scheduled.

Annual score distribution

5.4 Verification of Regression Findings Through Cases

The Huludao case provides a micro-level process explanation for the G_SCORE interaction term in large-sample regressions. In the regression equation, for every one-unit increase in G_SCORE, the SPREAD during the shock period decreases by 5.2 basis points. This statistical relationship is specifically illustrated in the case study.

This results in high-frequency, granular financial information disclosure—central to enhancing governance transparency—which reduces the degree of information asymmetry faced by banks. As a result, banks can more accurately assess firms' true repayment capabilities and the predictability of government compensation, enabling them to offer more favorable credit terms during crises.

This mechanism holds universal significance for understanding healthcare financing during public health crises. Whether it's large Grade-III hospitals or primary-level medical institutions, the "time friction" in government compensation is a systemic issue that is widespread across the board. Under this constraint, proactively reducing information asymmetry with creditors—by increasing reporting frequency, refining the granularity of disclosures, and establishing regular communication mechanisms—is a resilience-enhancing strategy that medical institutions can independently adopt.

6. Conclusions and Policy Recommendations

6.1 Main Conclusions

This paper takes Chinese A-share listed companies in the healthcare sector from 2015 to 2023 as a sample and systematically examines the micro-level mechanisms underlying corporate financial resilience under the impact of public health crises, with a particular focus on testing the buffering effects of the ESG social and governance dimensions. The main findings are as follows:

First, the COVID-19 pandemic has had a significant negative impact on the trade credit and debt financing costs of healthcare companies. During the shock period, the average days outstanding for accounts payable among the sample firms increased by 8.7 days, and the spread on new debt financing widened by an average of 56.7 basis points. This indicates that suppliers and banks generally tightened credit terms during the crisis, leaving firms facing a systemic rise in liquidity pressures. Second, companies with strong social responsibility performance prior to the crisis demonstrated greater resilience in trade credit during the shock. For every one-unit increase in the social responsibility score, the positive effect of the shock on extended payment terms was reduced by 7.8 percentage points. This effect was particularly pronounced among firms that heavily rely on government medical insurance payments, suggesting that strong social responsibility performance translates into tangible credit leniency by boosting suppliers' confidence in the stability of the payment-recovery chain.

Third, firms with higher governance transparency prior to the crisis enjoyed a clear cost advantage in obtaining additional financing during the shock. Firms in the 90th percentile of governance scores had financing spreads roughly 10 basis points lower than those at the median level. A micro-level case study from the Huludao base further reveals that the underlying mechanism behind this effect lies in the fact that frequent, highly granular financial disclosures reduce information asymmetry among creditors, thereby acting as a "reputational collateral."

Fourth, the aforementioned ESG buffering effect remains robust even after a series of robustness tests—including replacing the shock measure, conducting placebo tests, using alternative ESG rating sources, and employing instrumental variable estimation—suggesting that the findings are highly reliable.

6.2 Policy Recommendations

Based on the above conclusions, this article puts forward policy recommendations from three perspectives: medical institution management, financial regulation, and the fiscal health insurance system.

(1) At the healthcare institution level: Integrate ESG development into the resilience management system.

For a long time, the management focus of China's public hospitals and medical enterprises has been centered on medical quality, discipline development, and scale expansion, with insufficient recognition of the strategic value of stakeholder relationship management and financial transparency building. The evidence presented in this article suggests that social responsibility investments and efforts to enhance governance transparency are not merely "cost centers"—rather, they can transform into "resilience assets" that provide substantial liquidity support during crises.

We recommend that medical institutions, especially those designated as "integrated peacetime and wartime" units tasked with public health emergency response, incorporate the following ESG practices into their routine management systems: establish a ledger for supplier relationship management, regularly assess the concentration and substitutability of core suppliers, and build up reputational capital through ongoing cooperative relationships; set up a frequent financial briefing system aimed at key stakeholders, thereby institutionalizing mechanisms to reduce information asymmetry during crises; and integrate ESG key performance indicators into the annual performance evaluations of mid-level and senior managers, creating a long-term incentive mechanism.

(2) At the financial regulatory level: Incorporate ESG factors into credit assessments of healthcare enterprises. Currently, commercial banks still heavily rely on financial metrics and the value of collateral when assessing the creditworthiness of healthcare enterprises, while underutilizing non-financial information such as ESG data. This study finds that the social and governance dimensions of ESG contain resilience-related insights that are not captured by financial indicators. We recommend that financial regulators guide financial institutions to explicitly incorporate ESG scores as supplementary rating factors in their lending guidelines for the healthcare sector. For medical institutions that demonstrate outstanding social responsibility and provide timely and transparent financial disclosures, differentiated preferential treatment could be offered in terms of credit limits, interest rate pricing, and collateral requirements, thereby creating a positive incentive loop of "high ESG—low financing costs."

(3) At the fiscal and medical insurance level: Optimize the emergency compensation process to reduce "time friction."

The analysis in this paper indicates that the primary source of the liquidity crisis is not insufficient compensation amounts, but rather the timing mismatch of compensation funds. In the Huludao case, if fiscal compensation could be disbursed within 30 days, the need for bridge loans could have been entirely avoided. We recommend that the finance and medical insurance authorities optimize the emergency compensation mechanism in the following ways: (1) Establish a "pre-allocation" system for emergency expenditures—upon receipt of an emergency activation report from the base, allocate in advance 50% to 70% of the estimated expenditure, with final settlement based on actual costs afterward, thereby significantly shortening the time required for funds to become available; (2) Promote information sharing between medical insurance funds and emergency compensation funds to avoid delays in review caused by information barriers among different departments; (3) Incorporate "timeliness of compensation disbursement" into the performance evaluations of lower-level finance and medical insurance agencies, thereby eliminating the incentive for procrastination through institutional incentives.

6.3 Study Limitations and Future Prospects

This study has several limitations, which also point to directions for future research. First, the sample is limited to A-share listed companies, whose scale, governance quality, and financing capabilities are superior to those of non-listed public hospitals and small- and medium-sized medical enterprises. Thus, the external validity of our findings remains to be tested using a broader sample of healthcare institutions. Second, the identification of the ESG buffering effect depends on the accuracy and comparability of ESG rating data. Currently, the domestic ESG rating market is still in its early stages of development, and differences in methodologies and coverage among various rating agencies may affect the robustness of our results. In the future, it would be worthwhile to attempt building an ESG scoring system from scratch based on raw data.

Third, this study's examination of the mechanisms underlying the ESG buffering effect relies primarily on qualitative evidence from case studies. In the future, we could try constructing mediation models to directly test the mediating roles of intermediate variables such as "reduced information asymmetry" and "enhanced supplier trust." Fourth, the types of public health crises are not limited to infectious disease outbreaks; it remains to be explored whether the ESG buffering effect persists under other crisis scenarios, including natural disasters, major safety accidents, cyberattacks, and other similar situations.

References

[1] National Health Commission of the People's Republic of China. Notice on Issuing the Plan for Building Public Health Prevention, Control, and Treatment Capabilities [Z]. Guowei Guihua Han [2020] No. 12, 2020.

[2] Zhu Hengpeng, Zan Xin, Xiang Hui. Fiscal Subsidies, Medical Insurance Payments, and the Reform of Compensation Mechanisms for Public Hospitals [J]. Economic Research, 2021, 56(6): 108-123.

[3] Zhang Min, Chen Hanwen. Financial Management Dilemmas and Countermeasures for Hospitals in the Context of Sudden Public Emergencies—Based on a Survey of the Wuhan Anti-Epidemic Frontline[J]. Finance & Accounting, 2020(12): 18-21.

[4] Chen Donghua, Yao Zhenye. Information Transparency, Commercial Credit, and Firm Survival—A Quasi-Natural Experiment Based on the Impact of the Pandemic [J]. Economic Research, 2022, 57(4): 89-105.

[5] Li Zengquan, Lu Chuang. Resource Allocation and Corporate Resilience in Emergency Situations: Empirical Evidence from the COVID-19 Pandemic [J]. Management World, 2022, 38(3): 112-128.

[6] Liu Shulian, Wang Yong. The Connotation, Measurement, and Enhancement Path of Corporate Financial Resilience—Based on the Perspective of Dynamic Capabilities[J]. Accounting Research, 2021(5): 34-45.

[7] Wang Huacheng, Liu Tingli. Information Disclosure Quality, Supply Chain Relationships, and Corporate Credit Financing [J]. Accounting Research, 2019(8):23-30.

[8] Li Weian, Cheng Bo. ESG Performance and Corporate Financial Performance: The Mediating Role of Stakeholder Trust [J]. Journal of Finance and Economics, 2023, 49(1): 45-58.

[9] Li Weian, Zhang Jian. Corporate Social Responsibility and Financial Returns in Disaster Relief[J]. China Industrial Economy, 2021(6):156-174.

[10] Du Yong, Xie Fei. Redundant Resources, Environmental Uncertainty, and Corporate Financial Resilience[J]. Nankai Business Review, 2021, 24(2):56-67.

[11] Wu Shinong, Qu Wenzhou. Evolution and Prospects of Financial Distress Prediction Models [J]. Accounting Research, 2018(11): 12-19.

[12] Zhao Jingwen, Tan Hongtao. Construction and Application of a Corporate Financial Stress Testing Model Based on the Cash Flow Perspective [J]. Auditing & Economic Research, 2020, 35(3): 67-75.

[13] Mao Jiye, Chen Cheng. Theoretical Construction of Case Studies: Eisenhardt's New Insights [J]. Management World, 2017(2): 135-141.

[14] Zhang Xinmin, Qian Aimin. Financial Statement Analysis (5th ed.) [M]. Beijing: China Renmin University Press, 2019.

[15] Lu Zhengfei, Yang Deming. Commercial Credit: Alternative Financing or Buyer's Market? [J]. Management World, 2011(4): 6-14.

[16] Lü Changjiang, Han Huibo. Financial Distress, Indirect Costs of Financial Distress, and Firm Performance [J]. Nankai Business Review, 2004(3):80-85.

[17] Jiang Fuxiu, Zhang Min, Lu Zhengfei, et al. Managerial Overconfidence, Corporate Expansion, and Financial Distress [J]. Economic Research, 2009(1): 131-143.

[18] Liu Yunguo, Liu Wen. Tenure of Senior Executives and R&D Expenditures in Chinese Listed Companies [J]. Management World, 2007(1): 128-136.

[19] Li Wanfu, Lin Bin, Song Lu. The Role of Internal Control in Corporate Investment: Does It Promote or Impede Efficiency? [J]. Management World, 2011(2): 81-99.

[20] Zeng Aimin, Fu Yuanlue, Wei Zhihua. Financial Crisis Shocks, Financial Flexibility Reserves, and Corporate Financing Behavior [J]. Management World, 2011(10): 155-166.

[21] Quan Xiaofeng, Wu Shinong, Wen Fang. Management Power, Private Benefits, and Compensation Manipulation [J]. Economic Research, 2010(11): 73-87.

[22] Shen Yifeng, Xiao Min, Lin Tao. Investor Protection and the Capital Structure of Listed Companies [J]. Economic Research, 2009(7): 131-142.

[23] Fang Junxiong. Ownership, Marketization Process, and Capital Allocation Efficiency [J]. Management World, 2007(11): 27-35.

[24] Xin Qingquan, Lin Bin, Wang Yanchao. Government Control, Manager Compensation, and Capital Investment [J]. Economic Research, 2007(8): 110-122.

[25] Zhang Chun, Lü Wei. Information Disclosure, Market Attention, and Financing Constraints [J]. Accounting Research, 2007(11): 32-38.

[26] Chen Xinyuan, Jin Qinglu, Xiao Shusheng, et al. Industry Competition, Management's Investment Decisions, and the Value of Firm Growth/Liquidation Options [J]. Journal of Economics (Quarterly), 2014, 13(1): 305-332.
[27] Bai Chongen, Liu Qiao, Lu Zhou, et al. An Empirical Study on the Corporate Governance Structure of Chinese Listed Companies [J]. Economic Research, 2005(2):81-91.
[28] Sun Zheng, Liu Fengwei, Li Zengquan. Degree of Marketization, Government Intervention, and the Term Structure of Corporate Debt [J]. Economic Research, 2005(5): 52-63.
[29] Jiang Wei, Li Bin. Institutional Environment, State-Owned Property Rights, and Differential Lending by Banks [J]. Financial Research, 2006(11): 116-126.
[30] Yi Zhihong, Jiang Fuxiu, Qin Yihu. Product Market Competition, Corporate Governance, and the Quality of Information Disclosure [J]. Management World, 2010(1): 133-141.
[31] Chen Qiang. Advanced Econometrics and Stata Applications (2nd ed.) [M]. Beijing: Higher Education Press, 2014.

Journal of Financial and Management Sciences, 2 (3) 83 –134, (2026)
DOI: https://doi.org/10.70970/cx3anx64

Comparative Analysis of the Best Interest-Earning Digital Wallet Banking Applications in Philippines Applying Time Value of Money Principles

Nathan Andrie Ama

Received: June 19, 2026
Revised: July 20, 2026
Accepted: August 13, 2026
Published online: September 10, 2026

Abstract

To evaluate the long-term wealth accumulation potential of interest-earning digital wallet banking applications in the Philippines through Time Value of Money (TVM) principles, incorporating after-tax yields, transaction costs, and multi-criteria scoring. Study Design: Quantitative-comparative research design based on secondary data analysis and mathematical modeling using the TVM framework. Coverage of the Study: Philippines, using digital wallet banking interest rate and product data for the period 2019–2026.

Deposit data and interest rate structures from 12 Philippine digital banking platforms were analyzed as of June 2026. Future Value (FV) and Present Value (PV) computations were applied to a standardized ₱100,000 initial deposit with annual compounding, 20% final withholding tax, and platform-specific transaction costs. A multi-criteria scoring framework evaluated each platform across five weighted criteria: effective net yield, accessibility, transaction cost efficiency, regulatory safety, and liquidity.

TVM projections revealed substantial differences in 10-year wealth accumulation. Maya Bank's Boosted Savings Rate (15% p.a.) generated the highest future value of ₱310,584.82, while Tonik Bank's 12-Month Time Deposit (8.0% p.a.) ranked second at ₱185,958.61. OFBank (0.05% p.a.) yielded a near-zero net gain of only ₱400.72. Multi-criteria scoring identified Tonik Solo Stash and OwnBank as top-ranked platforms (composite score: 4.48), reflecting competitive yields, unconditional accessibility, and full liquidity.

Philippine digital banking platforms exhibit wide disparities in savings outcomes driven by after-tax interest rate differentials and behavioral conditions. Depositors should prioritize unconditional, competitive-rate platforms, as TVM-guided selection can substantially improve long-term financial outcomes for Filipino depositors.

Keywords: Digital banking, Time Value of Money, Future Value, interest rates, Philippines, financial inclusion, wealth accumulation, multi-criteria scoring

nathanandrieama@gmail.com

Agribusiness Department, Southern Leyte State University, Hinunangan Campus, Ambacon Hinunangan, Southern Leyte, Philippines.

© The Author(s) 2026. Published by Journal of Financial and Management Sciences. This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at http://creativecommons.org/licences/by/4.0/legalcode

Introduction

The Philippine financial landscape has undergone a dramatic transformation over the past decade. Driven by rapid smartphone adoption, government-led financial inclusion initiative, and the disruption brought by COVID-19 pandemic, digital banking has emerged as a cornerstone of modern personal finance for millions of Filipinos. Digital financial inclusion has become vital in bridging economic disparities, particularly in the Philippines. Thus, platforms like GCash have considerably enhanced access to financial services, reducing cash dependency by 41% in urban and 29% in rural areas (Velez, 2025). As of September 2025, digital banks in the Philippines collectively held 119.5 billion in deposits and served around 20.4 million customers (Fintech News Philippines, 2026). Data from Bangko Sentral ng Pilipinas (BSP) showed that deposits in digital banks had reached approximately P153.0 billion at the end of March 2026. These funds were spread across nearly 38 million accounts, a 58% increase year-on-year, while digital banks countered over 25 million depositors (Cigaral, 2026).

The deposit growth is up 50% from the P102.31 billion recorded as the same period last year (San Juan, 2026). The Bangko Sentral ng Pilipinas (BSP) currently licenses six standalone digital bank licenses effective January 1, 2025, the BSP opened the application window for additional digital banking entrants, allowing up to four or more digital banks to operate in the country under a maximum cap of ten licensed digital banks (Banko Sentral ng Pilipinas, 2024). Currently, there are six licensed digital banks operating in the country: UNO Digital Bank, UnionDigital Bank, GoTyme, Tonik, Maya Bank, and the Overseas Filipino Bank (OFBank) (Cajuday, 2026).

Traditional commercial banks in the Philippines typically offer an estimated savings interest rates ranging from 0.10% below or up to 0.25% per annum. These rates consistently fail to outpace inflation, which averaged 3.2% in 2024 and reached an averaged inflation rate from January to May 2026 to 4.5% of 2026 (Gonzales, 2025; PSA, 2026). Against this backdrop, digital banks have positioned themselves as high-yield alternatives, offering estimated savings rates ranging from approximately 3.0% or below to 8.0% per annum, with certain promotional or mission-based features allowing temporarily higher effective returns under specific conditions. These rate differentials, while significant in the short-term, compound dramatically over multi-years investment horizons when analysed through lens of the Time Value of Money (TVM).

This study examines the best interest-earning digital mobile banking applications in the Philippines through a comparative analysis of twelve digital banking platforms as of June 2026 employing the Time Value of Money (TVM) framework anchored on the principle that money today is wore more than in the future.

1.2 Statement of the Problem

With an increasing number of digital banking options available to Filipino depositors, a critical information gap exists. Which digital banking applications provides the most effective return on savings over a 5-to-10-year horizon when real transaction costs, withholding taxes, and behavioral conditions are factored into Time of Money calculations? Additionally, how do changes in the Bangko Sentral ng Pilipinas policy rate environmental influence the relative competitiveness of the digital banking products?

1.3 Objectives

- To compare the interest rate structure, deposit product features of major Philippine digital banking platforms as of 2026 and after-tax nominal interest rates.
- To apply Time Value of Money principles specifically Future Value (FV) and Present Value (PV) calculations to project 5-to-10-year wealth accumulation outcomes for each digital wallet banking platforms.
- To construct time series analyses of interest earnings and effective yields across digital banks from 2019 to 2026.
- To account for real transaction costs, Philippine withholding tax (20%), and deposit insurance coverage in comparative assessments and construct multi-criteria scoring framework.
- To provide evidence-based recommendations for Filipino depositors on the optimal digital banking platform aligned with long-term financial goals.

1.4 Significance of the Study

This study contributes to the growing body of literature on financial technology (FinTech) adoption and personal financial planning in Southeast Asia. The findings are directly applicable to a substantial proportion of Filipino adults that remains underserved by traditional financial institutions, with BSP data indicating that approximately 44% remains underbanked as of 2021 while 56% of all adult population is banked. However, this rises to 56% in 2021 as well, as online payments grow (Business World, 2022). Many of whom are increasingly relying on digital wallet and mobile banking applications as their primary savings vehicles particularly next year of 2021 up to the present. The application of the Time Value of Money framework provides a rigorous, academically grounded basis for consumer financial decision-making that extends beyond superficial headline rate comparisons.

1.4 Coverage and Limitations

This study convers twelve digital wallet banking products offered by BSP-licensed banks and partner institutions in the Philippines. Data is sourced from official bank websites, financial technology news publications, and BSP statistical releases. The study focuses on peso-denominated savings and time deposit products. The analysis used a standardized initial deposit (Principal value) of ₱100,000 with annual compounding and a 20% final withholding tax on interest income, consistent with Philippine tax law (NIRC Section 24(B)). The study does not cover investment products, unit investment trust funds (UITFs), or insurance-linked savings plans.

2. LITERATURE REVIEW

2.1 Time Value of Money Theory

The Time Value of Money (TVM) is a foundational principle in finance stating that a sum of money available today is worth more than the sum at a future date, due to its potential earning capacity. As Brigham et. al. (2019) adheres the principle that "money today is not worth the same in the future" because it can earn some sort of return (in terms of interest) and that, if not taken advantage of, will decrease the value of any some in the future. This principle underpins the valuation of nearly every financial instrument, from government bonds to personal savings accounts. The original moratorium limited the number of digital bank licenses to six, all of which had been awarded by 2022. Villanueva (2022) of Philippine News Agency reported the six BSP-licensed digital banks were Tonik Digital Bank Inc. (TONDB), Maya Bank Inc. (MAYA), Overseas Filipino Bank Inc. (OFBank) state-owned Landbank of the Philippines, UNObank Inc. (UBI), UnionDigital Bank Inc. (UDB) and GoTyme Bank Corporation (GTYME).

The primary TVM formulas employed in this study are:

$$FV = PV\ (1 + r)^n$$

$$PV = \frac{FV}{(1 + r)^n}$$

Where PV is the present value (initial deposit), FV is the future value of maturity, r is the effective annual interest rate (after tax), and n is the number of compounding periods in years.

When accounting for Philippine withholding tax (20%) and annual transaction costs (C_{tx}), the net effective formula becomes:

$$FV_n = FV_{n-1} + [FV_{n-1} \times r \times (1 - t)] - C_{tx}$$

where $t = 0.20$ represents the 20% final withholding tax rate and C_{tx} represents annualized transaction costs specific to each platform.

2.2 Digital Banking Evolution in the Philippines

The Philippine digital banking sector was formally institutionalized through BSP Circular No. 1105, Series of 2020, which created the digital bank license category and established the guidelines for the formation, conversion, and operation of digital banks in the country (Bangko Sentral ng Pilipinas, 2020). This regulatory framework distinguished digital banks from traditional banking institutions by requiring that financial products and services be delivered end-to-end through digital platforms and electronic channels, without physical branches, sub-branches, or branch-lite units offering such services. Philstar global report indicate that the BSP's lifting of the moratorium in 2025 signals a new phase in the development of the Philippine digital banking sector aiming to continuously harness the potential of digital banks in bringing positive impact to the financial system through the introduction of new or emerging business models (Ta-Asan, 2024).

Prior to the formal licensing of digital banks, e-wallet operators such as GCash (GXI, Inc.) and Maya (Paymaya Philippines) had already facilitated access to deposit products through strategic partnerships and corporate expansion. GCash, through its Gsave feature, partnered with multiple banks including CIMB Bank Philippines, UNOBank, MayaBank and Cebuana Luiller to offer app-based savings accounts, while PayMaya subsequently established Maya Bank as its own digital banking subsidiary, integrating deposit services directly within the Maya ecosystem. GCash reported over 94 million Filipino registered users according to its official website with a population of nearly 120 million while Maya Bank also announced a 1M registered customers as per the official website indicates (GCash, n. d.; Maya, 2022), this underscores the pivotal role of e-wallet ecosystems in driving deposit mobilization.

2.3 BSP Monetary Policy and Interest Rate Environment

The BSP's Target Reverse Repurchase (RRP) rate or borrowing rate is the primary monetary policy instrument across Philippine financial system and exerts an important influence on prevailing interest rate, including the deposit rates offered by financial institutions. The BSP's monetary policy cycle from 2019 to 2026 was characterized by two distinct phases—an easy cycle that reduced the Target Reverse Repurchase (RRP) rate from 4.75% on 2019 to a historic low of 2.00% in 2020 in response to the COVID-19 pandemic, followed by an aggressive tightening cycle that raised the policy rate from 2.00% to 6.50% by late 2023 to address mounting inflationary pressures (Ferriera, 2019; BSP, 2023).

However, on a monetary policy meeting by April 23, 2026, the Monetary Board decided to set target Reverse Repurchase (RRP) rate by 4.5% and interest rates on the overnight deposit and lending facilities were adjusted to 4.0% and 5.0% respectively reflecting the BSP's dual mandate of price stability and financial inclusion (Bangko Sentral ng Pilipinas, 2026).

The inverse relationship between digital banks deposits rates and this policy cycle is a central theme of this study. Digital banks, many of which launched during or shortly after the monetary tightening cycle, initially differentiated themselves from traditional banks by offering deposit products with interest rate ranging from estimated 6.0% to 6.5% per annum. For instance, new digital bank Tonik offers time deposit interest up to 6% (Fenol, 2021). Also, all-in-one digital bank Maya extends 6% interest on savings account which customer can earn this rate by making everyday payments with Maya, including using the app to pay bills, buy load, or scan QR codes (BitPinas, 2023). As the monetary environment normalized and profitability pressures mounted, rates converged towards an estimated 3.0%-4.0% by 2026, with only Tonik Bank's 12-month Time Deposit interest rate to 6%-8% for a minimum deposit of P5,000. Tonik now offers depositors 6% for 6 months, 7% for 9 months, and 8% for 12 months (PhilSTAR, 2026).

2.4 Philippine Deposit Insurance and Consumer Protection

The Philippine Deposit Insurance Corporation (PDIC) serves as the country's deposit insurance authority, providing protection to depositors in BSP-licensed banks by insuring eligible deposits up to the statutory coverage limits and contributing to the stability and integrity of the Philippine financial system (Philippine Deposit Insurance Corporation, 1963). Effective March 15, 2025, the Philippine Deposit Insurance Corporation (PDIC) increased the Maximum Deposit Insurance Coverage (MDIC) from ₱500,000 to ₱1,000,000 per depositor, per bank, thereby strengthening depositor protection and confidence in the Philippine banking system (Philippine

Deposit Insurance Corporation, 2025). All six licensed digital banks are covered by PDIC insurance making them equivalent to traditional banks in terms of deposit safety up to the coverage limit. This is materially important consideration in Time Value of Money analysis. The Philippine Deposit Insurance Corporation (PDIC) coverage level defines the rational maximum deposit amount for risk-averse investors in any single digital banking institution.

2.5 IPO Framework

The study utilized an Input-Process-Output (IPO) framework to examine and compare selected best interest-earning digital wallet banking applications in the Philippines (Figure 1). Inputs such as initial deposit amount, interest rates, investment period, transaction costs, digital banking products, and relevant BSP rates were gathered and analyzed. These data underwent Time Value of Money computations using present value and future value formulas, annual compounding assumptions, time series analysis, withholding tax adjustment, and multi-criteria scoring techniques. The output of the study included projected future values, net interest earned, rankings of digital wallet banking applications, and investment recommendations for potential depositors seeking optimal returns of funds.

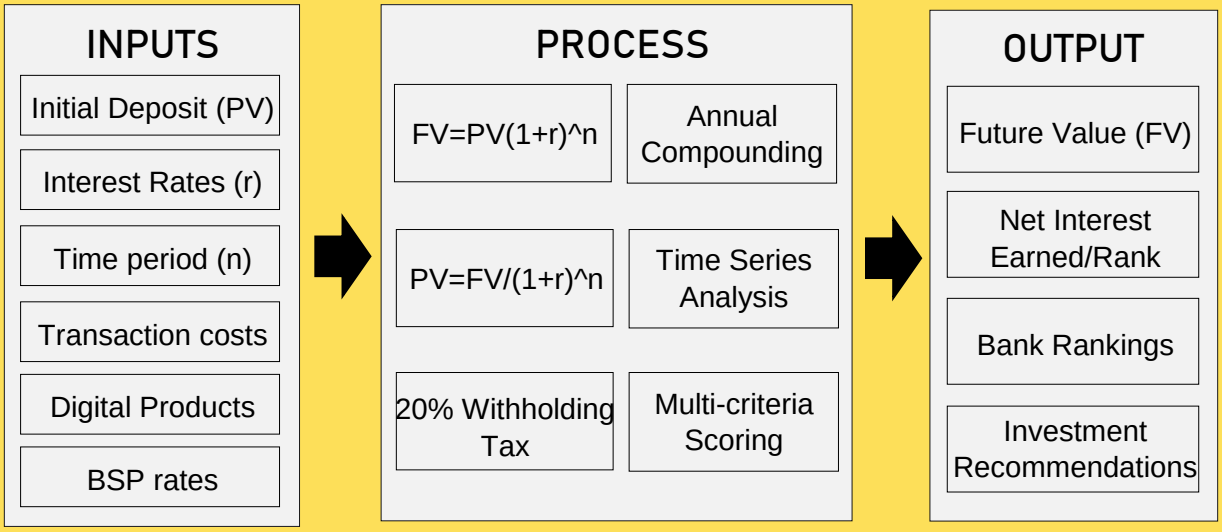


Figure 1: IPO Framework

3. MATERIALS AND METHODS

3.1 Study Design

This study adopts a quantitative-comparative design, combining secondary data analysis with mathematical modeling using the Time Value of Money framework. The analysis is cross-sectional (comparing selected interest-earning digital wallet banking applications in the Philippines at a specific point in time which is June 2026) and longitudinal (examining historical rate data from 2019-2026 and projecting future values over 10 years. Furthermore, TVM techniques were used to project future values of deposits over a 10-year investment horizon. Data triangulation was employed across official bank websites, BSP statistical releases, and financial technology news platforms to ensure accuracy and reliability of the data used in the analysis.

3.2 Data Source

Interest rate data was sourced from official digital bank websites and verified against third-party aggregators including Financial Technology related publications. BSP policy rate history was obtained from Trading Economics and BSP's official releases. Transaction fee structures were verified against each bank's published fee schedule as of June 2026. All rates are expressed percent per annum (% p. a.) and all monetary values in Philippine Pesos (₱).

3.3 Analytical Assumptions

The following standardized assumptions were applied uniformly across all calculations:

Table 1: Standardized assumptions across all calculations *N, A. Ama*

Assumption	Value	Rationale
Initial Deposit (PV)	**₱100,000**	Standardized for comparison; withing PDIC coverage limit
Target Future Value	**₱200,000**	Introduced as hypothetical goal for inverse TVM Analysis (PV) computation, representing goal-based financial planning rather than continuation of the base ₱100,000 projection
Compounding Frequency	**Annual**	Conservative assumptions; most banks compounded daily but was credited annually
Withholding Tax Rate (t)	**20%**	Aligned with Philippine final withholding tax law on interest income per NIRC Section 24(B)
Investment Year Range	**1-10 Years**	Aligned with 5–10-year parameter specified in study's scope
Deposit Currency	**Philippine Peso (₱)**	No foreign exchange (FX) risk considered
Application of PDIC Coverage	**₱1,000,000**	Per depositor and per bank effective March 15, 2025
Rate for Maya Boosted	**Up to 15% p.a.**	This bonus interest applied to deposit balance up to ₱100,000 (assumes mission completion as per Maya Digital Bank official website)
Transaction Costs	**Bank-specific annual estimates**	See Table 2; derived from published fee schedules. The study assumed 12 InstaPay transfers and 8 ATM withdrawals annually. For banks offering free transaction allowances, EAC was estimated under two scenarios: (1) transactions conducted within applicable free limits and (2) transactions exceeding such limits and incurring standard fees.
Rate Stability	**Rates held constant at 2026 levels**	No future rate change modeled in base case

Note: All assumptions reflect Philippine regulatory and market conditions as of June 2026.

3.4 Time Value of Money (TVM) Analytical Framework

The foundational premise of this analysis is that "money today is worth more than money in the future" it is expressed through the Future Value formula of savings deposits in Philippine digital banks. Given an initial principal (PV) of ₱100,000, the Future Value at year n is calculated as:

$$FV_n = PV \times (1 + r_{net})^n$$

Where $r_{net} = r_{gross} \times (1 - t)$ is the after-tax nominal interest rate and $t = 0.20$ is the Philippine final withholding tax rate applied to interest income. For example, applying Tonik Bank's 12-month Time Deposit rate of 8.0% per annum to ₱100,000 deposit over 10 years yields:

$$r_{net} = 0.08 \times (1 - 0.20) = 0.064 \approx 6.4\%$$

$$FV_{10} = 100{,}000 \times (1 + 0.064)^{10} = 100{,}000 \times (1.064)^{10} \approx ₱185{,}959$$

$$Net\ Gain = ₱185{,}959 - ₱100{,}000 \approx ₱85{,}959$$

This represents a net gain of ₱85,959.00 over 10 years, equivalent to an 85.96% cumulative return on the initial deposit. This also corresponds to an effective compound annual growth rate (CAGR) of approximately 6.4% after tax. On the other hand, the Present Value (PV) formulation is the inverse of the Future Value equation and determines the initial capital required to achieve a specified future target. Rearranging the Future Value (FV) equation:

$$PV = \frac{FV}{(1 + r_{net})^n}$$

To determine the required deposit to reach ₱200,000 in 10 years at a 6.4% net annual return:

$$PV = \frac{200{,}000}{(1 + 0.064)^{10}} = \frac{200{,}000}{(1.064)^{10}} = \frac{200{,}000}{1.860} \approx ₱107{,}527$$

This means that an initial investment of approximately ₱107,527 today would be required to accumulate ₱200,000 after 10 years under the assumed net interest rate.

3.5 Transaction Cost Analysis Framework

Transaction costs represent a material drag on effective returns, especially for active users that makes frequent fund transfers. Table 3 details the key transaction cost structures for each digital wallet banking platforms. Furthermore, annual cost formula applied is:

$$EAC = (T \times F_t) + (A \times F_a) + M$$

Where EAC denotes estimated annual cost T is the number of paid Instapay transfers per year, F_t is the transfer fee per transaction, A is the number of fee-charging ATM withdrawals per year, F_a is the ATM withdrawal fee per transaction and M is the annual maintenance fee. In this study, estimated annual transaction costs were calculated assuming 12 Instapay transfers and 8 ATM withdrawals per year at prevailing standard fees. For banks offering free transaction allowances, costs were assumed to be zero provided that usage remains within its free limits.

3.6 Multi-Criteria Scoring Framework

To provide a holistic investment recommendation, this study evaluates each digital banking platform acrosss five criteria weighted by relevance to long-term wealth maximization.

Table 2: Critera for scoring and ranking digital wallet banking

Criterion	Weight	Rationale
Effective Net Yield (10-Year)	**35%**	This measure total money earned after tax. Long-term compounding and has a real return over 10 years. Primary wealth accumulation driver
Accessibility (No Behavioral Conditions)	**20%**	This measures how easy it is to actually earn the advertised rate? By checking spending requirements, missions/taks, and minimum activity. Passive savers cannot maintain mission-based rates
Transaction Cost Efficiency	**15%**	This is about how much money do you lose while using the platform? This includes transfer fees, hidden charges, withdrawal limits, etc.
Regulatory Safety (BSP + PDIC)	**15%**	Measures how safe is your money legally?, BSP licensed and PDIC insurance. Deposit insurance and regulatory compliance
Flexibility / Liquidity	**15%**	This means, Can I withdraw my money anytime without penalty?

3.6.1 Effective Net Yield Scoring

Each criterion was scored on a 1-5 scale, where 5 represents the most favorable performance and 1 represents the least favorable performance. The final composite score was computed using a weighted average approach, with weights assigned according to their relevance to long-term wealth accumulation. The Yield scores were derived from Year 10 Net Interest Earned results. Products generating the higher net interest overy the 10-year investment horizon received higher scores because they demonstrate greater wealth accumulation potential under the Time Value of Money framework. Score categories were assigned according to predefined net-interest ranges based on the distribution of Year 10 returns.

Table 3: Scale for Yield scoring

Net Interest Earned	**Yield Score**
≥ ₱150,000	5.0
₱75,000 – ₱149,999	4.5
₱35,000 – ₱74,999	4.0
₱25,000 – ₱34,999	3.5
₱15,000 – ₱24,999	3.0
₱5,000 – ₱14,999	2.0
< ₱5,000	1.0

3.6.2 Accessibility of Behavioral Conditions

Accessibility Scores were assigned using the interest and product structures comparison. Products that allowed depositors to earn the stated interest rate without requirements, spending targets, transaction quotas, or restrictive balance received higher scores. Products requiring additional activities or maintaining specific balances received lower scores.

Table 4: Scale for Accessibility scoring

Accessibility Characteristics	**Score**
No conditions; rate automatically applied to all eligible balances	5.0
Minimal balance requirements only; no behavioral requirements	4.5
Moderate balance thresholds or deposit requirements	4.0
Significant balance thresholds or product restrictions	3.0 – 3.5
Requires substantial behavioral actions (spending, missions, transactions)	1.0 – 2.5

3.6.3 Transaction Cost Efficiency

Transaction cost efficiency scores were based on the Estimated Annual Cost (EAC) values. Products with lower annual transaction costs received higher scores because fees reduce effective returns. Platforms offering free or minimal-cost transfers and withdrawals received the highest ratings, while products with higher recurring transaction costs received lower ratings.

Table 5: Scale for transaction cost efficiency scoring

Estimated Annual Cost (EAC)	Score
₱0	5.0
₱1 – ₱100	4.5
₱101 – ₱150	4.0
₱151 – ₱200	3.5
₱201 – ₱300	3.0
> ₱300	2.0

3.6.4 Regulatory Safety (BSP + PDIC)

Regulatory safety scores were determined through documentary analysis of each platform's regulatory status. Scores considered whether the institution was licensed and supervised by the Bangko Sentral ng Pilipinas (BSP) and whether deposits were covered by the Philippine Deposit Insurance Corporation. Products meeting both criteria received the maximum safety score.

Table 6: Scale for regulatory safety scoring

Safety Level	Score
BSP + PDIC insured	5.0
BSP Only / unclear	3.0 – 4.0
Unregulated	1.0 – 2.5

3.6.5 Liquidity and Flexibility Score

Liquidity and flexibility scores were assigned based on the ease of accessing deposited funds and the presence of withdrawal restrictions, lock-in periods, or early withdrawal penalties. Savings accounts with unrestricted access to funds received higher scores, whereas time deposit products received lower scores due to reduced liquidity resulting from contractual holding periods.

Table 7: Scale for liquidity scoring

Liquidity Type	**Score**
Instant access	5.0
Minor delays	4.0
Some restrictions	3.0 – 3.5
Locked (Time Deposits)	1.2 – 2.5

3.6.6 Composite Score Formula

After scale scores were assigned for each criterion, with the weighted average determining the overall ranking and recommendation tier. Composite scores were calculated using the following formula:

Composite = (Yield × 0.35) + (Accessibility × 0.20) + (TxCost × 0.15) + (Safety × 0.15) + (Liquidity × 0.15)

The resulting composite scores were used to rank the digital banking platforms according to their overall attractiveness for long-term wealth accumulation, accessibility, cost efficiency (TxCost), safety, and liquidity.

4. RESULTS

This section presents and discusses the findings of the study on the long-term wealth accumulation potential of selected digital banking platforms in the Philippines. Using the Time Value of Money (TVM) framework, the analysis evaluates the future value, present value, net interest earnings generated by a standardized ₱100,000 initial deposit over investment periods ranging from one to ten years.

4.1 Overview of Licensed Digital Banks

The Philippines operates under a BSP-regulated digital banking framework that requires end-to-end digital delivery of banking services without physical branches, imposes a minimum capitalization requirement of ₱1 billion, and extends PDIC deposit insurance coverage to eligible deposits maintained in licensed digital banks. As of June 2026, six institutions obtained BSP-issued digital banks in the Philippines such as Maya Bank (MAYA), GoTayme Bank (GTYME), Tonik Digital Bank (TONDB), UnionDigital Bank (UDB), UNObank, and Overseas Filipino Bank (OFBank). In addition, several institutions offer digital banking services under existing banking licenses, including CIMB Bank Philippines operating under a commercial bank license, and OwnBank, Komo and Maribank (SeaBank), which operates under rural bank licenses, based on the BSP's Directory of Banks and Non-Bank Financial Institutions (Bangko Sentral ng Pilipinas, 2026).

4.2 Interest Rate and Product Structure Comparison

Table 8 presents the current interest rate structures, product types, and key conditions for each digital banking platform based from each banking official websites for current rates.

Table 8: Interest rate and product structure comparison

Bank	Base Rate (% p. a.)	Boosted Rate / TD Rate (% p. a.)	Product Name	Key Conditions
Maya Bank	3.50%	15.00%	Maya Savings Account	Only applied to balance up to ₱100,000 credited daily
Tonik Bank	4.00%	8.00% (12-month TD)	Solo Stash/TD	Minimum deposit of ₱5,000 to a maximum deposit of ₱250,000
Maribank (SeaBank)	3.25%	3.75% (3-month term)	MariBank Savings Account	No conditions for base rate and 3.75% applies to money that goes over the ₱1,000,000 mark
GoTyme Bank	3.0%	N/A flat rate	Go Save Account	No conditions
OwnBank	3.80%	4.00%-5.20% (TD)	OwnBank Savings Account	No conditions. Starts earning from ₱1
CIMB Bank PH	2.50%	Up to 4.00% (TD)	UpSave Account/Grow	Requires a minimum amount of ₱5,000 for boosted
UNO Digital Bank	3.00%	3.50%	UNOReady/ UNOearn	Minimum placement of ₱5,000 for boosted
UnionDigital Bank	3.00%	2.65%-3.125% (TD)	Union Savings+ Account	Minimum deposit of ₱1,000
Komo (EastWest)	2.50%	0.625%-3.570% (TD)	Komo Savings Account	Minimum of ₱10,000 for TD and ADB of ₱2,000 for Komo savings
OFBank	0.05%	N/A	Peso Savings Account	Interest rates applies to Regular Debit Card and YaniSaver

Note: Sources: Official bank websites, Abdullah (2026) of Fintech News, InvestTayo.ph, Manila Shaker websites. TD = Time Deposit. ADB = Average Daily Balance

4.3 Transaction Cost Structure Analysis

Table 9: Transaction cost structure by Digital Banking Platforms applying estimated annual cost (EAC) of selected Digital Banking Platforms in the Philippines

Bank	**Instapay Fee**	**ATM Withdrawal**	**Mainte . Fee**	**Est. Annual Cost EAC (₱)**
Maya Bank	₱15.00 per transaction transferring funds via Instapay from Maya savings account	₱10.00 Landbank ATMs; ₱15.00-18.00 other local bank ATMs	None	₱260.00 - ₱324.00
Tonik Bank	₱8.00 per transaction of money transfer to other local banks or e-wallets	Free (Mastercard, Maestro, Circus logo)	None	₱96.00
Maribank (SeaBank)	50 free transfers/month; beyond limit incurs ₱15.00 pesos	₱15.00 - 18.00 other local bank ATMs	None	₱120.00 - ₱144.00 with free transfer; succeeding costs ₱300.00 - ₱324.00
GoTyme Bank	20 free transfers/month; beyond limit incurs ₱9.00 pesos	Free (GoTyme Bank, Euronet and Robinson malls)	None	₱0 with free transfers; succeeding costs ₱108.00
OwnBank	Free with unlimited transactions	No physical ATM card	None	₱0.00
CIMB Bank PH	2 free transfers daily; beyond limit incurs ₱10.00 pesos	Free (BancNet or Visa-affiliated ATM)	None	₱0 with fee transfers; succeeding costs ₱120.00
UNO Digital Bank	₱8.00/transaction of transferring funds; via QR Ph is free	2 free ATM withdrawals/month ; Succeeding incurs ₱15.00	None	₱96.00 under study assumptions; ₱216.00 if all ATM withdrawals incur fees
UnionDigial Bank	₱10.00 standard InstaPay transfers	No physical ATM card	None	₱120.00
Komo (EastWest)	₱8.00/transaction of transferring	4 free/month; succeeding incurs ₱10.00 - 18.00	None	₱96.00 under study assumptions; ₱176.00 - ₱240.00

	funds; via QR Ph is free			if all ATM withdrawals incur fees
OFBank	₱15.00/transaction of transferring funds	Free (Landbank ATMs & Braches, Local ATMs, Cardless Withdrawal)	None	₱180.00

Note: Estimated Annual Cost (EAC) was calculated using the formula $EAC = (T \times F_t) + (A \times F_a) + M$*, assuming 12 InstaPay transfers and 8 ATM withdrawals annually. Estimates reflect either the utilization of free transaction allowances or the application of standard fees when such allowances are exceeded. Data sourced from official bank websites*

Table 9 presents the transaction cost structure of selected digital banking platforms in the Philippines based on Instapay transfer fees, ATM withdrawal charges, maintenance fees, and the resulting Estimated Annual Cost (EAC). The findings indicate considerable variation in annual transaction costs across banks, primarily attributable to differences in fee schedules and the availability of free transaction allowances. Among the platforms, OwnBank and GoTyme Bank exhibited the lowest annual transaction costs, with EAC values of ₱0.00 under the study assumptions due to their unlimited or generous free transfer and withdrawal provisions. Similarly, CIMB Bank PH recorded no annual transaction costs when free daily transfer allowances were fully utilized. In contrast, Maya Bank have the highest EAC, ranging from ₱260.00 to ₱324.00, reflecting its standard InstaPay fees combined with ATM withdrawal charges. MariBank (SeaBank) also showed a relatively higher potential cost, ranging from ₱300.00 to ₱324.00 when free transfer benefits were exceeded, although costs remained substantially lower (₱120.00 – ₱144.00) when customers operated within the free transfer limits.

Banks imposing fixed transfer fees but offering free ATM access, such as Tonik Bank, UnionDigital Bank, and OFBank, have moderate EAC values of ₱96.00, ₱120.00, and ₱180.00, respectively. Meanwhile, the estimated annual costs associated with UNO Digital Bank and Komo (EastWest) depended largely on the utilization of their free ATM withdrawal benefits. Under the study assumptions., both institutions incurred relatively low EAC values of ₱96.00; however, costs increased substantially when all ATM withdrawals became fee-incurring transactions. In summary, the results suggest that digital banks offering free transaction allowances may substantially reduce the financial burden associated with routine banking activities. Nevertheless, the extent of these savings depends on customers' transaction behavior and their ability to remain within the prescribed free transaction thresholds. Consequently, prospective depositors should consider not only deposit interest rates but also transaction cost structures when selecting a digital banking platform, as these charges may influence the net financial benefits derived from maintaining deposits over time.

4.4 Sector Deposit and User Statistics

Table below presents aggregate and individuals deposit user statistics for the Philippine digital banking sector. These figures contextualize the market reach and financial scale of each platform.

Table 10: Sector deposit and user statistics

Metric	Value	Reference Period
Philippine Digital Bank Deposits (6 Banks)	₱139 Billion	December 2025
Total Sector Deposits and Growth	₱188.7 Billion (+44.82% YoY)	March 2026
Total Registered Accounts of Digital Banks	₱37.97 million	End-March 2025
Number of BSP-Licensed Digital Banks	6	June 2026
Profitable Digital Banks	(Maya Bank ₱1.7 billion in 2025, OFBank ₱86.28 million in 2024)	End of 2024 OFBank, End of 2025 Maya Bank
PDIC Deposit Insurance Coverage	₱1,000,000 per depositor per bank	Effective March 15, 2025
Maya Bank	10.7 million bank customers	End-2025

Note: Sources: Chan (2026) of Business World, San Juan (2026) of Business Mirror, Philippine Deposit Insurance Coverage (PDIC), Context.Ph, Manila Bulletin

4.5 After-Tax Interest Rates of Digital Wallet Banking Platforms

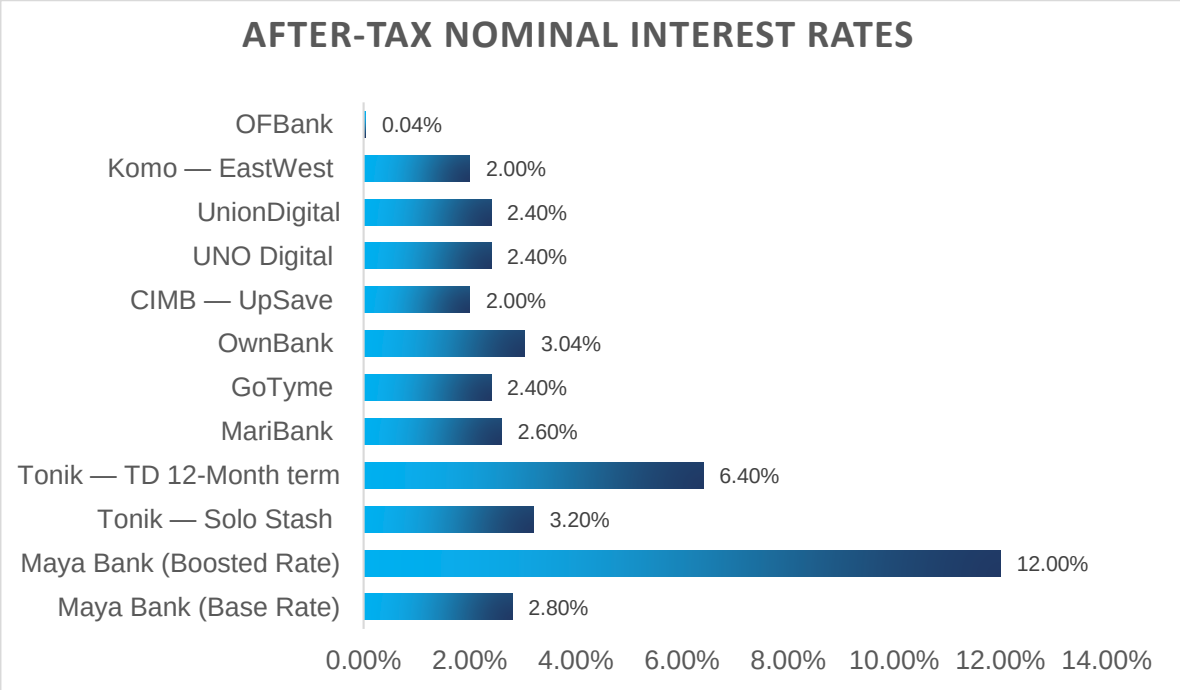


Figure 2: After-Tax Interest Rates of Digital Wallet Banking Platforms

After-tax nominal interest rates were computed using the formula $r_{net} = r_{gross} \times (1 - t)$, where $t = 20\%$ representing the Philippine final withholding tax imposed on interest income shown in Figure 2. The figure demonstrates notable differences in the effective returns offered by digital banks, which may substantially influence the future growth of depositors' savings through the effects of compound interest. Among the products assessed, Maya Bank's Boosted Savings Rate exhibited the highest after-tax nominal interest rate at 12.00%, indicating the greatest potential, for wealth accumulation among the platforms considered. This was followed by Tonik Bank's 12-month Time Deposit, which provided an after-tax return of 6.40%.

The relatively higher rates offered by these products means that they may generate significantly larger future values for depositors who maintain their funds over extended periods. Additionally, moderate after-tax rates were observed for Tonik Solo Stash (3.20%), OwnBank (3.04%), Maya Bank's Base Rate (2.80%), and MariBank (2.60%). Meanwhile, Go Tyme, UNO Digital Bank, and UnionDigital Bank shared identical after-tax rates of 2.40%, indicating comparable earning potential under similar investment conditions.

The lowest after-tax rates among the major digital banks were reported for CIMB Upsave and Komo by EastWest at 2.00%. Notably, OFBank recorded the lowest after-tax nominal interest rate at only 0.04%, resulting in minimal growth of deposited funds over time. This finding highlights the substantial impact that differences in effective interest rates may have on long-term savings outcomes. Therefore, the figure suggests that digital banking products offering high after-tax returns are generally more advantageous for depositors seeking to maximize the future value of their savings, although promotional rates may depend on specific eligibility requirements and prevailing market conditions.

4.6 Future Value Projection Table (10 Years)

Table below presents the projected Future values for all digital wallet banking platforms at key time horizons from Year 1, 3, 5, 7, and 10, based on a ₱100,000 initial deposit with annual compounding, 20% withholding tax, and platform-specific annual transaction costs.

Table 11: Future values projection of other digital wallet banking platforms

Digital Bank	Year 1	Year 3	Year 5	Year 7	Year 10
Maya Bank (Base 3.5%)	₱102,800.00	₱108,637.40	₱114,806.26	₱121,325.42	₱131,804.78
Maya Bank (Boosted 15%)	₱112,000.00	₱140,492.80	₱176,234.17	₱221,068.14	₱310,584.82
Tonik — Solo Stash (4.0%)	₱103,200.00	₱109,910.48	₱117,057.30	₱124,668.83	₱137,024.10
Tonik — TD 12-Month term (8.0%)	₱106,400.00	₱120,455.01	₱136,366.64	₱154,380.13	₱185,958.61
MariBank (3.25%)	₱102,600.00	₱108,004.56	₱113,693.81	₱119,682.74	₱129,262.81
GoTyme (3.0%)	₱102,400.00	₱107,374.18	₱112,589.99	₱118,059.16	₱126,765.06
OwnBank (3.8%)	₱103,040.00	₱109,400.06	₱116,152.68	₱123,322.11	₱134,914.46
CIMB — UpSave (2.5%)	₱102,000.00	₱106,120.80	₱110,408.08	₱114,868.57	₱121,899.44
UNO Digital (3.0%)	₱102,400.00	₱107,374.18	₱112,589.99	₱118,059.16	₱126,765.06
UnionDigital (3.0%)	₱102,400.00	₱107,374.18	₱112,589.99	₱118,059.16	₱126,765.06
Komo — EastWest (2.5%)	₱102,000.00	₱106,120.80	₱110,408.08	₱114,868.57	₱121,899.44
OFBank (0.05%)	₱100,040.00	₱100,120.05	₱100,200.16	₱100,280.34	₱100,400.72

Note: For products with conditional promotional rates such as Maya Boosted Savings, fulfillment of all applicable requirements and maintenance of the eligible deposit balance were assumed across the entire projection period. Author's calculation based on Table 8. Assume initial Deposit of ₱100,000

Table 11 presents the projected future values of a hypothetical ₱100,000 deposit invested across selected Philippine digital banking platforms over a 10-year period using the Time Value of Money framework. The results demonstrate substantial differences in wealth accumulation attributable to variation in annual interest rates after accounting for the 20% final withholding tax on interest income. Among the platforms analyzed, Maya Bank's Boosted savings rate generated the highest projected value, reaching ₱310,584.82 after 10 years. This means that a higher effective annual yield significantly enhances long-term growth through the effects of compound interest. Tonik Bank's 12-month Time Deposit ranked second, increasing the initial deposit to ₱185,958.61 over the same period, while Tonik Solo Stach and Ownbank produced moderate growth, with ending balances of ₱137,024.10 and ₱134,914.46, respectively. Platforms offering relatively lower interest rates such as CIMB Upsave, Komo by EastWest, GoTyme, UNO Digital Bank, and UnionDigital Bank, exhibited more conservative growth trajectories, yielding final values ranging from approximately ₱121,899.44 to ₱126,765.06 after 10 years. MariBank's savings product generated slightly higher returns, accumulating to ₱129,262.81 over the projection period. Conversely, OFBank produced the lowest projected growth due to its minimal interest rate, resulting in a future value only marginally higher than the original principal amount.

4.7 Present Value Projection with a target of ₱200,000.00 (10 Years)

Table 12: Present value projection of digital wallet banking platforms with a target of ₱200,000

Digital Bank	Year 1	Year 3	Year 5	Year 7	Year 10
Maya Bank (Base)	₱194,552.53	₱184,098.67	₱174,206.53	₱164,845.92	₱151,739.57
Maya Bank (Boosted)	₱178,571.43	₱142,356.05	₱113,485.37	₱90,469.84	₱64,394.65
Tonik — Solo Stash	₱193,798.45	₱181,966.27	₱170,856.50	₱160,425.02	₱145,959.72
Tonik — TD 12-Month term	₱187,969.92	₱166,037.09	₱146,663.44	₱129,550.35	₱107,550.82
MariBank	₱194,931.77	₱185,177.37	₱175,911.08	₱167,108.47	₱154,723.54
GoTyme	₱195,312.50	₱186,264.51	₱177,635.68	₱169,406.59	₱157,772.18
OwnBank	₱194,099.38	₱182,815.26	₱172,187.15	₱162,176.92	₱148,242.08
CIMB — UpSave	₱196,078.43	₱188,464.47	₱181,146.16	₱174,112.04	₱164,069.66
UNO Digital	₱195,312.50	₱186,264.51	₱177,635.68	₱169,406.59	₱157,772.18
UnionDigital	₱195,312.50	₱186,264.51	₱177,635.68	₱169,406.59	₱157,772.18
Komo — EastWest	₱196,078.43	₱188,464.47	₱181,146.16	₱174,112.04	₱164,069.66
OFBank	₱199,920.00	₱199,760.19	₱199,600.48	₱199,440.89	₱199,201.75

Note: Present values were Author calculated using PV formula. After-tax interest rates were used for (r). Assume ₱200,000 target. All computations assume annual compounding and constant interest rates throughout the projection period. Rates reflect prevailing digital banks savings and time deposits rates.

Table 12 presents the present value projections to accumulate future target amount of ₱200,000 across selected Philippine digital banking platforms over different investment periods. The results indicate that the amount of initial capital needed decreases as both the investment period and the effective after-tax interest rate increase. Among the digital banking products analyzed, Maya Bank's Boosted Savings Rate required the smallest initial investment to achieve the ₱200,000 target. At an after-tax return of 12.00%, a depositor would need to invest only ₱64,394.65 today to accumulate ₱200,000 after 10 years. Moreover, Tonik Bank's 12-month Time Deposit required an initial investment of only ₱107,552.82 over the same period, reflecting the benefits of higher effective interest rates and compound growth. On the other hand, digital banking products with lower after-tax interest rates required substantially larger initial deposits to reach the same future value target. For example. CIMB UpSave and Komo by EastWest required approximately ₱164,069.66 after 10 years, while GoTyme, UNO Digital Bank, and UnionDigital each required ₱157,772.18.

Maya Bank's Base Rate, MariBank, OwnBank, and Tonik Solo Stash produced intermediate results, requiring initial investments ranging from ₱145,959.72 to ₱154,723.54 over the 10-year period. Meanwhile, OFBank required the highest initial deposit, amounting to ₱199,201.75 to achieve ₱200,000 after 10 years. This outcome reflects its very low after-tax interest rate of 0.04%, which contributes minimally to the growth of invested funds over time. Conversely, depositors relying on lower-yield savings products must contribute substantially more upfront to attain the same financial objective. These results underscore the importance of considering effective interest rates when selecting digital banking products for long-term savings and financial planning.

4.8 Net Interest Earned Comparison

Table 13 isolates net interest earned ($Net\ Interest = Future\ Value - Initial\ Principal\ of$ ₱100,000) at Year 5 and Year 10, providing a direct measure of wealth creation across digital wallet banking platforms.

Table 13: Net interest earned comparison of digital wallet banking platforms at Year 5 and 10

Digital Bank	Net Interest – Year 5	Net Interest – Year 10	Y10 vs. Y5 Growth
Maya Bank (Base 3.5%)	₱14,806.26	₱31,804.78	114.81%
Maya Bank (Boosted 15%)	₱76,234.17	₱210,584.82	176.23%
Tonik — Solo Stash (4.0%)	₱17,057.30	₱37,024.10	117.06%
Tonik — TD 12-Month term (8.0%)	₱36,366.64	₱85,958.61	136.37%
MariBank (3.25%)	₱13,693.81	₱29,262.81	113.69%
GoTyme (3.0%)	₱12,589.99	₱26,765.06	112.59%
OwnBank (3.8%)	₱16,152.68	₱34,914.46	116.15%
CIMB — UpSave (2.5%)	₱10,408.08	₱21,899.44	110.41%
UNO Digital (3.0%)	₱12,589.99	₱26,765.06	112.59%
UnionDigital (3.0%)	₱12,589.99	₱26,765.06	112.59%
Komo — EastWest (2.5%)	₱10,408.08	₱21,899.44	110.41%
OFBank (0.05%)	₱200.16	₱400.72	100.20%

Note: All values are based on a ₱100,000 initial deposit and computed using standardized time value of money (TVM) framework after 20% withholding tax and platform-specific transaction costs. Year-over-Year Growth were calculated $(Net\ Interest\ Y10 - Net\ Interest\ Y5 \div Net\ Interest\ Y5) \times 100$

Table 13 presents a comparative analysis of net interest earned across selected Philippine digital banking and e-wallet savings platforms over a 5-year and 10-year investment horizon, based on a standardized ₱100,000 initial deposit under a net-of-20% withholding tax framework. Results show a clear compounding effect across all platforms, with higher nominal interest rates producing greater long-term accumulation of net interest. Among all platforms, the Maya Bank Boosted 15% scenario generates the highest returns, increasing from ₱76,234.17 at Year 5 to ₱210,584.82 at Year 10, a 176.23 Year-over-Year growth, which highlights the strong sensitivity of long-term returns to elevated promotional interest rates. In contrast, lower-yield accounts such as CIMB UpSave and Komo (2.5%) exhibit more modest but stable growth of approximately 110.41%, demonstrating the limited but steady accumulation effect of conservative savings rates.

Moderate-yield platforms such as Tonik Solo Stash (4.0%), OwnBank (3.8%), MariBank (3.25%). GoTyme (3.0%), UNO Digital (3.0%), and UnionDigital (3.0%) show relatively consistent performance, with Year 10 values ranging between approximately ₱26,000 to ₱37,000, and growth rates clustered around 112% to 117%. Meanwhile, Tonik's 8.0%-time deposit product significantly outperformance standard savings accounts reaching ₱85,958.61 by Year 10 with a 136.37% growth rate, reflecting the advantage of fixed-term higher-yield instruments. Lastly, OFBank (0.05%) shows minimal but positive accumulation, increasing from ₱200.16 to ₱400.72 over the period, indicating near-zero effective yield after tax. Thus, results confirm that even small differences in interest rates product substantial divergence in long-term net interest outcomes due to compounding effects.

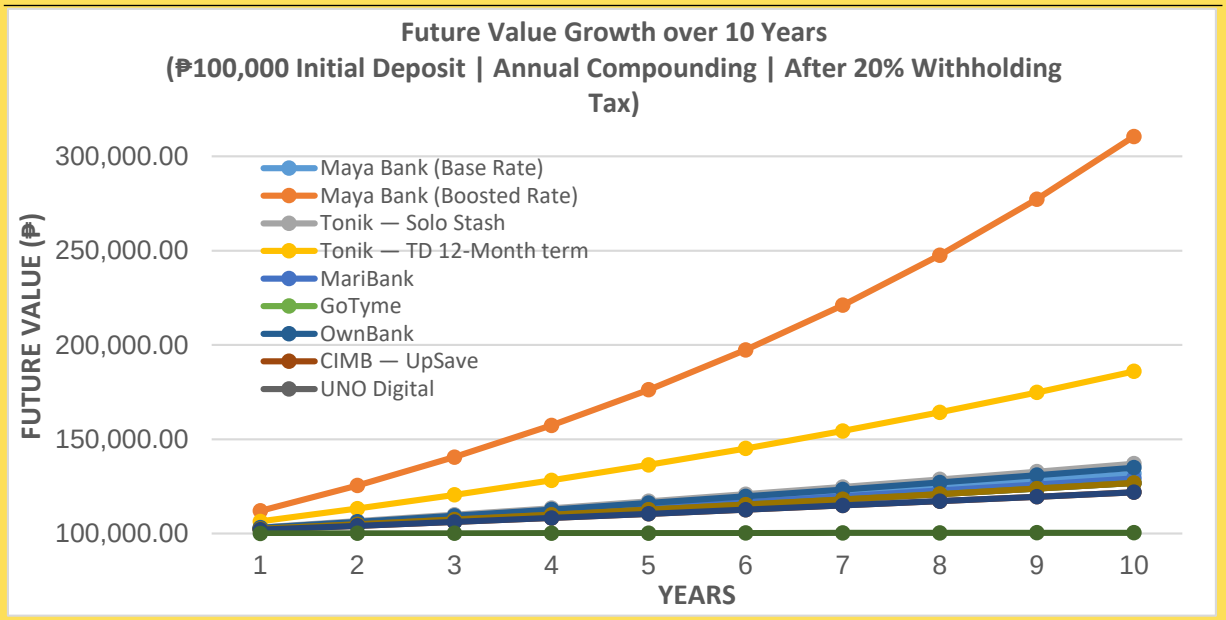


Figure 3: Future Value Growth Over 10 Years (₱100,000 Initial Deposit, After 20% Withholding Tax, Annual Compounding of all Digital Banks).

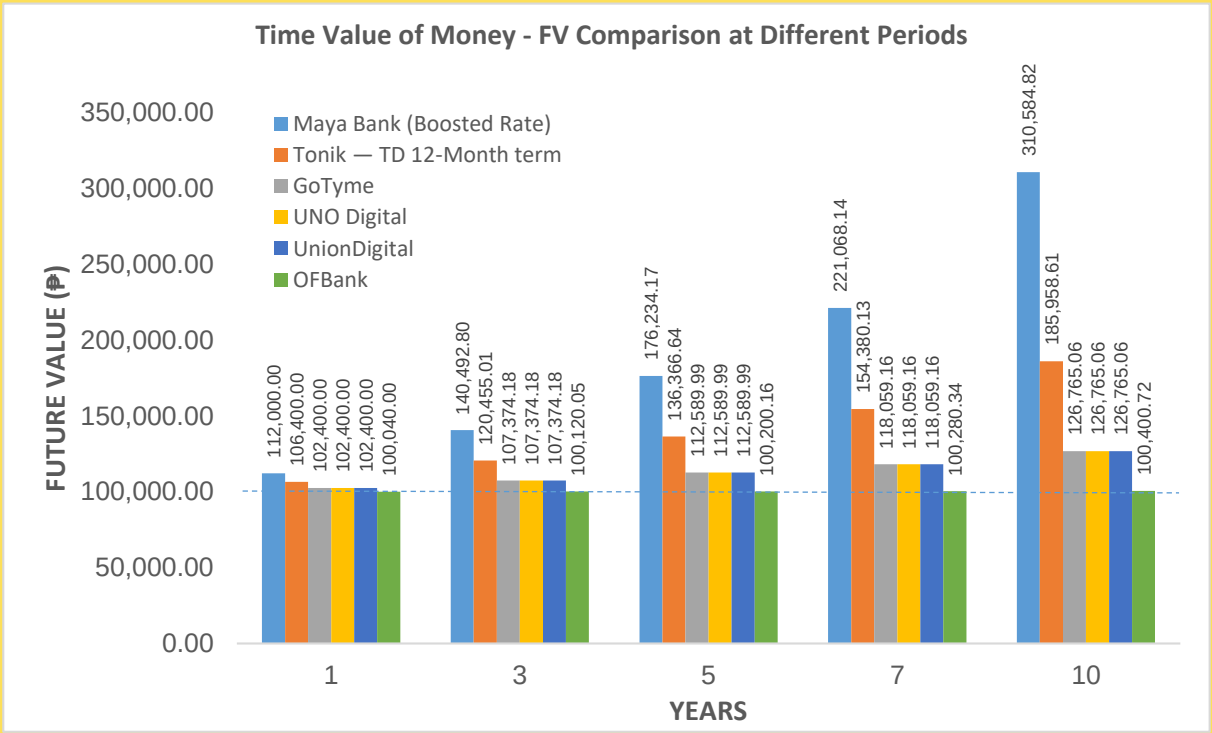


Figure 4: Time Value of Money Across Six BSP-Licensed Digital Banks at Different Periods

Figure 3 shows that the future value of a ₱100,000 deposit varies considerably across BSP-licensed digital banks due to differences in effective interest rates after tax. Among all banks, Maya Bank (Boosted Rate) demonstrates the strongest growth, increasing the investment in 10 years, indicating the substantial impact of higher interest rates on long-term wealth accumulation. Tonik's 12-Month Time Deposit ranks second, which is significantly higher than the returns of most savings accounts. In contrast, banks offering lower effective rates, such as UNO Digital, UnionDigital, CIMB UpSave, OwnBank, MariBank, and Komo, generate more modest future values after 10 years. This highlights the importance of interest rate differentials and compound growth in maximizing investment returns over extended periods. On the other hand, Figure 4 illustrates how the future value changes over selected periods (1, 3, 5, 7, 10) across six major BSP-licensed digital banks, still Maya Boosted Rate produces the highest future values from ₱112,000 after 1 years to ₱310,585, Tonik's 12-Month Term follows as second-best performer, reaching ₱185,959 after 10 years. UNO Digital and UnionDigital have moderate growth, while GoTyme and OFBank yield the lowest future values, remaining close to the initial principal.

4.9 Time Series Analysis

4.9.1 BSP Policy Rate History (2016-2026)

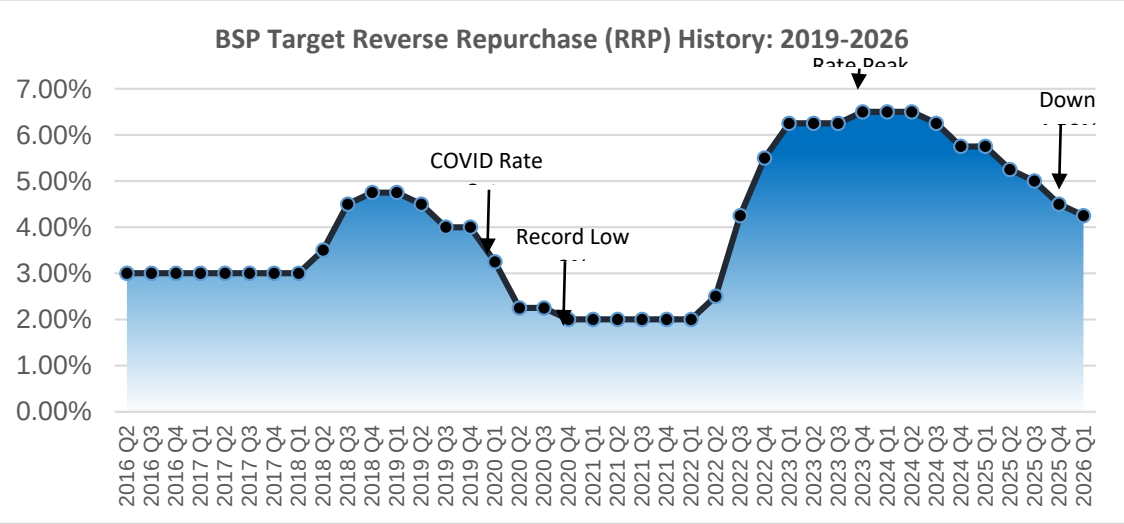


Figure 5: BSP Target Reverse Repurchase (RRP) Rate History: 2016-2026. Source: Trading Economics

Figure 5 illustrates the movement of the Bangko Sentral ng Pilipinas (BSP) Target Reverse Repurchase (RRP) Rate from 2016-2026 (Trading Economics, 2026). The policy rate declined sharply from 4.75% in early 2019 to a record of low 2.00% by late 2020 and throughout 2021, reflecting the BSP's accomodative monetary policy during the COVID-19 pandemic to support economic recovery. Beginning in 2022, the BSP implemented a series of aggressive rate hikes in response to rising inflation, causing the RRP rate to increase rapidly and reach a peak of 6.50% in 2023-2024, the highest level during the period. After maintaining this restrictive stance for several quarters, the BSP gradually reduced rates as inflationary pressures eased, bringing the policy rate down to approximately 4.25% by early 2026. In summary, this demonstrates how monetary policy shifted from economic stimulus during the pandemic inflation control during the post-pandemic recovery period, directly influencing the market interest rates and the deposit rate offered by digital banks. See Table 14 documenting the key BSP rate decision milestones and their contextual drivers.

Table 14: BSP Policy Rate Milestones and Contextual Drivers (2019-2026)

Period	BSP RRP Rate	Key Driver
2016 Q2 - 2018 Q1	3.00%	Stable monetary policy amid manageable inflation and steady economic growth
2018 Q2 - 2018 Q4	3.50% → 4.75%	Monetary tightening in response to rising inflation and peso depreciation
2019 Q1 - Q4	4.75% → 4.00%	Gradual policy easing as inflation moderated and economic growth slowed
2020 Q1 - Q4 (COVID-19 Period)	3.25% → 2.00%	Aggressive policy maintained to sustain economic recovery and liquidity
2021 Q1 - 2022 Q1 (Record Low)	2.00%	Accommodative policy maintained to sustain economic recovery and liquidity
2022 Q2 - 2022 Q4	2.50% → 5.50%	Rapid tightening cycle triggered by global inflation, higher commodity prices and peso pressures
2023 Q1 - Q3	6.25%	Restrictive monetary stance to contain persistent inflationary pressures
2023 Q4 - 2024 Q2 (Peak)	6.50%	Highest policy easing as inflation showed signs of moderation
2024 Q3 - Q4	6.25% → 5.75%	Initial policy easing as inflation showed signs of moderation
2025 Q1 - Q4	5.75% → 4.50%	Continued easing cycle amid improving inflation outlook and economic stabilization
2026 Q1 (Latest)	4.25%	Further precautionary rate cut to support growth while inflation remained manageable

Note: Sources: Trading Economics, BSP Monetary Policy Decisions page

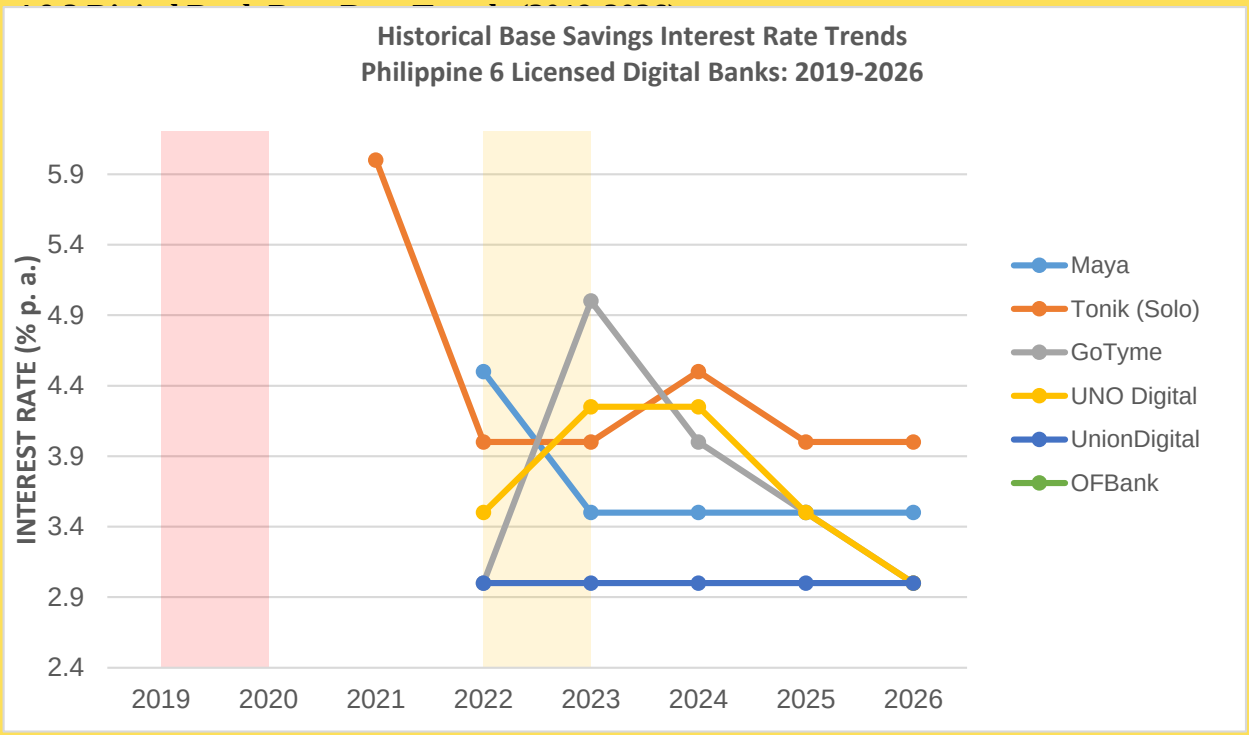


Figure 6: Historical Base Savings Rate Trends for Philippine Major 6 Licensed Digital Banks (2019-2026). Shaded regions indicate COVID Period (Red) and BSP Hiking Cycle (Orange)

Figure 6 tracks the historical savings interest rates offered by 6 major digital banks since their respective launches. The figures indicates a general pattern of interest-rate normalization across the sector. Most digital banks initially offered relatively high savings rate as part of customer acquisition strategies during their early years of operation. Over time, these rates gradually declined or stabilized, resulting in a narrower range of approximately 3.0% to 4.0%. This pattern suggests a transition from aggressive market-entry pricing toward more stable and sustainable deposit-rate strategies. The specific annual rates and changes for each bank are discussed in Table 15.

Table 15: Historical Savings Rate by 6 Major Digital Bank (% per annum, 2019-2026)

Bank	2019	2020	2021	2022	2023	2024	2025	2026
Maya Bank	—	—	—	4.5	3.5	3.5	3.5	3.5
Tonik Bank (Solo)	—	—	6.0	4.0	4.0	4.5	4.0	4.0
GoTyme Bank	—	—	—	3.0	5.0	4.0	3.5	3.0
UNO Digital Bank	—	—	—	3.5	4.25	4.25	3.5	3.0
UnionDigital Bank	—	—	—	3.0	3.0	3.0	3.0	3.0
OFBank	—	—	—	0.05	0.05	0.05	0.05	0.05

Note: "—" indicates had not yet commenced operations in that year. Sources: Wikipedia, BitPinas, Bankero, Inquirer.net, Digital banking official websites, DigitalhelpPh, Rosales (2022) of Spot.ph, Pagkakatotohan (2023) of Moneymaxph, Domingo (2023) of Inquirer.net, ManilaShaker Philippines, Digital Banks PH Update Facebook, DigitalbanksPh in Reddit

Table 15 shows the historical base savings interest rate trends of the six major digital banks from 2019-2026. Table demonstrate differing interest rate strategies during the early years of digital bank operations, followed by a gradual convergence of rate as the industry matured. During the market-entry phase (2021-22023), several banks offered relatively high savings rates to attract depositors and rapidly expand their customer base. Tonik Bank recorded the highest savings rate at 6.0% in 2021, while Maya Bank launched with a competitive 4.5% rate in 2022. GoTyme Bank also pursued an aggressive deposit strategy, increasing its base savings rate from 3.0% in 2022 to 5.0% in 2023. Likewise, UNO Digital Bank raised its rate from 3.5% in 2022 to 4.25% in 2023 and maintained this level through 2024.

Beginning in 2023 and continuing through 2026, most institutions gradually reduced or stabilized their rates, resulting in a narrower range of approximately 3.% to 4.0% per annum. This convergence suggests a transition from aggressive customer acquisition strategies toward more sustainable deposit-pricing models. The decline was particularly evident for Tonik and GoTyme, whose rates decreased from peal levels to approximately 4.0% and 3.0% respectively. Maya's base savings similarly declined from 4.5% to 3.5% and were remained stable until 2026, while UnionDigital maintained a relatively stable rate of 3.0% throughout the period.

UNO Digital exhibit a different trajectory, increasing from 3.5% to 4.25% during its early years before subsequently adjusting to 3.5% and further decreased to 3.0%, reflecting evolving competitive positioning within the market. By 2025-2026, most digital banks clustered between 3.0% and 4.0%, indicating maturing industry characterized by reduced promotional pricing, normalization of interest-rate competition, and great emphasize on long-term profitability and balance-sheet sustainability.

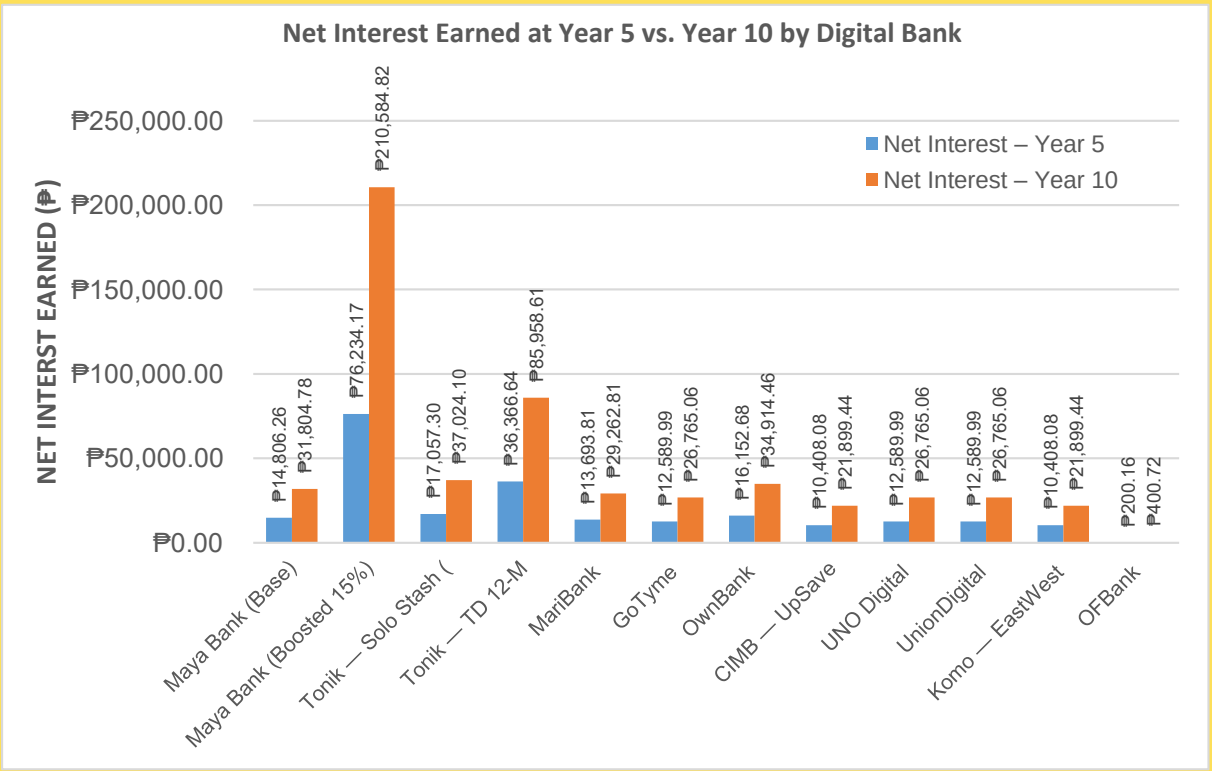


Figure 7: Net Interest Earned at Year 5 vs. Year 10 by Digital Bank (₱100,000 Initial Deposit, After 20% Tax). Authors' Calculations from Table 13

Figure 7 presents the cumulative net interest earnings by digital bank from Year 0 to Year 10. The acceleration of earnings in later years demonstrates the compounding effect validating the TVM principle that depositing earlier and maintaining balances longer maximizes wealth creation. Figure 2 provides a direct year-5 vs. year-10 comparison that quantifies the cost of delayed savings. In addition, Table 16 presents the yearly (1 3, 5, 7, 10) net interest earned series for digital bank platforms.

Table 16: Annual Net Interest Earned Time Series of Digital Banks (Year 1, 3, 5, 7, 10)

Digital Bank	Year 1	Year 3	Year 5	Year 7	Year 10
Maya Bank (Base 3.5%)	₱2,800.00	₱8,637.40	₱14,806.26	₱21,325.42	₱31,804.78
Maya Bank (Boosted 15%)	₱12,000.00	₱40,492.80	₱76,234.17	₱121,068.14	₱210,584.82
Tonik — Solo Stash (4.0%)	₱3,200.00	₱9,910.48	₱17,057.30	₱24,668.83	₱37,024.10
Tonik — TD 12-Month term (8.0%)	₱6,400.00	₱20,455.01	₱36,366.64	₱54,380.13	₱85,958.61
MariBank (3.25%)	₱2,600.00	₱8,004.56	₱13,693.81	₱19,682.74	₱29,262.81
GoTyme (3.0%)	₱2,400.00	₱7,374.18	₱12,589.99	₱18,059.16	₱26,765.06
OwnBank (3.8%)	₱3,040.00	₱9,400.06	₱16,152.68	₱23,322.11	₱34,914.46
CIMB — UpSave (2.5%)	₱2,000.00	₱6,120.80	₱10,408.08	₱14,868.57	₱21,899.44
UNO Digital (3.0%)	₱2,400.00	₱7,374.18	₱12,589.99	₱18,059.16	₱26,765.06
UnionDigital (3.0%)	₱2,400.00	₱7,374.18	₱12,589.99	₱18,059.16	₱26,765.06
Komo — EastWest (2.5%)	₱2,000.00	₱6,120.80	₱10,408.08	₱14,868.57	₱21,899.44
OFBank (0.05%)	₱40.00	₱120.05	₱200.16	₱280.34	₱400.72

Note: Note: All values are based on a ₱100,000 initial deposit, 20% withholding tax and platform-specific transaction costs. Year-over-Year Growth were calculated $(Net\ Interest\ Year\ 10 - Net\ Interest\ Year\ 5 \div Net\ Interest\ Year\ 5) \times 100$. *Authors' calculation from Table 11*

Table 16 presents the projected annual net interest earned across various Philippine digital banks over a 10-year period, based on a ₱100,000 initial deposit and incorporating 20% withholding tax and platform-specific costs. Results show a clear divergence on long-term earnings depending on interest rate structures and compounding effects, The highest-performing accounts are those elevated promotional of term-based rates, particularly Maya Bank (Boosted 15%) and Tonik 23-Month Term (8.0%), which generate substantially higher cumulative returns over time, reaching ₱210,584.82 and ₱85,958.61 respectively by Year 10. In contrast, standard savings accounts with moderate rates such as GoTyme, UNO Digital, UnionDigital, and MariBank show steady but relatively modest growth, clustering within the ₱26,000 to ₱29,000 by Year 10.

Consequently, lower-interest platforms such as CIMB UpSave (2.5%), Komo-EastWest (2.5%), and OFBank (0.05%) produce the weakest long-term returns, highlighting the limited compounding benefit of low base rates despite consistent growth over time.

4.8 Comparative Analysis and Investment Recommendations

4.8.1 Platform Ranking and Scores

Table 17 will present the composite platform ranking based on the multi-criteria scoring framework. Scores are assigned on a 1-5 scale per criterion, with the weighted average determining the final recommendation tier.

Table 17: Digital Bank Composite Investment Score and Ranking

Bank & Product	Yield Score	Accessibility	Transaction Cost	Safety	Liquid	Composite	Rank
Maya Bank (Base)	3.5	4.5	2.5	5.0	5.0	4.0	10
Maya Bank (Boosted)	5.0	1.5	2.5	5.0	1.5	3.4	11
Tonik — Solo Stash	4.0	4.5	4.5	5.0	5.0	4.48	1
Tonik — TD 12-Month term	4.5	4.0	4.5	5.0	1.5	4.03	9
MariBank	3.5	5.0	4.0	5.0	5.0	4.33	4
GoTyme	3.5	5.0	4.0	5.0	5.0	4.33	3
OwnBank	3.5	5.0	5.0	5.0	5.0	4.48	2
CIMB - UpSave	3.0	4.0	5.0	5.0	5.0	4.1	8
UNO Digital	3.5	5.0	4.5	5.0	5.0	4.4	7
UnionDigital	3.5	4.5	4.0	5.0	5.0	4.23	6
Komo – EastWest	3.0	5.0	4.5	5.0	5.0	4.23	5
OFBank	1.0	4.0	3.5	5.0	5.0	3.18	12

Note: Scores on a 1–5 scale (5 = best). Composite = Yield×0.35 + Accessibility×0.20 + TxCost×0.15 + Safety×0.15 + Liquidity×0.15. Row highlighted in yellow indicates top-ranked platform. TD = locked Time Deposit (lower liquidity score). Authors' evaluation

Table 17 presents the composite scores and rankings of selected digital banking platforms based on five weighted criteria, the effective net yield (35%), accessibility (20%), transaction cost efficiency (15%), regulatory safety (15%), and liquidity/flexibility (15%). The results indicate that no single platform dominates all criters; rather, the highest-ranked products are those that successfully balance return, convenience, cost efficiency, safety, and accessibility. Tonik Solo Stash and OwnBank obtained the highest composite scores (4.48), indicating the strongest overall value proposition among the evaluated platforms. Although neither product generated the highest net interest earnings, both combined competitive returns with high accessibility, low transaction costs, full liquidity, and regulatory protection. This means that products offering consistently attrative returns without restrictive conditions may provide greater practical value to ordinary depositors than products that rely on promotional or conditional interest rates. Community discussions and industry reviews likewise frequently identify Tonik Solo Stach as simpler options for savers who do not want monthly tasks (Beto, 2026).

Conversely, UNO Digital, Maribank, and GoTyme formed the second tier of performers, with composite scores ranging from 4.33 to 4.40. These products benefited from their straightforward account structures, absence of significant behavioral requirements, and relatively low transaction costs. Their strong performance highlights the importance of accessibility and liquidity in determining overall depositor value, particularly for users seeking uncomplicated savings products. For instance, for passive saver, choose GoTyme for the best "no-effort" yield. At 3.0% p.a. base interest with no missions and no caps, it is the 2026 leader for those who want their money to grow silently in the background, while choose UNO offers the best "Step-up" rates for smaller balances (MoneyHub PH, 2026). However, we have to take note that digital banks are for growth; traditional banks are for stability. Study of Ballo et. al. (2024) on intention to use digital banking platforms found that percieved usefulness, percieved risk, trust, and convenience significantly affected the intention to use digital banking services of most Filipinos. Security, privacy and reliability are also among those that appeal more to customers.

Komo, UnionDigital, CIMB UpSave, and Tonik-TD occupid the middle ranks. While Tonik's 12-Month Time Deposit generate substantially higher interest earnings that most savings accounts, its lower liquidity score reduced its overall ranking because funds are locked for a fixed term. This finding illustrate the trade-off between return and accessibility that is commonly observed in savings and investment products. These findings are consistent with the liquidity-return trade-off identified in the banking literature. Bikker & Gerritsen (2017) states that depositors generally prefer liquidity, whereas banks prefer stable funding sources. In addition, longer-maturity deposit products tend to offer higher rates as compensation for reduces liquidity. This holds for different maturities for time deposits, but also for "softer" features such as withdrawal fees and bonus rates for savings accounts.

In addition, Laureti & Szafarz (2016) reported that the liquidity premium—the difference between the interest rates paid on illiquid and liquid savings accounts—is higher in commercial banks, suggesting that depositors are compensated with higher returns when they accept restrictions on access to their funds. The authors may further suggest that some depositors may prefer lower-yield liquid accounts because of the flexibility and immeditate accessibility they provide.

Maya Bank (Base) rand near the lower end despite its respectable returns because its transaction cost efficiency score was reduced by comparatively higher estimated annual transaction cost efficiency score was reduced by comparatively higher estimated annual transaction costs. Meanwhile, Maya Bank (Boosted) ranked only 11th despite achieving the highest net interest earnings and yield score. This outcome demonstrates the influence of accessibility and liquidity considerations within the mul-criteria framework. Maya's boosted interest rates requires users to satisfy specific missions, spending activities, and other qualifying conditions, making the advertised yield less attainable for passive savers. Both official product teerms and indepedent reviews note that boosted rates are contingent upon meeting qualifying requirements and are often capped at a specified balance. Therefore, the lower accessibilitty score for Maya Boosted reflects the additional effort required to qualify for enhanced interest rates. This means that percieved ease of use particularly with those that do not require users to complete specific behavioral conditions may influence how users intent to adopt and invest digital banking services. Tugade et. al. (2021) identifies effort expectancy and perceived ease of use as important determinants of digital banking acceptance. Products requiring fewer actions for ease of use to obtain benefits are generally perceived as more accessible than those requiring users to complete specific behavioral conditions.

Lastly, OFBank received the lowest composite score (3.18). Although the platform benefits from full regulatory protection and liquidity, its extremely low interest rate significantly constrained long-term wealth accumulation potential. As reflected in the TVM analysis, OFBank generated only ₱400.72 in net interest after 10 years from a ₱100,000 initial deposit, substantially lower than all other platforms evaluated. Consequently, while OFBanj may serve depositors prioritizing security and basic banking services, it offers limited attractiveness as a long-term savings vehicle when compared with higher-yield digital banking alternatives.

4.8.2 Investment Recommendations by Depositor Profile

Based on the TVM Analysis and composite scoring, the following recommendations are provided for different depositor profiles:

Long-Term Yield Maximizer (5-10 Years, Limited Liquidity Needs): Tonik Bank 12-Month Time Deposit (8.0% p.a.) is recommended for depositors primarily seeking maximum long-term returns. The product generated ₱85,958.61 net interest after 10 years from a ₱100,000 initial deposit, making it the second highes-performance after Maya Boosted. However, unlike promotional savings rates, the return is predictable and does not require spending missions or behavioral conditions. This product is most suitable for savers who can commit their funds for fixed periods and are willing to sacrifice liquidity in exchange for higher returns.

Active Digital Ecosystem User: Maya Bank Boosted Savings (Up to 15.0% p.a.) is recommended for depositors who actively use the Maya ecosystem for payments, purchases, and other qualifying transactions. The product achieved the highest net interest earnings in the study, generating ₱310,584.82 over 10 years. Nevertheless, the boosted rate requires users to satisfy specific behavioral conditions and applies to only eligible balances. Therefore, it is most appropriate for highly engaged users who can consistently meet the qualification requirements.

Balanced Saver (Yield, Accessibility, and Liquidity): Tonik Solo Stash (4.0% p.a.) and OwnBank Savings (3.8% p.a.) are recommended for depositors seeking a balance return, convenience, and accessibility. Both platforms achieved the highes composite score (4.48) in the multi-criteria evaluation. Tonik Solo Stash generated ₱37,024.10 in net interest after 10 years, while OwnBank generated ₱34,914.46. Neither product requires complex missions or spending conditions, and both offer unrestricted access to deposited funds, making them attrative options for long-term passive savers.

Conservative Saver (Zero conditions, Zero Fees): MariBank (3.25% p.a.) and GoTyme Bank (3.0% p.a.) are recommended for conservative depositors who prioritize simplicity, ease of use, and straightforward account structures. Both of the platforms provides competitige savings rates without requiring behavioral conditions, maintain strong regulatory protection, and also offers high liquidity. Their composite scores (4.33) reflect their ability to provide favorable balance between returns and depositor convenience. MariBank's 15 free weekly transfers provide unmatched operational flexibility.

Cost-Conscious Depositor: OwnBank (3.8% p.a.) and CIMB UpSave (2.5% p.a.) are recommended for depositors seeking to minimize transaction-related expenses. Both platforms recorded the highest transaction cost efficiency scores due to their minimal or zero estimated annual transaction costs under the study assumptions. Such features help preserve effective returns by reducing fee-related costs of interest earnings.

Maximum Liquidity Depositor: GoTyme Bank (3.0% p.a.), MariBank (3.25% p.a.), Tonik Solo Stash (4.0% p.a.), and OwnBank (3.8% p.a.). Depositors requiring immediate access to their funds should consider fully liquid savings products such as GoTyme Bank, MariBank, Tonik Solo Stash, and OwnBank. These platforms provide unrestricted withdrawals and fund accessibility while maintaining competitive interest rates, making them suitaable for emergency funds and short-to-medium-term savings goals.

Deposit Diversification Strategy (Max PDIC Coverage): To maximize deposit insurance coverage and reduce concentration risk, depositors with balances exceeding the insured limit may adopt a diversification strategy across multiple BSP-regulated and PDIC-insured digital banks. For example, spread ₱1000,000 across multiple BSP-regulated and PDIC-insured digital banks such ass Tonik Bank (₱250k TD), Maya Bank (₱250k), amd MariBank / GoTyme Bank (₱500k split) in order to maximize insurance coverage (up to ₱500,000 per bank) while optimizing aggregate yield, liquidity, and institutional diversification across the portfolio.

5. DISCUSSION

5.1 Key Findings

The Time Value of Money (TVM) analysis reveas several critical findings for Filipino digital bank depositors. First, the compounding effect produces exponential divergence in outcome over time. Among all platforms evaluated, Maya Bank's Boosted Savings Rate generated the highest projected future value of ₱310,584.82 after 10 years, while OFBank recorded the lowest at ₱100,400.72, a gap of ₱210,184.10 on a ₱100,000 initial deposit. This substantial divergence underscores the high opportunity cost of depositing in low-yield platforms, particularly for depositors who prioritize transactional convenience over long-term wealth accumulation.

Secondd, behavioral conditions significantly affect achievable yields. Maya Bank's 15% boosted rate, while nominally the highest among all evaluated platforms, is conditionally attained through monthly spending issions and balance capitalizations of up to ₱100,000 requirements that passive or irregular depositors may not consitently fulfill. As reflected in the composite scoring framework, Maya Bank Boosted ranked only 11th despite recording the highest yield score, owing to its lower accessibility and liquidity scores (1.5). This outcome is consistent with literature who identified perceived ease of use and effort expectancy as important determinants of digital banking adoption, suggesting that products requiring fewer behavioral conditions to obtain benefits are more practically accessible to the broader depositor population.

Third, the TVM principle is empirically validated across all platform projections. As demonstrated, a depositors placed ₱100,000 in Tonik's 12-Month Time Deposit and maintained it for 10 years would accumulate ₱185,958.61, compared to substantially lower terminal values for platforms offering base rates between 2.5% p.a. and 3.0% p.a. The Present Valye (PV) projections further confirm that achieving a ₱200,000 target over 10 years requires only ₱107,550.82 in initial capital under Tonik's TD rate, compared to ₱199,201.75 under OFBank's near-zero rate, a difference of ₱91,651.13 in required initial capital for the same future objective. These results affirm that time itself functions as a financial asset: the earlier a deposit is placed and the longer it is maintained, the greater the compounding benefit acrrued, reducing the initial capital principal required to meet future financial targets.

5.2 Implications for Depositors

The findings carry a meaningful practical implication for Filipino depositors navigating an increasingly competitive digital banking landscape. The composite scoring results suggest that platforms offering unconditional, competitive rates with minimal transaction costs and full liquidity such as Tonik Solo Stash and OwnBank, both of which achieved the highest composite scores of 4.48, may provide greater practical value than platforms offering higher but conditionally attained promotional rates. Moreover, net interest earned comparisons across Year 5 and Year 10 periods demonstrate that even modest differences in effective after-tax rates produce substantial divergence in long-term outcomes due to compounding effects. For instance, the difference between the 4.0% after tax equivalent rate offered by Tonik Solo Stash and the 2.0% offered by CIMB UpSave translates to a ₱15,124.66 gap in the net interest earned by Year 10 (₱37,024.10 vs. ₱21,899.44), despite both being standard savings products without lock-in restrictions. These results means that depositors who remain inattentive to effective interest rate differentials across platforms may inadvertently forgo significant wealth accumulation over time. In addition, transaction costs, while individually modest in absolute terms, also warrant consideration. Estimated Annual Costs (EAC) across platforms range from ₱0.00 for OwnBank anf GoTyme to as high as ₱324.00 for Maya Bank under certain usage patterns. Over a 10-year period, these cumulative costs may meaningfully influence net returns. Especially for lower-yield accounts wherein inters income becomes limited. Conversely, depositors is necessary to evaluate not only the advertised interest rates but also the total cost of maintaining and operating their accounts when selecting these digital wallet banking platforms.

5.3 BSP Policy Rate Implications

The BSP's March 2026 rate hike to 4.50%, the first tightening move in over two years, signalling a potentially favorable environmental for deposit rates. Historically, digital banks have been slow to pass rate hikes to depositors (preferring to protect margins) but quick to cut rate during easing cycles. The ongoing Middle East conflict-driven inflation pressure suggests that deposit rates may stabilize or modestly improve in late 2026, which would improve Future Value (FV) outcomes for time deposits rolling over in that period.

5.4 Limitations

Several limitations should be acknowledged when interpreting the results of this study.

- Future Value (FV) and Present Value (PV) projections presented only assume constant interest rates throughout the 10-year projection period, annual compounding, and the continuous fulfillment of all applicable conditions for promotional rates. In practices, digital banks frequently revise their savings rates in response to shift in BSP monetary policy, competitive dynamics, and internal profitability objectives. Several institutions have already adjusted their base savings rates since commencing operations, and further rate changes can reasonably be expected over the projection horizon.
- The Estimated Annual Cost (EAC) framework employed is based on standardized assumptions of 12 InstaPay transfers and 8 ATM withdrawals annually, which may not reflect the actual transaction behavior of all depositor segments. Depositors with higher transactional volumes may incur substantially greater annual costs, especially on platforms that had a limited free transaction allowance, and these additional costs would further reduce the net financial benefit of maintaining deposits over time.
- The composite scoring framework reflected the subjective weighting assigned to each evaluation criterion and represents one possible framework among several alternatives. Different weighting schemes for insrance, assigning greater importance to liquidity or transaction cost efficiency would produce different composite rankings, and the framework should therefore be interpreted as a structured analytical tool rather than a definitive investment recommendation.
- This study uses annual compounding for comparability, most digital banks compound interest daily and credit it monthly or annually; daily compounding would produce marginally higher Future Values (FV) outcomes.
- Finally, the study focuses exclusively on interest income and transaction costs as measures of financial benefit, without accounting for supplementary features such as cashback rewards, insurance products, loan facilities, or ecosystem integrations that some digital banks offer and which may influence the overall value proposition for depositors. Further research may benefit from incorporating these non-interest benefits into a more comprehensive multi-criteria assessment framework.

6. CONCLUSION

The study evaluated 12 digital wallent banking platforms in the Philippines through the lens of Time Value of Money (TVM) principles, providing Filipino depositors with an empirically ground framework for seledcting the most effective savings vehicle over a 5-to-10-year investment periods. The findings confirm that interest rate differentials among digital banks produce substantial divergence in long-term wealth accumulation outcomes. A standardized ₱100,000 deposit placed in Maya Bank's Boosted Savings Account (15% p.a.) yields a projected future value of ₱310,583.82 after 10 years, while the same amount deposited in OFBank (0.05%) p.a.) grows to only ₱100,400.72, a gap of over ₱210,000 on an identical initial capital. This stark constrast underscores the high opportunity cost of depositing in low-yield platforms, even when these platforms offer strong liquidity and regulatory safety,

However, the highest nominal rate deos not always translates to the most practical choice. Maya Bank's Boosted Rate, while nominally superiod, requires consistent fulfillment of monthly spending mission and is capped at ₱100,000 in eligible balance, conditions that passive or irregular depositors may not sustain over time. The multi-criteria scoring framework revelaed that Tonik Solo Stash and OwnBank, both achieving the highest composite scores of 4.48, represent the most well-roundd options for the majiroty of Filipino depositors, combining competitive after-yax yields with unconditional accessibility, zero or minimal transaction costs, and full liquidity.

For depositors prioritizing maximum fixed returns withour behavioral conditions, Tonik Bank's 12-Month Time Deposit (8.0% p.a.) generated ₱85,958.61 in net interest after 10 years and requires only ₱107,550.82 in initial capital today to reach a ₱200,000 target compared to ₱199,201.75 required under OFBank's near-zero-rate. In addition, conservative depositors seeking simplicity and zero transactional friction are best served by GoTyme Bank and MariBank, both offering unconditional base rates with no maintenance fees and strong PDIC insurance coverage.

Furthermore, transaction costs, though modest individually, also merit attention. Estimated annual costs range from ₱0.00 for OwnBank and GoTyme to as high as ₱324.00 for Maya Bank under active usage patterns. Compounded over a decade, these fees meaningfully erode net returns, especially for lower-yield accounts where interest income is already limited. All 12 platforms evaluated hold BSP licenses and PDIC deposit insurance coverage of up to ₱1,000,000 per depositor bank effective March 2025, ensuring that regulatory safety is not a differentiating factor. Depositors with balances exceeding the insured threshold are advised to diversify across multiple institutions to maximize both insurance protection and aggregate yield.

In summary, Filipino depositors are encouraged to move beyond headline interest rate comparison and evalute digital banking platforms holistically considering effective after-tax yields, behavioral conditions, transaction costs, liquidity needs, and long-term compounding effects. The earlier a deposit is placed and the longerr it is maintained in a competitive-yield platform, the greater the financial benefit derived through the power of compounding. In a rapidly evolving digital banking landscape, informed and timely deposit decisions remain one of the most accessible tools available to ordinary Filipinos for building long-term financial resilience.

Competing interests

Authors have declared that no competing interests exist.

REFERENCES

Abdullah. (2026). Comparing deposit interest rates of Philippines digital banks (2026). https://fintechnews.ph/69840/digital-banking-news-philippines/philippines-digital-banks-deposit-interest-rates-compared/

Bangko Sentral ng Pilipinas. (2020). Circular No. 1105: Guidelines on the establishment of digital banks. https://www.bsp.gov.ph/Regulations/Issuances/2020/c1105.pdf

Bangko Sentral ng Pilipinas. (2023). Summary of monetary policy decisions. https://www.bsp.gov.ph/Price%20Stability/MonetaryPolicyReport/SummaryofMPDecisions_November2023.pdf

Bangko Sentral ng Pilipinas. (2024). Circular No. 1205: Guidelines on the establishment of digital banks. https://www.bsp.gov.ph/Regulations/Published%20Issuances/Images/Circular_1205.pdf

Bangko Sentral ng Pilipinas. (2026). Directory of banks and non-bank financial institutions. https://www.bsp.gov.ph/SitePages/FinancialStability/DirBanksFIList.aspx

Bangko Sentral ng Pilipinas. (2026). Monetary Board raises target RRP rate by 25 basis points. https://www.bsp.gov.ph/SitePages/MediaAndResearch/MediaDisp.aspx?ItemId=7884&MType=MediaReleases

Bangko Sentral ng Pilipinas. (2026). Monetary policy decisions. https://www.bsp.gov.ph/SitePages/PriceStability/MonetaryPolicyDecision.aspx

Bankero. (2026). Maya to trim base savings rate to 3% starting April 1.

Ballo, J. B., Estandian, V. C. A., Padual, S. R. M., Torres, R. D., German, J. D., & Redi, A. A. N. P. (2024). Assessing digital bank preferences in the Philippines: An application of analytic hierarchy process. Procedia Computer Science, 234, 1553–1560. https://doi.org/10.1016/j.procs.2024.03.157

Beto. (2026). Best digital bank Philippines 2026: Rates, conditions & real peso math. https://www.gotruva.com/banking/rates/best-digital-bank-philippines

BigPinas. (2023). All-in-one digital bank Maya extends 6% interest on savings accounts. https://bitpinas.com/news/digital-bank-maya-extends-6-interest-on-savings-accounts/

Bikker, J. A., & Gerritsen, D. F. (2017). Determinants of interest rates on time deposits and savings accounts: Macro factors, bank risk, and account features. International Review of Finance, 18(2), 169–216. https://doi.org/10.1111/irfi.12143

BitPinas. (2024). Maya interest rate 2024 | Promotions | overview. https://bitpinas.com/fintech/maya-interest-rate-promotions-overview/

Brigham, E., Houston, F., Hsu, J., Kong, Y., & Baany-Ariffin, A. N. (2019). Essentials of financial management (4th ed., pp. 155–188).

Business World. (2022). Philippines' banked adults rise to 56% in 2021 as online payments grow. https://bworldonline.com/banking-finance/2022/08/23/469819/philippines-banked-adults-rises-to-56-in-2021-as-online-payments-grow/

Cajuday, N. (2026). BSP to release shortlist for 4 new digital bank licensees in Q1 2026; eyes foreign players. https://bitpinas.com/fintech/bsp-4-digital-bank/

Chan, K. (2026). Philippine financial system resources climb in Q1. https://bworldonline.com/top-stories/2026/05/22/751346/philippine-financial-system-resources-climb-in-q1/

Cigaral, I. N. (2026). Digital bank deposits top P150B. https://business.inquirer.net/592487/digital-bank-deposits-top-p150b

Cigaral, I. N. (2026). Philippine digital bank deposits reached nearly P139B in 2025. https://business.inquirer.net/576494/ph-digital-bank-deposits-reached-nearly-p139b-in-2025

Context.ph. (2026). Maya recognized by global rankings for digital banking growth. https://context.ph/2026/04/16/maya-recognized-by-global-rankings-for-digital-banking-growth/

Digital Banks PH Update. (2025). https://web.facebook.com/phdigitalbanks/posts/gotyme-bank-is-cutting-its-go-save-interest-rate-to-3-pa-from-35-effective-janua/1388093863327798/?_rdc=1&_rdr#

DigitalbanksPh. (2025). UNO interest changes. effective September 9. https://www.reddit.com/r/DigitalbanksPh/comments/1n9ubdo/uno_interest_changes_effective_september_9/

DigitalhelpPh. (2026). Tonik mobile banking interest rate: Maximizing your savings in the Philippines. https://digitalhelpph.com/tonik-mobile-banking-interest-rate/

Domingo, R. (2023). GoTyme digibank increases annual interest on savings to 5% from 3%. https://business.inquirer.net/393822/gotyme-digibank-increases-annual-interest-on-savings-to-5-from-3

Fenol, J. (2021). New digital bank Tonik offers time deposit interest up to 6 percent. https://www.abs-cbn.com/business/03/18/21/new-digital-bank-tonik-offers-time-deposit-interest-up-to-6-percent

Ferreira, J. (2019). Philippines holds key interest rate at 4.75%. https://tradingeconomics.com/articles/02072019085508.htm

Fintech News Philippines. (2026). Comparing deposit interest rates of Philippines digital banks (2026). https://www.mexc.fm/news/631022

GCash. (n.d.). About us. https://gcash.com/about-us

Gcash. (2026). What are the interest rates in #UNOready@GCash for regular savings and time deposit? https://help.gcash.com/hc/en-us/articles/14232563839001-What-are-the-interest-rates-in-UNOready-GCash-for-regular-savings-and-time-deposit

Gonzales, A. L. (2025). PH average inflation decelerates to 3.2% in 2024. https://www.pna.gov.ph/index.php/articles/1241158

Inquirer.net. (2021). Digital-only bank Tonik woos with staggering deposit interest of 6%. https://business.inquirer.net/319751/digital-only-bank-tonik-woos-with-staggering-deposit-interest-of-6

InvestTayo.ph. (2026). Top digital banks in the Philippines (Mar 2026). https://investtayo.ph/

Laureti, C., & Szafarz, A. (2016). The price of deposit liquidity: Banks versus microfinance institutions. Applied Economics Letters, 23(17), 1244–1249. https://doi.org/10.1080/13504851.2016.1148249

Manila Bulletin. (2026). Maya recognized by Forbes, The Asian Banker. https://mb.com.ph/2026/04/17/maya-recognized-by-forbes-the-asian-banker

Manila Shaker. (2026). MariBank introduces upfront time deposit. https://manilashaker.com/maribank-introduces-upfront-time-deposit/

ManilaShaker Philippines. (2025). GoTyme Bank lowers Go Save interest rate to 3.5%. https://manilashaker.com/gotyme-bank-lowers-go-save-interest-rate-to-3-5/

Maya. (2022, October 12). Maya Bank leads digital banks as it crosses 1M customer base in five months. https://www.maya.ph/stories/maya-bank-leads-digital-banks-as-it-crosses-1m-customer-base-in-five-months-3

MoneyHUB Ph. (2026). Comparing the top 6 digital banks in the Philippines (2026). https://moneyhubph.com/banking/digital-banks-2026

Pagkakatotohan, J. (2023). Grow your money with high-interest savings accounts in the Philippines. https://www.moneymax.ph/personal-finance/articles/high-interest-savings-account-philippines

Philippine Deposit Insurance Corporation (PDIC). (2025). Increase in PDIC maximum deposit insurance coverage. https://www.pdic.gov.ph/rib-3_443

Philippine Deposit Insurance Coverage (PDIC). (1963). Philippine deposit insurance system at a glance. https://www.pdic.gov.ph/public-policy

Philippine Statistics Authority (PSA). (2026). Summary inflation report consumer price index (2018=100): May 2026. https://psa.gov.ph/price-indices/cpi-ir

PhilSTAR Tech. (2026). Digital bank Tonik upgrades time deposit interest rates. https://philstartech.com/news/2026/02/15/16982/digital-bank-tonik-upgrades-time-deposit-interest-rates/

Rosales, C. (2022). Looking for a high-interest savings account? Here are your options. https://www.spot.ph/newsfeatures/money/100443/high-interest-savings-account-digital-bank-neobank-a4373-20220720

San Juan, A. E. (2026). Pace of growth of deposits in digital banks aggressive. https://businessmirror.com.ph/2026/05/27/pace-of-growth-of-deposits-in-digital-banks-aggressive/

Ta-Asan, K. (2024). BSP lifts ban on new digital banks. https://www.philstar.com/business/2024/12/28/2410195/bsp-lifts-ban-new-digital-banks

Tonik. (2024). Why you should be interested in bank interest rates. https://tonikbank.com/blog/why-you-should-be-interested-bank-interest-rates

Trading Economics. (2026). Philippines interest rate — historical data. https://tradingeconomics.com/philippines/interest-rate

Tugade, C., Reyes, J., & Nartea, M. (2021). Components affecting intention to use digital banking among Generation Y and Z: An empirical study from the Philippines. The Journal of Asian Finance, Economics and Business, 8(12), 509–518. https://doi.org/10.13106/JAFEB.2021.VOL8.NO12.0509

UNO Digital Bank. (2022). Annual report (p. 2).

UNObank Inc. (2023, December 5). Double your daily interest rate promo [Press release].

Velez, G. (2025). A systematic review of mobile banking, fintech innovations, and regulatory gaps to achieve financial inclusion in the Philippines. Journal of Interdisciplinary Perspectives, 3(3). https://doi.org/10.69569/jip.2025.056

Villanueva, J. (2022). BSP: PH now has 6 digital banks. https://www.pna.gov.ph/articles/1182068

Wikipedia. (2022). Maya Bank, Inc. https://en.wikipedia.org/wiki/Maya_(mobile_payments)

Journal of Financial and Management Sciences, 2 (3) 135 –193, (2026)
DOI: https://doi.org/10.70970/9qm5fh69

The value of financing decisions and sustainability: A hybrid systematic literature review and pathways for future research

Silvah Ndallah Kivindu

Received: April 14, 2026
Revised: June 6, 2026
Accepted: August 13, 2026
Published online: September 10, 2026

Abstract

This study seeks to provide a thorough systematic evaluation of peer-reviewed literature about financing decisions related to sustainability, emphasizing current research trends and suggesting future research avenues. The study conducts a systematic evaluation of 85 peer-reviewed journal publications concerning finance decisions and sustainability, sourced from the Web of Science database. The study employs the SPAR-4-SLR protocol alongside theory-context-characteristics and method frameworks, integrating framework-based content analysis with bibliometric methods to guarantee methodological rigor and objectivity. The review shows that research on financing decisions in the context of sustainability is mostly based on two main areas: strategic decisions and sustainability indices that are meant to help make the best financing decisions. Even though there have been some recent improvements, there are still many promising areas in sustainable finance that need to be looked into. This gives researchers a chance to do more work. This study offers essential insights for corporate decision-makers, investment managers, policymakers, and investors, enabling the incorporation of sustainability factors into financing strategies to improve long-term financial and non-financial sustainability and ensure regulatory compliance. Financing decisions and sustainability represent a relatively novel research domain in which investors, corporate decision-makers, and change agents are considering factors beyond mere financial rewards. This underscores the importance of this work as a pertinent and significant addition to academic conversation.

Keywords: Financing Decisions, Sustainability, SPAR-4-SLR, Equity Financing, Debt Financing, TCCM

Silvah.kivindu@strathmore.edu

Strathmore University Business School, Strathmore University, Nairobi, Kenya

© The Author(s) 2026. Published by Journal of Financial and Management Sciences. This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at http://creativecommons.org/licences/by/4.0/legalcode

1. Introduction

A firm's financing decisions (FD) plays a crucial role in influencing a firm's performance and sustainability (ST). FD refers to the optimal mix choice between internal financing (retained earnings) and the external financing (debt or equity) to support a business's investments, operations and growth (Rashid, 2014). According to the pecking order theory, firms strategically allocate and hierarchically finance from internal sources and upon exhaustion, external sources (Myers and Majluf, 1984). The strategic financing mix of retained earnings, debt and equity is essential for attaining sustainability goals, as financing decisions directly influences a firm's valuation, risk profile and the cost of capital (Al Amosh et al., 2024; Arhinful et al., 2024). Internal funding mitigates the firm's risk profile relative to external financing (Magnanelli and Izzo, 2017; Arhinful et al., 2024), while external financing enhances the firm's value (Al-Najjar and Al-Najjar, 2017; Abogazia et al., 2024). Other studies have found that external financing decisions negatively affects the firm value (Le and Phan, 2017; Dang et al., 2019).

For a firm to be considered sustainable, it has to manage its financial and non-financial affairs efficiently and effectively (Salehi and Arianpoor, 2021; Ombai, Kiflemariam and Odollo, 2024). Such sustainability can be evaluated through the corporate sustainability performance (CSP) or corporate social responsibility (CSR). CSP measures the efficacy with which a firm integrates social, environmental, economic, and governance factors into its operations and assesses their effects on both the company and society (Thao, Anh and Velencei, 2019; Cassely et al., 2021). Sustainability issues have become essential to company plans (Baumgartner and Rauter, 2017; Thun *et al.*, 2024) encompassing financial systems (Ziolo et al., 2019; Folqué, Escrig-Olmedo and Corzo Santamaría, 2021), management techniques (Onwuzulike et al., 2024), and reporting requirements (Yáñez et al., 2019; Arvidsson and Dumay, 2022).

Therefore, organizations must incorporate sustainability into their strategic frameworks, cultivate new competencies, and execute focused management solutions.

Research demonstrates that robust CSP and CSR can improve financial outcomes, ease financial limitations, diminish risk while lowering the cost of capital. For instance, Xu, Xu and Yu (2021) examined the impact of obligatory CSR disclosure on the expense of debt financing in China and found that, firms that disclosed their CSR activities had access to lower cost of capital as well having access to a larger pool of debt financing. The findings corroborated earlier studies by Bhuiyan and Nguyen (2020) who studied effects of CSR on the cost of debt and cost of capital in Australian markets and Tan et al., (2020) who studied CSR disclosures on the choice of between public debt and bank debt. This access to funding enhances the firm's liquidity and mitigates its risk profile thereby improving its sustainability. In a study of the Australian market, Nguyen, Agbola and Choi (2019) found that CSR and information asymmetry were adversely correlated. The adverse correlation was more pronounced in larger enterprises and those possessing greater market power. The inverse relationship between CSR and information asymmetry was found to diminish for enterprises exhibiting elevated equity risk. According to Luo et al. (2019) each unit increase in the quality of the company's environmental information disclosure led to a 0.31% decrease debt financing costs.

Integrating sustainable practices in financing decisions has been found beneficial. Some practices like green credit increasingly facilitates the advancement of environmentally sustainable firms while constraining polluting entities by directing social capital to enhance environmental governance and foster green production within society (Xu and Li, 2020). It was found that green firms had lower cost of external financing.

This integration was further corroborated by Huang et al. (2022) who found that companies that implement strategies for managing climate risk, such as governance at the board level, corporate climate strategy, specific or integrated processes for addressing climate change, climate opportunities, and engagement in climate policy, can alleviate the adverse effects of climate risk on external financing agreements. Therefore, enhanced corporate social responsibility enables organizations to cultivate more stable connections with consumers, employees, and suppliers, thus mitigating business and insolvency risks. External financiers demand reduced loan interest rates for enterprises exhibiting superior social responsibility.

This paper therefore tries to bring out the value of the intersection between financing decisions and sustainability, with the objective of addressing existing gaps in the literature. This study enhances the literature by elucidating the trade-offs and synergies between funding decisions and sustainable results, driven by the significance of sustainable business practices. Guided by Paul et al. (2021), this study employs a comprehensive method to delineate many elements of financing decisions within a sustainable framework, providing insights for stakeholders and directing future research by identifying knowledge gaps and new avenues by examining peer-reviewed research published in esteemed academic publications.

It complies with established protocols and methodological criteria to guarantee objectivity, academic rigor, and reproducibility. Subsequent to contemporary review articles by (Bhukya and Paul, 2023; Khan, Anas and Uddin, 2024; Rashid et al., 2025), this study seeks to address research questions based on (Paul and Rosado-Serrano, 2019) theory-context-characteristics and methods (TCCM) framework.

RQ1a **What are the dominant publications and citation trends in the literature that concurrently examine FD and ST?**

RQ1b Who are the most prominent authors, and which works, and publications have exerted the greatest impact in this field?

RQ2 What principal theories have been utilized to examine the junction between FD and ST?

RQ3 In which geographical and industry-specific contexts has research investigated the concurrent dynamics of FD and ST?

RQ4 What are the fundamental variables—namely independent, dependent, instrumental, mediating, control, and moderating variables—that delineate studies on FD and ST?

RQ5 What tools, procedures, and statistical techniques are commonly employed in research examining FD in conjunction with ST?

RQ6 What prospective avenues does the existing literature provide for future investigation into the interconnection between FD and ST?

The subsequent sections of this review article are structured as follows: Section 2 delineates the approach employed for this review. Section 3 delineates the findings, including the theories utilized, the situations examined, the distinguishing qualities (or dimensions), and the methodological techniques within the literature. Section 4 explores the progression of FD in ST research, pinpointing particular deficiencies and proposing possible avenues for further inquiry. Ultimately, Section 5 presents the study's conclusive insights.

2. Methodology

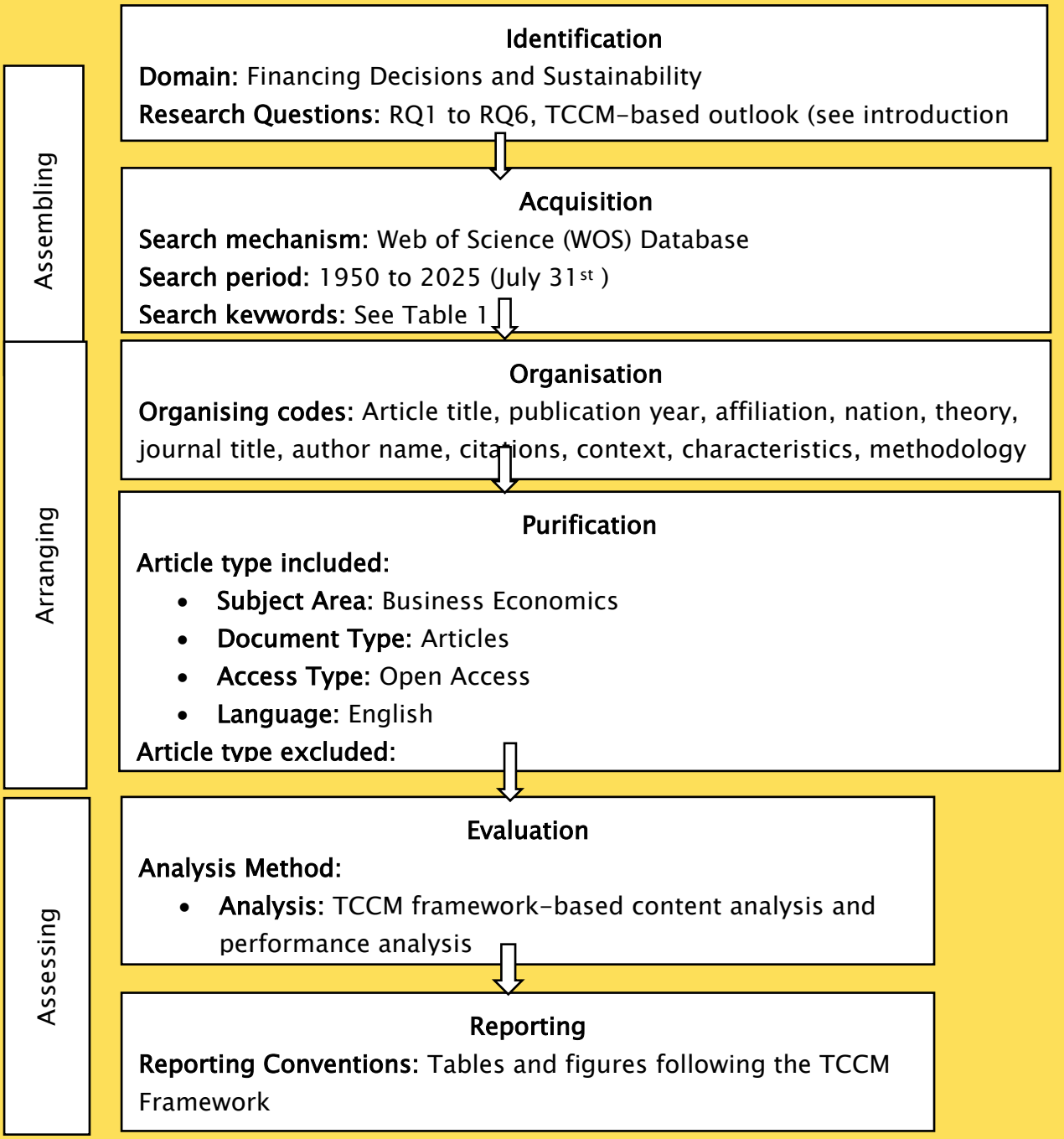
According to (Christofi *et al.*, 2021) systematic literature review (SLR) follows a step by step process of identifying, choosing and consolidating key studies that address research issues within a specific domain or field. Furthermore, it also leads to creation of new research insights, new models and theories. This study employs a domain-based methodology and focus. This is corroborated by recently published review manuals on design and technique (Kraus *et al.*, 2022; Lim, Kumar and Ali, 2022). Initially, from a methodological perspective, the study employs a hybrid systematic review technique utilizing the TCCM framework (Paul and Rosado-Serrano, 2019). Secondly, the work concentrates on domain hybrids (Rashid et al., 2025), whereby the intersectional literature on FD and ST is thoroughly synthesized.

This study will employ the SPAR-4-SLR procedure to ensure rigor and generativity (Paul *et al.*, 2021), in addition to selecting an organizing framework. The protocol has three primary stages and six subordinate stages (Refer to Figure 1). A protocol enhances impartiality in methodological selections, consistency in implementation, and transparency conducive to replication (Lim, Kumar and Ali, 2022).

2.1 Assembling

Identification: The analysis concentrated exclusively on peer-reviewed academic journal articles, which are deemed more dependable than industrial sources, theses, dissertations and conference proceedings (Paul et al., 2021). Data was obtained from the Web of Science (WoS) database, one of the most comprehensive citation databases spanning several fields, including social sciences, technology, art, and science.

Acquisition: Web of Science database has been found to be the most comprehensive database compared to other databases (Martín-Martín *et al.*, 2018; Zhu and Liu, 2020; Singh *et al.*, 2021), for example WoS citations were 95% compared to Scopus at 92%.The search query was executed on the title, abstract, and keyword fields, resulting in articles published from the domain's establishment until July 2025. The keyword string (Table 1) was created based on previous systematic literature reviews (Law, Ye and Chan, 2022; Sureka et al., 2022; Rashid et al., 2025).



Source: Adapted from Paul *et al.* (2021) Figure 1. SPAR-4-SLR protocol review process

Table 1. Keyword search strategy

Concepts	Keywords
1. Financing Decisions	"Debt Financing" OR "Equity Financing" OR "Internal Financing" OR "Capital Structure" OR "External Financing"
2. Sustainability	"Corporate Social Responsibility" OR "Sustainable Development" OR "Environmental Sustainability" OR "Social Sustainability" OR "Corporate Sustainability" OR "Sustainability" OR "ESG"
Search Strategy	#1 AND #2

Source: Author, 2025

2.2 Arranging

Organisation: A comprehensive systematic review was performed to organize the paper efficiently. The TCCM framework was used because it allows the study to encompass many domains of the literature as the primary organizational structure (Paul et al., 2021; Rashid et al., 2025).

Purification: This step involves a number of techniques to determine the eligibility of those articles that are ultimately included in the analysis as shown in Figure 1. From the year 1950 up to 31st July 2025, query 1 in Table 1 gave us 7,227 articles whereas query 2 from Table 1 gave us 427,381 articles. Queries 1 and 2 were combined (#1 AND #2) which resulted to 585 articles. Due to accessibility, the authors were interested in the Open Access articles which narrowed it down to 284 articles. We were left with 85 high-quality publications for a thorough analysis after carefully implementing the inclusion and exclusion criteria as guided by Lim, Yap and Makkar (2021); Mishra, Singh and Koles (2021).

The 85 articles reviewed in this study was considered adequate as per the recommended number of at least 40 articles for a SLR (Paul and Criado, 2020; Paul et al., 2021). Bibliometrix-R was used to thoroughly screen, clean and combine the final data set for the hybrid SLR.

2.3 Assessing

*Evaluation:*We evaluated the final data set of peer-reviewed journal articles using a combination of performance analysis and content analysis rather than typical bibliometric methods in order to strictly comply to the particular feature of the SLR and its framework-based approach ((Paul et al., 2021). As shown in Figure 1, we maintained the organization of this review in accordance with the TCCM framework's dimensions. For the analysis, we used MS Excel and the Bibliometrix package to perform trends in the literature.

*Reporting:*After an extensive content analysis performed throughout the review, the final phase involved creating clear and exact tables and visualizations, as detailed in the following sections. These tables systematically display the organized findings obtained from the TCCM technique, supplemented by comprehensive sections, tables, and figures to assure academic rigor and improve understanding.

3. Analysis and findings

3.1 Performance trends

3.1.1 *RQ1a:* Publication and citation trends

According to our search history, the FD and ST domain began to attract interest in 2011 and has had exponential growth since that time (See Figure 2). During this period, 85 peer-reviewed articles of high quality were published across 37 journals (refer to Table 3), garnering a total of 3,415 citations, resulting in an average of 40.18 citations per article and an h-index of 21.

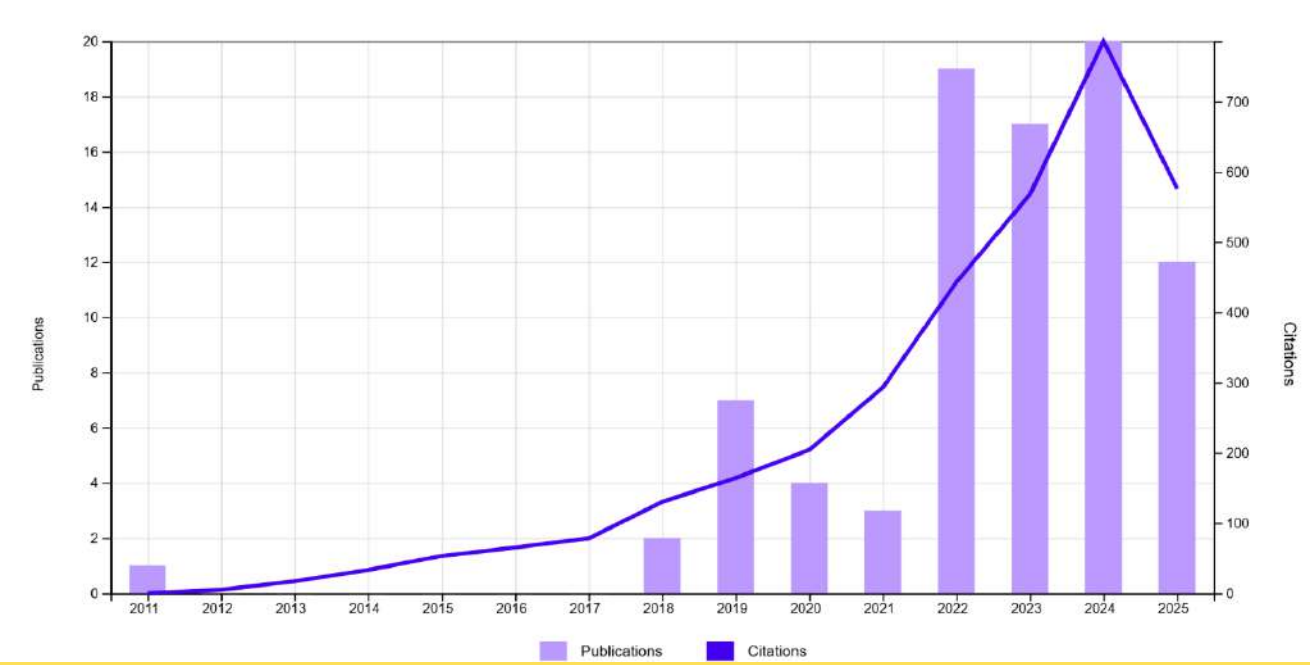


Figure 2: Yearly publications and citations

Source: Web of Science (2025)

From the initial data set of 585 articles on the financing decisions and sustainability, the interest in FD and ST started around 2002 and saw a tremendous growth up to 31st July 2025 with the year 2024 having the highest peer reviewed publications of 130 articles and the highest citation of 4,744. The total citations of the 585 articles were 18,686 with an average citation per item of 31.94 and an H-Index of 57. (See Figure 3)

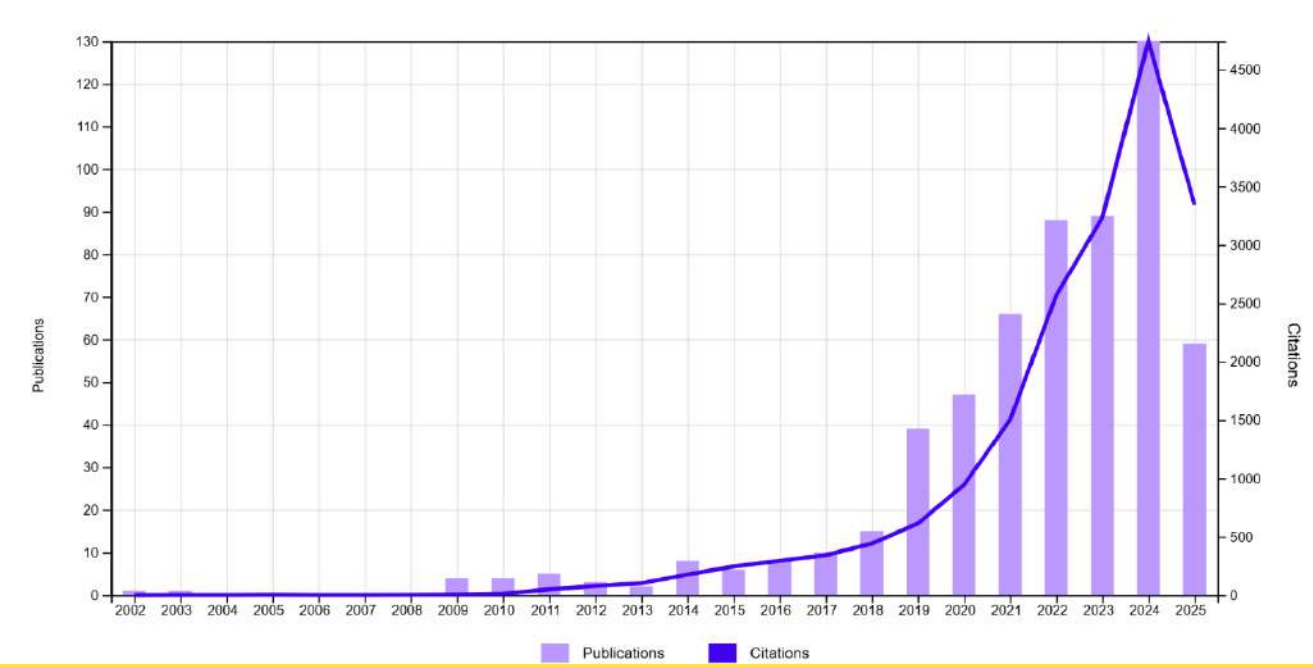


Figure 3: Yearly publications and citations of the full data set

Source: Web of Science (2025)

3.1.2 *RQ1b:* Prominent authors, Articles and Publications

The top 10 leading authors and articles in the financing decisions and sustainability are mentioned in Table 2, Table 3 and Table 4 respectively

Table 2: The most prominent Authors

Authors	Citations
Sadok El Ghoul	1984
Omrane Guedhami	1984
Chuck C.Y. Kwok	1984
Dev R. Mishra	1984
Viktoria Aust	166
Ana Isabel Morais	166
Ines Pinto	166
Edith Ginglinger	137
Quentin Moreau	137

Source: Authors (2025)

From Table 2, we figured out that Sadok El Ghoul, Omrane Guedhami, Chuck C.Y. Kwok and Dev R. Mishra are the joint most prominent authors in the FD and ST domain with 1,984 citations for an article they jointly published. Our findings on the prominent authors are in agreement with the findings of Rashid et al. (2025). Table 3 shows the top ten most prominent articles in the FD and ST domain, with the leading article having 1,984 citations and a yearly average of 132.27 citations. The most prominent article is "Does corporate social responsibility affect the cost of capital?" (El Ghoul et al., 2011).

Table 3: The most prominent articles

Article	Authors	Total Citations	Citations per Year
Does corporate social responsibility affect the cost of capital?	El Ghoul et al. (2011)	1984	132.27
How does foreign direct investment contribute to Sustainable Development Goals? Evidence from African countries	Aust, Morais and Pinto (2020)	166	27.67
Climate Risk and Capital Structure	Ginglinger and Moreau (2023)	137	45.67
Carbon emissions and the cost of debt in the eurozone: The role of public policies, climate-related disclosure and corporate governance	Palea and Drogo (2020)	102	17.00
ESG performance, capital financing decisions, and audit quality: empirical evidence from Chinese state-owned enterprises	Zahid, Saleem and Maqsood (2023)	84	28.00
ESG Disclosure, REIT Debt Financing and Firm Value	Feng and Wu (2023)	79	26.33
Environmental performance and firm financing during COVID-19 outbreaks: Evidence from SMEs	Wellalage et al. (2022)	54	13.50
Sustainable product innovation in agri-food industry: Do ownership	Aibar-Guzmán et al. (2022)	50	12.50

structure and capital structure matter?			
Corporate social responsibility, green financial system guidelines, and cost of debt financing: Evidence from pollution-intensive industries in China	Li, Chen and Xiang (2022)	45	11.25
The role of environmental, social, and governance rating on corporate debt structure	Asimakopoulos, Asimakopoulos and Li (2023)	40	13.33

Source: Authors (2025)

Sustainability journal was found to be the dominant journal in the FD and ST domain with a total of 31 articles published of the 85 articles under review. The top 10 journals are shown in Table 4.

Table 4: The most prominent journals

Journal	Record Count	% of 85
Sustainability	31	36.471%
Corporate Social Responsibility and Environmental Management	4	4.706%
Business Strategy and The Environment	3	3.529%
Environmental Science and Pollution Research	3	3.529%
Frontiers in Environmental Science	3	3.529%
Journal of Cleaner Production	3	3.529%
Discrete Dynamics in Nature and Society	2	2.353%
Finance Research Letters	2	2.353%
International Journal of Environmental Research and Public Health	2	2.353%
International Review of Economics Finance	2	2.353%
Totals	55	64.705%

Source: Author (2025)

3.2 *RQ2:* What principal theories examine the junction between FD and ST?

Theories are essential in research as they offer a framework for comprehending, elucidating, and forecasting occurrences or a phenomenon. In the FD and ST sector, several theories have been employed, as elaborated in the subsequent sub-section, and illustrated in Table 5, according to the TCCM framework.

3.2.1 Trade-Off Theory

The trade-off theory of capital structure posits that firms select their capital structures to equilibrate the advantages of debt, particularly the interest tax shield, against the corresponding costs of financial strain (Kraus and Litzenberger, 1973). By balancing debt's tax advantages against its risks, businesses can promote responsible management, stakeholder trust, and long-term sustainability (Ai, Frank and Sanati, 2020).

By examining the capital structure of enterprises in the United Kingdom throughout periods of crises, the findings by Alhajjeah and Besim (2024) agreed with the Trade-off Theory that firms that balanced the costs of crises and the tax shield, increased their firm value. In the study by Ginglinger and Moreau (2023), their findings align with the concept that physical climate risk influences leverage through increased anticipated distress costs and elevated operating expenses. These findings strengthen the theory that for firms' sustainability, their financing decisions have to balance off the gains and the costs of the financing choice.

3.2.2 Information Asymmetry Theory

Information asymmetry is another key theory that has been used by various authors studied in this SLR. Following the works by Akerlof (1970); Spence (1973) and Rothschild and Stiglitz (1978), it asserts that an imbalance of knowledge exists between several parties, typically between management (agents) and investors or debtors (principals). Managers typically possess superior, timelier, and comprehensive information regarding the company's actual financial condition, operational hazards, and sustainability efforts compared to external stakeholders. According to El Ghoul et al. (2011), subpar CSR performance heightens information asymmetry, while robust CSR is associated with a diminished cost of equity. Furthermore, a study by Goss and Roberts (2011) revealed that organizations with elevated CSR risks due to information asymmetry had higher borrowing rates, as lenders perceived them as potentially incapable of repaying debt. Therefore, in the presence of information asymmetry, the financing decision attracts a higher cost.

3.2.3 Pecking Order Theory

In financing decisions, the pecking order theory has been used by various authors and it implies that, the financing decisions are influenced by firm specific factors as well as managerial preferences. Proposed by Myers and Majluf (1984), the pecking order theory posits that a target capital structure does not exist. The companies prioritize financing sources in the following sequence: internal financing (retained earnings) and then external financing through debt and equity. Chen, Jung and Chen (2011) studied the how the pecking order theory explained financing decisions for Taiwan based electronic companies. Their findings showed that financing decisions are influenced by profitability and growth rate. Profitability adversely impacts financing decisions thereby making companies to choose utilizing their profits to fund business operations, so relying less on debt financing. The growth rate positively influences financing decisions. The more substantial growth possibility will possess an enhanced financing decision to facilitate financing for expansion.

3.2.4 Stakeholder Theory

According to this theory, an organization cannot exist in isolation. It must coexist with society, enabling the organization to leverage natural resources, human capital, and other assets to provide goods and services (Cots, 2011). At the same time, the organization has to ensure that it does not pollute the environment during its production processes. If it so does, it has to put in sustainability measures in place to minimise the pollution effects(Hoque, Clarke and Huang, 2016). Bhattacharya, Korschun and Sen (2009) notes that, for an organization to be successful, all the needs of the different stakeholders have to be satisfied. This satisfaction leads to better financing decisions with better financing costs and reduced information asymmetry. Öztekin et al. (2022) found that, from the standpoint of debt holders, the disclosure of superior ESG performance is associated with a reduced cost of financing for the firms, which was consistent with the stakeholder's theory.

3.2.5 Other Theories

In this review domain, other theories have been used to explain the intersection of financing decisions and sustainability. Among them are Agency theory (Choi et al., 2020), Modigliani-Miller (M-M) theory (Xu *et al.*, 2020), Legitimacy theory (Lyssimachou and Bilinski, 2023), Signaling theory (Alshareef, 2024a), Life-cycle theory (Dai and Xue, 2022), Resource-Based Theory (Fernandes, Grochau and Ten Caten, 2023) and Sustainable Finance Theory(Zhang, Lin and Cao, 2024).

Using M-M theory, Feldhütter and Pedersen (2022) proposed the notion of ESG-MM, indicating that if markets price ESG linearly and ESG variables are additive, the issuance of green bonds should not diminish the overall cost of capital, as other securities become comparatively "browner." However, their findings indicated that, although capital structure should theoretically be inconsequential under linear ESG pricing and additive ESG metrics, empirical findings revealed that green bond issuances can reduce the cost of capital, suggesting a breach of the ESG-MM principle.

Based on the study on Legitimacy theory, Attig, Rahaman and Trabelsi (2025) found that private lenders impose penalties on companies with inadequate environmental records by increasing loan spreads and fees. Furthermore, greenwashing resulted in elevated costs of debt financing thereby enabling lenders to provide favorable non-price conditions to mitigate elevated loan expenses for companies involved in selective disclosure, balancing returns with the firms' financing accessibility.

Table 5: A summary of the theories used by the reviewed studies on the intersection of financing decisions and sustainability

Theories used	Representative studies
Trade-off Theory	Du, Wu and Jin (2019); Xu et al. (2020); Zhao et al. (2022); Asimakopoulos, Asimakopoulos and Li (2023); Kong et al. (2023); Wen et al. (2023); Wu et al. (2023); Xin et al. (2023); Alhajjeah and Besim (2024); Subhani, Zunhuan and Khan (2025)
Information Asymmetry Theory	El Ghoul et al. (2011); Palea and Drogo (2020); Li, Chen and Xiang (2022); Wang et al. (2022); Yao, Qi and Guo (2022); Feng and Wu (2023); Tu et al. (2024); Yang et al. (2024); Zhu, Liu and Zhang (2025)
Pecking Order Theory	Zhao et al. (2022); Asimakopoulos, Asimakopoulos and Li (2023); Ginglinger and Moreau (2023); Kong et al. (2023); Wu et al. (2023); Xin et al. (2023); Zahid, Saleem and Maqsood (2023); Ahamad et al. (2024); Alhajjeah and Besim (2024); Rivera-Franco, Requejo and Suárez-González (2025)
Stakeholder Theory	El Ghoul et al. (2011); Li, Chen and Xiang (2022); Wang et al. (2022); Wellalage et al. (2022); Yao, Qi and Guo (2022); Alshareef (2024); Dai and He (2025); Mhiri et al. (2025); Rivera-Franco, Requejo and Suárez-González (2025); Subhani, Zunhuan and Khan (2025)
Legitimacy Theory	Wang et al. (2022); Lyssimachou and Bilinski (2023); Zahid, Saleem and Maqsood (2023); Yang et al. (2024); Yao and Bao (2024); Attig, Rahaman and Trabelsi (2025)
Modigliani-Miller Theory	Xu et al. (2020); Feldhütter and Pedersen (2022); Asimakopoulos, Asimakopoulos and Li (2023); Ginglinger and Moreau (2023); Kong et al. (2023)

Source: Author (2025)

3.3 *RQ3*: Research Contexts

This section analyses the article's settings to ascertain the contextual significance of FD and ST. Context denotes the background, setting, and conditions pertinent to a study, which affect its design, interpretation, and generalizability (Weise et al. 2020). The focus extends beyond the individual study issue to encompass the overarching societal, cultural, and theoretical frameworks that inform the research process. Grasping the context is essential for researchers to explain their work effectively, interpret findings appropriately, and guarantee the relevance and impact of their research (Ponterotto and Grieger, 2007). In line with previous review articles (Lim, Kumar and Ali, 2022; Rashid et al, 2025) the study considers industries and countries as the contexts of analysis.

3.3.1 Industry-specific context

For the industry-specific context, the study sample of clusters is shown in Table 6. Most of the studies were done on A-share listed companies. Other industries studied were Renewable energy, manufacturing sector, social enterprises, hospitality and tourism, PPP projects, health care industry, mining and extraction industry, financial firms as well as micro-finance institutions. SMEs sector was also studied from the SLR articles sampled.

Table 6: Industry-specific context of the study sample

Industry	Representative studies
A-Share listed companies	Tang, Qi and Zhou (2023); Tu et al. (2024); Yao and Bao (2024); Zhu, Liu and Zhang (2025)
Renewable energy	Dogah, Wesseh Jr and Adomako (2025)
Manufacturing sector	Yang, et al. (2024)
Social enterprises	Fernandes, Grochau and Ten Caten (2023)
Hospitality and tourism	Lyssimachou and Bilinski (2023)
PPP projects	Du, Wu and Zhao (2018); Du, Wu and Jin (2019)
Health care	Y. Zhao et al. (2022)
Mining & extraction	Wojewska et al. (2024)
Financial sector	Rehman, Gonenc and Hermes (2023)
Micro-finance institutions	Ahamad et al., (2024b)

Source: Author (2025)

3.3.2 Country-specific context

Table 7 illustrates the regional distribution of publications based on the sample country of the study. The majority of the studies have been conducted in China, EU and USA. The notion of CS in the context of ST has been less examined in developing or emerging economies (Mubashar and Tariq 2019; Rashid et al. 2025).This indicates that the subject has predominantly been investigated in developed economies, underscoring the need for research encompassing developing and impoverished nations.

Table 7: Country-specific context of the study sample

Country	Count	Representative studies
China	48	Yao and Bao (2024)
EU	18	Amarna et al. (2024)
USA	15	Liu, Wu and Zhou (2024)
Ghana	2	Kong et al. (2023)
Pakistani	1	Xuezhou et al. (2022)
Saudi Arabia	1	Alshareef (2024b)

Source: Author (2025)

3.4 *RQ4*: Fundamental variables delineating the studies on FD and ST

This section presents the fundamental variables that have been used for studies on FD and ST. It presents the independent variables, dependent variables, mediating variables, moderating variables, control variables a s well as instrumental variables that have been used. This summary is shown in Table 8.

Table 8: Dimensions of financing decisions in the context of sustainability

Independent Variables	Dependent Variables	Control Variables	Moderating Variables	Mediating variables	Instrumental Variable	Representative Studies
CSR Performance	Cost of Equity	Beta, Size, Book to Market ratio, Leverage	-	-	-	El Ghoul et al. (2011)
Climate Risk	Leverage, Cost of Debt, Credit Rating, Net Equity Issued	Profitability, Age, Tobin's Q, Operational Expenses, R&D Expenditure, Size, Interest Coverage	ESG Performance	-	-	Ginglinger and Moreau (2023)
Carbon Intensity	Cost of Debt	Leverage, Operating Margin,	post-2015 Dummy	-	-	Palea and Drogo (2020)

		Working Capital Ratio, Size				
ESG	Debt Financing, Equity Financing	ROA, Z-Score, Net Operating Assets, Board Size, CEO Duality	Audit Quality	-	-	Zahid, Saleem and Maqsood (2023)
ESG Disclosure	Cost of Debt, Financial flexibility, Credit Ratings, Firm value	Book value of Assets, Age, Assets Growth, Operating Income, Leverage, Cash Equivalents,	-	-	-	Feng and Wu (2023)

(continued)

Table 8: Dimensions of financing decisions in the context of sustainability (continued)

Independent Variables	Dependent Variables	Control Variables	Moderating Variables	Mediating variables	Instrumental Variable	Representative Studies
Capital Structure, Ownership Structure	Sustainable Product Innovation	Size, ROA, Cash, Dividends, CAPEX, Age, Foreign Sales	-	-	-	Aibar-Guzmán et al. (2022)
CSR	Cost of Debt	Size, ROA, Leverage, Growth, Debt Structure, Cash needs, Age, Fixed Assets, Number of Independent Directors	Green Financial Guidelines	-	-	Li, Chen and Xiang (2022)

ESG Rating	Debt Structure	Assets, Market-to-Book Ratio, Sales, Tangibility, Profitability, SGA cost, Sales over Assets, Financial Pressure. R&D Intensity		-	-	Asimakopoulos, Asimakopoulos and Li (2023)
Debt Funding, Equity funding	ESG performance	Size, Age, Profitability	Ownership Concentration	-	-	Wen et al. (2023)

(continued)

Table 8: Dimensions of financing decisions in the context of sustainability (continued)

Independent Variables	Dependent Variables	Control Variables	Moderating Variables	Mediating variables	Instrumental Variable	Representative Studies
Green Innovation	Firm Value (Tobin's Q)	Size, ROA, Leverage, Growth, CEO Duality, Age	Corporate Governance Index	Sustainable Development Capability, Debt Financing Cost	Green_Mean	Dai and Xue (2022)
ESG Grade, CSR	Cost of equity	Book-to-Market, Size, Leverage, Market Beta	-	-	-	Ok and Kim (2019)
Environmental management, Debt Financing	Sustainable Financial Growth	Size, Net Assets, Growth Rate	-	Debt Financing	-	Xu et al. (2020)

CSR	Institutional Ownership	Leverage, ROA, R&D, MV, B/M, P/S	-	-	-	Lyssimachou and Bilinski (2023)
Profitability, Growth Opportunity, Non-debt Tax Shields, Size, Tangibility of Assets, Debt Ratio	Leverage	Industry Effect, Ownership type	-	-	-	L. Zhao et al. (2022)
Environmental performance	Access to External Financing	Size, Age, Ownership Top Managers Experience, Current Loan	-	-	-	Wellalage et al. (2022)

(continued)

Table 8: Dimensions of financing decisions in the context of sustainability (continued)

Independent Variables	Dependent Variables	Control Variables	Moderating Variables	Mediating variables	Instrumental Variable	Representative Studies
CSR	Enterprise Innovation (RD)	Financial Slack, Leverage, Age, Equity concentration, Enterprise value, Growth, ROA, Nature of ownership	Market Competition Degree	Debt Financing Cost	-	Yao, Qi and Guo (2022)
Current Ratio (CR), Debt Ratio (DR)	ROE, Return on Invested Capital (ROIC)	Size, Asset Growth, Operation Efficiency, Assets Tangibility	-	-	-	Wu et al. (2023)

Absolute Disclosure Ratio, Weighted Disclosure Ratio	Debt Cost	Leverage, Profitability, Tangibility, Interest coverage ratio, Expected Default Frequency, Cashflow volatility, Environmental Impact ratio	-	-	-	Attig, Rahaman and Trabelsi (2025)

(continued)

Table 8: Dimensions of financing decisions in the context of sustainability (continued)

Independent Variables	Dependent Variables	Control Variables	Moderating Variables	Mediating variables	Instrumental Variable	Representative Studies
Debt Ratio, Debt to Equity Ratio	ROE, Return on Invested Capital (ROIC)	Size, Assets Growth, Operational Efficiency, Assets Tangibility	-	-	-	Kong et al. (2023)
Age, Beta, Dividend Yield, Size, Turnover, Firm specific risk	Leverage, Institutional Ownership	Market-to-Book ratio, R&D, Asset Beta, Log of Sales, Selling Expenditure/Sales	-	-	Industry Dummy & Year Dummy	Choi et al. (2020)

Carbon Information Disclosure (CarbDisc), Sustainable Development (SustaDe)	Financing Cost (Debt Cost)	Size, Profitability, ROA, Quick Ratio, Fixed Asset Turn Over, Total Asset Turn Over, Equity Concentration, Stock liquidity	Sustainable Development	-	-	Wang et al. (2022)
ESG Score	Leverage	Cash, Growth, Profitability, Dividend payout, Non-debt tax shields, Tangibility, Size	-	-	-	Morais et al. (2025)

(continued)

Table 8: Dimensions of financing decisions in the context of sustainability (continued)

Independent Variables	Dependent Variables	Control Variables	Moderating Variables	Mediating variables	Instrumental Variable	Representative Studies
ESG Rating	Excessive Corporate Debt	Size, Age, Revenue Growth, CEO Duality, Ownership Concentration, Board Size	Cost of Equity Capital	Total Asset Turnover, Debt Financing Cost	Lagged ESG Performance	Yang, Yang, et al. (2024)
Investor Sentiment (Stock Mispricing)	Green Innovation	Size, Age, leverage, ROA, Growth, Asset Structure, Cash Flow, Ownership Concentration, Board Independence, State Ownership	Financial Constraints, Institutional ownership, analyst coverage, state ownership	-	-	Dong, Zhang and Chen (2024)

ESG of Debt, ESG Level	Cost of debt capital, Cost of equity capital, WACC, Enterprise value	Control bond	-	-	-	Feldhütter and Pedersen (2022)
ESG Rating, Financial Sector Development	Corporate Debt Financing	Size, Inflation Rate, Trade Openness, Government Effectiveness, Political Stability, Cross-Border Investment	Financial Sector Development	-	-	Subhani, Zunhuan and Khan (2025)

(continued)

Table 8: Dimensions of financing decisions in the context of sustainability (continued)

Independent Variables	Dependent Variables	Control Variables	Moderating Variables	Mediating variables	Instrumental Variable	Representative Studies
Carbon Emissions Trading Policy (CETP)	ESG performance	Firm Size, Total number of employees, Firm age, Debt-Asset ratio, ROA, Fixed Asset investment	-	Green Tech Innovation & Financing Constraints	-	Dai and He (2025)
Retained Earnings, Deposits, Donations, Commercial	Self-Sustainability, Cost efficiency, revenue efficiency	size, Inflation Rate, GDP, CYR	External governance	-	-	(Ahamad et al. (2024a, 2024b)

Borrowing, Equity						
Climate Risk (CR)	Shadow Banking (SB), Credit Chain (SB_CC), Credit Intermediary (SB_CI)	Leverage, ROA, Size, Age, Dual, Interest, Tangible Asset Ratio	-	Cross-Risks (RISK2), Cash Holding (CASH)	Average Climate Risk Levels of other Firms	Zhang, Lin and Cao (2024)
ROA, ROE, Tobin's Q, CSR,	Short Term Debt to Assets (SDA), Long-Term Debt to Assets (LDA), Total Debt to Assets (TDA)	Growth, Tangibility, Liquidity, Size, Risk	-	ESG	-	Alhajjeah and Besim (2024)

(continued)

Table 8: Dimensions of financing decisions in the context of sustainability (continued)

Independent Variables	Dependent Variables	Control Variables	Moderating Variables	Mediating variables	Instrumental Variable	Representative Studies
Enterprise digital evolution	Outward foreign investment	Size, Age, Revenue Growth, Board Independence, CEO Duality, Ownership Concentration, Board Size	Age, Debt Cost	ESG Performance	Lagged digital evolution	Yang, Gan, et al. (2024)
Dividend distribution, Market orientation,	Financial Diversity Index	Impact Sector, business model, development stage	-	-	-	Fernandes, Grochau and Ten Caten (2023)

Impact measurement, incubation, tech adoption						
CSR Score	Trade credit	Size, Age, Cash, Tangibility, ROA, Leverage, Tobin's Q, Asset maturity, Purchases, GDP Growth Rate,	Family ownership	-	-	Rivera-Franco, Requejo and Suárez-González (2025)
ESG Performance	Excessive Debt level, Probability of excessive debt	ROA, Firm Size, Growth, Ownership, non-debt tax shield	Internal Control Quality, Analyst Attention	Corporate Debt Financing costs, Short-term debt length,	Number of shares held by corporate ESG funds	Zhu, Liu and Zhang (2025)

(continued)

Table 8: Dimensions of financing decisions in the context of sustainability (continued)

Independent Variables	Dependent Variables	Control Variables	Moderating Variables	Mediating variables	Instrumental Variable	Representative Studies
CSR	Leverage, Long-term debt ratio	ROA, Board Size, Tangibility, GDP rate, Tobin-Q, Inflation	Culture	-	ESG Score	Mhiri et al. (2025)
Firm environmental Protection Investment (EPI)	Debt financing costs (Cost)	Tobin's Q, Liquidity, Sales, ROA, Bankruptcy Risk (Z-Score), Intangible Assets	Green Finance, Air quality, Environmental regulation intensity (policy)	Green Technology innovation, ESG performance	EPI_Mean of other firms in the same province	Yao and Bao (2024)

Institutional Ownership (IO), Family Ownership (FO), Government Ownership (GO), Managerial Ownership (MO)	Higgins (1977) Sustainable Growth Rate	Size, Leverage, Age, Board Size, Board Independence	-	-	-	Alshareef (2024a, 2024b)
Lagged Financial Leverage (Leveraget-1)	Market Long term Debt ratio	Profitability, Tangibility, Size, Growth	Gross National Income (GNI), Life **C**ycle Stages (LCS)	-	-	Xin et al. (2023)
Financing Source proportions, Sustainability Factor,	Capital Structure, Debt-Service Capacity, Equity IRR	Interest Rates, Tax Benefits, Inflation, Public v Private funding	Debt-Equity ratio, Tax Benefits	-	-	González-Ruiz, Botero-Botero and Peña (2022)

Investment per period	

(continued)

Table 8: Dimensions of financing decisions in the context of sustainability (continued)

Independent Variables	Dependent Variables	Control Variables	Moderating Variables	Mediating variables	Instrumental Variable	Representative Studies
Environmental management, Debt Financing	Financial Sustainable Growth	Size, Net Assets, Growth Rate	-	Debt Financing	Lagged EM and DF	Ren et al. (2022)
ESG Rating	Corporate Innovation, Media Sentiment	Size, Debt Level, ROA, Age, Analyst coverage, Cash flow level	Media Sentiment	Corporate Financing Constraints	Lag Term of ESG rating (ESGR_L), Mean value of ESGR for other companies in the same industry (ESGR_A)	Tu et al. (2024)

Source: Author (2025)

3.5 *RQ5*: Research Methods

(Rashid *et al.*, 2025) notes that, conceptual research entails the formulation of an idea by analysing existing data or augmenting a theory by a review of relevant literature, whereas empirical research is grounded in observations, experiments, and verified data. From the findings of this review, almost all the articles under review were empirical research.

Research design for the empirical studies were observed, out of which quantitative studies were the majority, then case studies, qualitative and mixed methods. Furthermore, panel data was used by majority of the empirical articles. The conclusion from this review is that research in FD and ST is mostly empirical, quantitative and uses panel data. This trend is shown in Table 9.

Table 9. Trends in research design

Research design	% of the studies	Representative studies
Quantitative	90.70%	(Wang *et al.*, 2022; Dong, Zhang and Chen, 2024; Attig, Rahaman and Trabelsi, 2025; Rivera-Franco, Requejo and Suárez-González, 2025)
Case Studies	4.65%	González-Ruiz, Botero-Botero and Peña (2022)
Qualitative	2.33%	Zheng, Li and Zhao (2021)
Mixed Methods	2.32%	Du, Wu and Jin (2019)

Source: Author (2025)

For the data analysis, OLS and panel regression was the mostly across the articles reviewed for the data analysis. GMM estimators were used by several studies as well as discounted cashflows (DCF) and Difference in Differences (DID). Scenario and period analysis was used as well. Some of the studies could use more than one data analysis method. This is summarised in Table 10.

Table 10. Trends in data analysis

Data Analysis	Representative studies
OLS Regression	Ginglinger and Moreau (2023); Lyssimachou and Bilinski (2023); Xin et al. (2023); Zahid, Saleem and Maqsood (2023); Yao and Bao (2024)
Panel Regression	Wang et al. (2022); Wen et al. (2023); Dong, Zhang and Chen (2024); Yang, Gan, et al. (2024)
2SLS & GMM	Xu et al. (2020); Ren et al. (2022); Wu et al. (2023)
Scenario/Period Analysis	González-Ruiz, Botero-Botero and Peña (2022)
DID	Dai and He (2025)
Propensity Score Matching	Tu et al. (2024); Dai and He (2025); Morais et al. (2025)
Quantile Regression	L. Zhao et al. (2022)

Source: Author (2025)

4. *RQ6*: Future research avenues in Financing Decisions and Sustainability

Under the TCCM lens, this review paper provides a comprehensive overview of the intersection of financing decisions and sustainability. The first observation made was in regard to the geographical distribution. Much of the studies were done in the developed markets and this provides a gap in that the developing and less developed countries/regions. As noted by Yeh et al. (2020) and Rashid et al., (2025), studies in the developing and the underdeveloped regions would not only validate the trends seen in the developed markets but also bridge the global gap in the FD and ST interaction.

Under the research designs, comparative studies are missing. We have investors who invest in different geographics, and this would enrich the findings in the FD and ST dimension. As noted in prior review works by Muhammad and Ali (2025); Rashid et al. (2025), most of the studies relating to capital structure or financing decisions and sustainability are empirical studies that are quantitative in nature. Future studies should diversify the study methodologies for example, adopting mixed methods, using qualitative data as well as refocusing on conceptual studies. Case studies can be considered as well for future studies as it might validate the quantitative studies.

Under the quantitative studies, most of the reviewed articles used panel data. It would be beneficial for future studies to use other types of data in their studies. Panel regression and OLS regression were highly used to analyse the data as well. Analysing the data with other options like structural equation modelling would improve the rigour of future studies. On the variables, moderating variables were mostly used compared to mediating variables. Future studies can mediate more than moderate the relation between financing decisions and sustainability. Also, most of the studies have financing decisions as the dependent variables, and sustainability as the predictor variable. Making the FD to be independent variable and ST be the dependent variable might add rigour the studies in FD and ST. CSR, ESG performance are worthwhile variables that need further studying.

From this review, there have been heavy reliance on listed firms being studied. This leaves the unlisted firms out but for future studies, they can focus more on the unlisted firms. The argument could be lack of data publicly, but then future researchers can benefit by changing the research methodology as well as the data. Lastly, from this review, research in FD and ST only started around 2011, this means that this is a relatively new field that requires a lot of research.

5. Conclusion and Limitations

This SLR concludes by looking at the implications of FD and ST research and findings to different stakeholder, followed by the research conclusions and the limitations of the study.

It will require collective efforts of all stakeholders towards attainment of the SDGs, and this would improve economic, social and environmental sustainability. To academicians, this review highlights the need for more research in the FD and ST intersection. There are different ways on how academicians can improve the research in FD and ST field. For example, collaborations between sustainability researchers and finance scholars could provide more rigour in this domain. Furthermore, FD and ST cuts across different firms in different sectors and such studies could be used to validate other studies.

To the shareholders, the review has found that firms engaging in CSR activities are more likely to get lower cost of debt. With lower cost of debt, it would mean more distributable profits, and this would be beneficial to the shareholders. Furthermore, firms that engage is sustainability activities have been found to increase their firm value and this would be in line with wealth maximization objective of the sharholders.

To the creditors and debtholders, firms that engage in sustainability practices are more likely to perform better and this ensures that debts and liabilities are paid on time. Furthermore, firms engaging in CSR activities, having better ESG performance, have reduced risk profile and this would mean that creditors and debtholders risk of having non-performing credit is lowered. The lenders can also incorporate CSR and ESG ratings in their credit evaluation criteria.

The investors are able to align their investment practices with the firms that have their shared vision and goals. For example, impact investors are not only interested in the financial gains from investments, but also are interested in how the firm impacts socially, economically and environmentally.

Furthermore, ethical and responsible investors are able to weed out firms form their portfolios that are not aligned with their investment mantra. To the regulators, they can formulate guidelines that link financing decisions and sustainability. Also, they can promote disclosures and reporting requirements for FD and ST.

This study finds that Trade-off theory is the most used foundational theory for the FD and ST intersection. Most of the studies have been done in the developed world and close to none in the developing and under-developed countries. Methodologically, most of the studies have relied more on empirical studies over conceptual studies with the empirical studies relying more on quantitative methods. The quantitative methods have relied more on panel data with panel and OLS regression being the most used tools of analysis. This study acknowledges possible limitations among them, source scope as well as restricted language as the study focussed on articles that have been published in English only. This could have produced biasness that could affect the generalizability of the findings. The use of TCCM framework may have limited the analytical depth and so, future reviewers could utilise other frameworks. Finally, this SLR highlights the fields of FD and ST as emerging and underexamined domains, offering significant prospects for the advancement of rigorous research in this area.

Declaration on the use of AI

This SLR has not been generated by any generative software. The authors declare the use of Quillbot for paraphrasing as well as reducing the grammatical errors of this SLR.

Conflict of Interest and Funding.

On behalf of all the authors, the corresponding author states that there is no conflict of interest.

References

Abogazia, A.H. *et al.* (2024) 'The moderating effect of external financing on the relationship between integrated reporting and firm value in Egypt', *Journal of Financial Reporting and Accounting*, 22(5). Available at: https://doi.org/10.1108/JFRA-05-2022-0195.

Ahamad, S. *et al.* (2024a) 'Relationship between microfinance institutions' self-sustainability and financing sources: Moderating role of external governance. ', *Annals of Public and Cooperative Economics*, 95(4), pp. 971–1001.

Ahamad, S. *et al.* (2024b) 'Relationship between microfinance institutions' self-sustainability and financing sources: Moderating role of external governance. ', *Annals of Public and Cooperative Economics*, 95(4), pp. 971–1001.

Ai, H., Frank, M.Z. and Sanati, A. (2020) 'The Trade-off Theory of Corporate Capital Structure', *SSRN Electronic Journal* [Preprint]. Available at: https://doi.org/10.2139/ssrn.3595492.

Aibar-Guzmán, B. *et al.* (2022) 'Sustainable product innovation in agri-food industry: Do ownership structure and capital structure matter?', *Journal of Innovation and Knowledge*, 7(1). Available at: https://doi.org/10.1016/j.jik.2021.100160.

Akerlof, G.A. (1970) 'The market for "lemons": Quality uncertainty and the market mechanism', *Quarterly Journal of Economics*. Available at: https://doi.org/10.2307/1879431.

Alhajjeah, D. and Besim, M. (2024) 'Firms' Capital Structure during Crises: Evidence from the United Kingdom. ', *Sustainability*, 16(13), p. 5469.

Al-Najjar, B. and Al-Najjar, D. (2017) 'The impact of external financing on firm value and a corporate governance index: SME evidence', *Journal of Small Business and Enterprise Development*, 24(2). Available at: https://doi.org/10.1108/JSBED-11-2016-0172.

Alshareef, M.N. (2024a) 'Ownership structure and financial sustainability of Saudi listed firms. ', *Sustainability*, 16(9), p. 3773.

Alshareef, M.N. (2024b) 'Ownership structure and financial sustainability of Saudi listed firms. ', *Sustainability*, 16(9), p. 3773.

Amarna, K. *et al.* (2024) 'The effect of environmental, social, and governance disclosure and real earning management on the cost of financing', *Corporate Social Responsibility and Environmental Management*, 31(4). Available at: https://doi.org/10.1002/csr.2740.

Al Amosh, H. *et al.* (2024) 'Capital structure decisions and environmental, social and governance performance: insights from Jordan', *Journal of Financial Reporting and Accounting*, 22(4). Available at: https://doi.org/10.1108/JFRA-12-2021-0453.

Arhinful, R. *et al.* (2024) 'The influence of cost of debt, cost of equity and weighted average cost of capital on dividend policy decision: Evidence from non-financial companies listed on the Frankfurt Stock Exchange. ', *Future Business Journal*, 10(1), p. 99.

Arvidsson, S. and Dumay, J. (2022) 'Corporate ESG reporting quantity, quality and performance: Where to now for environmental policy and practice?', *Business Strategy and the Environment*, 31(3). Available at: https://doi.org/10.1002/bse.2937.

Asimakopoulos, P., Asimakopoulos, S. and Li, X. (2023) 'The role of environmental, social, and governance rating on corporate debt structure', *Journal of Corporate Finance*, 83. Available at: https://doi.org/10.1016/j.jcorpfin.2023.102488.

Attig, N., Rahaman, M. and Trabelsi, S. (2025) 'Creditors at the gate: Effects of selective environmental disclosure on the cost of debt. ', *Corporate Governance: An International Review*, 33(2), pp. 202–230.

Aust, V., Morais, A.I. and Pinto, I. (2020) 'How does foreign direct investment contribute to Sustainable Development Goals? Evidence from African countries', *Journal of Cleaner Production*, 245. Available at: https://doi.org/10.1016/j.jclepro.2019.118823.

Baumgartner, R.J. and Rauter, R. (2017) 'Strategic perspectives of corporate sustainability management to develop a sustainable organization', *Journal of Cleaner Production*, 140. Available at: https://doi.org/10.1016/j.jclepro.2016.04.146.

Bhattacharya, C.B., Korschun, D. and Sen, S. (2009) 'Strengthening stakeholder-company relationships through mutually beneficial corporate social responsibility initiatives', *Journal of Business Ethics*, 85(SUPPL. 2). Available at: https://doi.org/10.1007/s10551-008-9730-3.

Bhuiyan, M.B.U. and Nguyen, T.H.N. (2020) 'Impact of CSR on cost of debt and cost of capital: Australian evidence', *Social Responsibility Journal*, 16(3). Available at: https://doi.org/10.1108/SRJ-08-2018-0208.

Bhukya, R. and Paul, J. (2023) 'Social influence research in consumer behavior: What we learned and what we need to learn? – A hybrid systematic literature review', *Journal of Business Research*, 162. Available at: https://doi.org/10.1016/j.jbusres.2023.113870.

Cassely, L. *et al.* (2021) 'Corporate social performance (CSP) in time of economic crisis', *Sustainability Accounting, Management and Policy Journal*, 12(5). Available at: https://doi.org/10.1108/SAMPJ-07-2020-0262.

Chen, L., Jung, C. and Chen, S.-Y. (2011) 'How the Pecking-Order Theory Explain Capital Structure', *Journal of International Management Studies*, 6.2(1984).

Choi, P.M.S. *et al.* (2020) 'Corporate governance and capital structure: Evidence from sustainable institutional ownership', *Sustainability (Switzerland)*. Available at: https://doi.org/10.3390/su12104190.

Christofi, M. *et al.* (2021) 'Agility and flexibility in international business research: A comprehensive review and future research directions', *Journal of World Business*, 56(3). Available at: https://doi.org/10.1016/j.jwb.2021.101194.

Cots, E.G. (2011) 'Stakeholder social capital: A new approach to stakeholder theory', *Business Ethics*, 20(4). Available at: https://doi.org/10.1111/j.1467-8608.2011.01635.x.

Dai, D. and Xue, Y. (2022) 'The Impact of Green Innovation on a Firm's Value from the Perspective of Enterprise Life Cycles', *Sustainability (Switzerland)*, 14(3). Available at: https://doi.org/10.3390/su14031226.

Dai, Y. and He, R. (2025) 'The Impact of Carbon Emissions Trading Policy on the ESG Performance of Heavy-Polluting Enterprises: The Mediating Role of Green Technological Innovation and Financing Constraints. ', *Sustainability*, 17(4), pp. 2071–1050.

Dang, H.N. *et al.* (2019) 'Study the Impact of Growth, Firm Size, Capital Structure, and Profitability on Enterprise Value: Evidence of Enterprises in Vietnam', *Journal of Corporate Accounting and Finance*, 30(1). Available at: https://doi.org/10.1002/jcaf.22371.

Dogah, K.E., Wesseh Jr, P.K. and Adomako, S. (2025) 'Green credit policy, technological innovation, and corporate financial performance: Evidence from the energy industry. ', *Business Strategy and the Environment*, 34(1), pp. 1171–1188.

Dong, L., Zhang, X. and Chen, J. (2024) 'Does investor sentiment drive corporate green innovation: Evidence from China. ', *Sustainability*, 16(8), p. 3220.

Du, J., Wu, H. and Jin, R. (2019) 'Capital structure of public-private partnership projects: A sustainability perspective', *Sustainability (Switzerland)*, 11(13). Available at: https://doi.org/10.3390/su11133505.

Du, J., Wu, H. and Zhao, X. (2018) 'Critical factors on the capital structure of Public-Private Partnership projects: A sustainability perspective', *Sustainability (Switzerland)*, 10(6). Available at: https://doi.org/10.3390/su10062066.

Feldhütter, P. and Pedersen, L.H. (2022) 'Is Capital Structure Irrelevant with ESG Investors?', *SSRN Electronic Journal* [Preprint]. Available at: https://doi.org/10.2139/ssrn.4227547.

Feng, Z. and Wu, Z. (2023) 'ESG Disclosure, REIT Debt Financing and Firm Value', *Journal of Real Estate Finance and Economics*, 67(3). Available at: https://doi.org/10.1007/s11146-021-09857-x.

Fernandes, E. da S., Grochau, I.H. and Ten Caten, C.S. (2023) 'Impact Investing: Determinants of External Financing of Social Enterprises in Brazil', *Sustainability (Switzerland)*, 15(15). Available at: https://doi.org/10.3390/su151511935.

Folqué, M., Escrig-Olmedo, E. and Corzo Santamaría, T. (2021) 'Sustainable development and financial system: Integrating ESG risks through sustainable investment strategies in a climate change context', *Sustainable Development*, 29(5). Available at: https://doi.org/10.1002/sd.2181.

El Ghoul, S. *et al.* (2011) 'Does corporate social responsibility affect the cost of capital?', *Journal of Banking and Finance*, 35(9). Available at: https://doi.org/10.1016/j.jbankfin.2011.02.007.

Ginglinger, E. and Moreau, Q. (2023) 'Climate Risk and Capital Structure', *Management Science*, 69(12). Available at: https://doi.org/10.1287/mnsc.2023.4952.

González-Ruiz, J.D., Botero-Botero, S. and Peña, A. (2022) 'Analysis of the Capital Structure in Sustainable Infrastructure Systems: A Methodological Approach', *Sustainability (Switzerland)*, 14(19). Available at: https://doi.org/10.3390/su141912662.

Goss, A. and Roberts, G.S. (2011) 'The impact of corporate social responsibility on the cost of bank loans', *Journal of Banking and Finance*, 35(7). Available at: https://doi.org/10.1016/j.jbankfin.2010.12.002.

Hoque, A., Clarke, A. and Huang, L. (2016) 'Lack of Stakeholder Influence on Pollution Prevention: A Developing Country Perspective', *Organization and Environment*, 29(3). Available at: https://doi.org/10.1177/1086026615623057.

Huang, H.H. *et al.* (2022) 'Firm climate risk, risk management, and bank loan financing', *Strategic Management Journal*, 43(13). Available at: https://doi.org/10.1002/smj.3437.

Khan, F.M., Anas, M. and Uddin, S.M.F. (2024) 'Anthropomorphism and consumer behaviour: A SPAR-4-SLR protocol compliant hybrid review', *International Journal of Consumer Studies*. Available at: https://doi.org/10.1111/ijcs.12985.

Kong, Y. *et al.* (2023) 'Capital Structure and Corporates Financial Sustainability: Evidence from Listed Non-Financial Entities in Ghana', *Sustainability (Switzerland)*, 15(5). Available at: https://doi.org/10.3390/su15054211.

Kraus, A. and Litzenberger, R.H. (1973) 'A STATE-PREFERENCE MODEL OF OPTIMAL FINANCIAL LEVERAGE', *The Journal of Finance*, 28(4). Available at: https://doi.org/10.1111/j.1540-6261.1973.tb01415.x.

Kraus, S. *et al.* (2022) 'Literature reviews as independent studies: guidelines for academic practice', *Review of Managerial Science*, 16(8). Available at: https://doi.org/10.1007/s11846-022-00588-8.

Law, R., Ye, H. and Chan, I.C.C. (2022) 'A critical review of smart hospitality and tourism research', *International Journal of Contemporary Hospitality Management*. Available at: https://doi.org/10.1108/IJCHM-08-2021-0986.

Le, T.P.V. and Phan, T.B.N. (2017) 'Capital structure and firm performance: Empirical evidence from a small transition country', *Research in International Business and Finance*, 42. Available at: https://doi.org/10.1016/j.ribaf.2017.07.012.

Li, Y., Chen, R. and Xiang, E. (2022) 'Corporate social responsibility, green financial system guidelines, and cost of debt financing: Evidence from pollution-intensive industries in China', *Corporate Social Responsibility and Environmental Management*, 29(3). Available at: https://doi.org/10.1002/csr.2222.

Lim, W.M., Kumar, S. and Ali, F. (2022) 'Advancing knowledge through literature reviews: "what", "why", and "how to contribute"', *Service Industries Journal*, 42(7–8). Available at: https://doi.org/10.1080/02642069.2022.2047941.

Lim, W.M., Yap, S.F. and Makkar, M. (2021) 'Home sharing in marketing and tourism at a tipping point: What do we know, how do we know, and where should we be heading?', *Journal of Business Research*, 122. Available at: https://doi.org/10.1016/j.jbusres.2020.08.051.

Liu, F.H., Wu, Q. and Zhou, Y. (2024) 'Bank deregulation and corporate social responsibility. ', *Journal of Financial Stability*, 74, p. 101313.

Luo, W. *et al.* (2019) 'Environmental information disclosure quality, media attention and debt financing costs: Evidence from Chinese heavy polluting listed companies', *Journal of Cleaner Production*, 231. Available at: https://doi.org/10.1016/j.jclepro.2019.05.237.

Lyssimachou, D. and Bilinski, P. (2023) 'Does corporate social responsibility affect the institutional ownership of firms in the hospitality and tourism industry?', *Tourism Economics*, 29(4). Available at: https://doi.org/10.1177/13548166211069899.

Magnanelli, B.S. and Izzo, M.F. (2017) 'Corporate social performance and cost of debt: The relationship', *Social Responsibility Journal*, 13(2). Available at: https://doi.org/10.1108/SRJ-06-2016-0103.

Martín-Martín, A. *et al.* (2018) 'Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories', *Journal of Informetrics*, 12(4). Available at: https://doi.org/10.1016/j.joi.2018.09.002.

Mhiri, C. *et al.* (2025) 'Corporate social responsibility and capital structure: Moderating effect of culture. ', *Corporate Social Responsibility and Environmental Management*, 32(1), pp. 698–717.

Mishra, R., Singh, R.K. and Koles, B. (2021) 'Consumer decision-making in omnichannel retailing: Literature review and future research agenda', *International Journal of Consumer Studies*. Available at: https://doi.org/10.1111/ijcs.12617.

Morais, F. *et al.* (2025) 'The effect of environment, social and governance on demand and supply of debt', *Applied Economics*, 57(21). Available at: https://doi.org/10.1080/00036846.2024.2331422.

Mubashar, A. and Tariq, Y. Bin (2019) 'Capital budgeting decision-making practices: evidence from Pakistan', *Journal of Advances in Management Research*, 16(2). Available at: https://doi.org/10.1108/JAMR-07-2018-0055.

Muhammad, H. and Ali, S. (2025) 'The interplay of board gender diversity, debt financing, and sustainable investment: evidence from Europe. ', *Journal of sustainable finance & investment*, 15(1), pp. 1–21.

Myers, S.C. and Majluf, N.S. (1984) 'Corporate financing and investment decisions when firms have information that investors do not have', *Journal of Financial Economics*, 13(2). Available at: https://doi.org/10.1016/0304-405X(84)90023-0.

Nguyen, V.H., Agbola, F.W. and Choi, B. (2019) 'Does corporate social responsibility reduce information asymmetry? Empirical evidence from Australia', *Australian Journal of Management*, 44(2). Available at: https://doi.org/10.1177/0312896218797163.

Ok, Y. and Kim, J. (2019) 'Which corporate social responsibility performance affects the cost of equity? Evidence from Korea', *Sustainability (Switzerland)*, 11(10). Available at: https://doi.org/10.3390/su11102947.

Ombai, P., Kiflemariam, A. and Odollo, L. (2024) 'Financial and Non-Financial Information on Strategy Management Process; A Systematic Literature Review. ', *Journal of Strategic Management*, 8(1), pp. 33–64.

Onwuzulike, O.C. *et al.* (2024) 'Corporate sustainability and innovation: Integrating strategic management approach. ', *World Journal of Advanced Research and Reviews*, 23(3), p. 4.

Öztekin, Ö. *et al.* (2022) 'ESG and the cost of capital Does disclosure of ESGÖztekin, Ö., Flannery, M. J., Aleknevičienė, V., Stralkutė, S., Modigliani, F., Miller, M. H., Bacha, S., Ajina, A., Saad, S. Ben, Liao, L. K. C., Mukherjee, T., Wang, W., Freeman, R. E., Harrison, J. S., ', *Sustainability (Switzerland)*, 16(1).

Palea, V. and Drogo, F. (2020) 'Carbon emissions and the cost of debt in the eurozone: The role of public policies, climate-related disclosure and corporate governance', *Business Strategy and the Environment*, 29(8). Available at: https://doi.org/10.1002/bse.2550.

Paul, J. *et al.* (2021) 'Scientific procedures and rationales for systematic literature reviews (SPAR-4-SLR)', *International Journal of Consumer Studies* [Preprint]. Available at: https://doi.org/10.1111/ijcs.12695.

Paul, J. and Criado, A.R. (2020) 'The art of writing literature review: What do we know and what do we need to know?', *International Business Review*, 29(4). Available at: https://doi.org/10.1016/j.ibusrev.2020.101717.

Paul, J. and Rosado-Serrano, A. (2019) 'Gradual Internationalization vs Born-Global/International new venture models: A review and research agenda', *International Marketing Review*. Available at: https://doi.org/10.1108/IMR-10-2018-0280.

Ponterotto, J.G. and Grieger, I. (2007) 'Effectively Communicating Qualitative Research', *The Counseling Psychologist*, 35(3). Available at: https://doi.org/10.1177/0011000006287443.

Rashid, A. (2014) 'Firm external financing decisions: explaining the role of risks', *Managerial Finance*, 40(1). Available at: https://doi.org/10.1108/MF-02-2013-0049.

Rashid, U. *et al.* (2025) 'Unlocking the synergy between capital structure and corporate sustainability: a hybrid systematic review and pathways for future research. ', *International Journal of Organizational Analysis*. [Preprint].

Rehman, A., Gonenc, H. and Hermes, N. (2023) 'Carbon disclosure policy, external financing needs and the cost of capital: Does financial market quality matter?', *Business Strategy and the Environment*, 32(8). Available at: https://doi.org/10.1002/bse.3452.

Ren, Z. *et al.* (2022) 'A Decision Support System to Estimate Green Sustainability from Environmental Protection and Debt Financing Indicators', *Agriculture (Switzerland)*, 12(8). Available at: https://doi.org/10.3390/agriculture12081249.

Rivera-Franco, P., Requejo, I. and Suárez-González, I. (2025) 'Does CSR facilitate access to trade credit? The role of family ownership. ', *Review of Managerial Science*, 19(5), pp. 1477–1512.

Rothschild, M. and Stiglitz, J. (1978) 'Equilibrium in competitive insurance markets: An essay on the economics of imperfect information. In Uncertainty in economics ', *Academic Press.*, pp. 257–280.

Salehi, M. and Arianpoor, A. (2021) 'The relationship among financial and non-financial aspects of business sustainability performance: evidence from Iranian panel data', *TQM Journal*, 33(6). Available at: https://doi.org/10.1108/TQM-08-2020-0175.

Singh, V.K. *et al.* (2021) 'The journal coverage of Web of Science, Scopus and Dimensions: A comparative analysis', *Scientometrics*, 126(6). Available at: https://doi.org/10.1007/s11192-021-03948-5.

Spence, M. (1973) 'Job market signaling', *Quarterly Journal of Economics*, 87(3). Available at: https://doi.org/10.2307/1882010.

Subhani, B.H., Zunhuan, S. and Khan, M.A. (2025) 'Finance for a Greener future: Evolving the financial sector for ESG and sustainable corporate debt management.', *Borsa Istanbul Review*, 25(2), pp. 337–349.

Sureka, R. *et al.* (2022) 'Five decades of research on capital budgeting – A systematic review and future research agenda', *Research in International Business and Finance*, 60. Available at: https://doi.org/10.1016/j.ribaf.2021.101609.

Tan, W. *et al.* (2020) 'Corporate social responsibility (CSR) disclosure and the choice between bank debt and public debt', *Accounting Horizons*, 34(1). Available at: https://doi.org/10.2308/acch-52631.

Tang, S., Qi, S. and Zhou, C. (2023) 'Impact of dual control system of energy consumption and intensity on cost of debt financing: micro-evidence from Chinese listed companies', *Environmental Science and Pollution Research*, 30(19). Available at: https://doi.org/10.1007/s11356-023-26408-4.

Thao, L.H.N., Anh, D.N.P. and Velencei, J. (2019) 'Measuring corporate social performance', *Serbian Journal of Management*, 14(1). Available at: https://doi.org/10.5937/sjm14-18009.

Thun, T.W. *et al.* (2024) 'The role of sustainability integration into the corporate strategy – A perspective on analysts' perceptions and buy recommendations', *Heliyon*, 10(3). Available at: https://doi.org/10.1016/j.heliyon.2024.e25008.

Tu, K. *et al.* (2024) 'ESG Ratings, Media Sentiment, and Corporate Innovation Performance. ', *Sustainability*, 16(24), p. 11166.

Wang, G. *et al.* (2022) 'Corporate Carbon Information Disclosure and Financing Costs: The Moderating Effect of Sustainable Development', *Sustainability (Switzerland)*, 14(15). Available at: https://doi.org/10.3390/su14159159.

Weise, A. *et al.* (2020) 'Assessing context suitability (generalizability, external validity, applicability or transferability) of findings in evidence syntheses in healthcare—An integrative review of methodological guidance', *Research Synthesis Methods*. Available at: https://doi.org/10.1002/jrsm.1453.

Wellalage, N.H. *et al.* (2022) 'Environmental performance and firm financing during COVID-19 outbreaks: Evidence from SMEs', *Finance Research Letters*, 47. Available at: https://doi.org/10.1016/j.frl.2021.102568.

Wen, K. *et al.* (2023) 'The Moderating Role of Ownership Concentration on Financing Decisions and Firm's Sustainability: Evidence from China', *Sustainability (Switzerland)*, 15(18). Available at: https://doi.org/10.3390/su151813385.

Wojewska, A.N. *et al.* (2024) 'The criticality of lithium and the finance-sustainability nexus: Supply-demand perceptions, state policies, production networks, and financial actors', *Extractive Industries and Society*, 17. Available at: https://doi.org/10.1016/j.exis.2023.101393.

Wu, N. *et al.* (2023) 'Do Liquidity and Capital Structure Predict Firms' Financial Sustainability? A Panel Data Analysis on Quoted Non-Financial Establishments in Ghana', *Sustainability (Switzerland)*, 15(3). Available at: https://doi.org/10.3390/su15032240.

Xin, Y. *et al.* (2023) 'Unleashing the Moderating Influence of Firms' Life Cycle Stages and National Income on Capital Structure Targeting Behavior: A Roadmap towards Sustainable Development', *Sustainability (Switzerland)*, 15(4). Available at: https://doi.org/10.3390/su15042945.

Xu, H., Xu, X. and Yu, J. (2021) 'The Impact of Mandatory CSR Disclosure on the Cost of Debt Financing: Evidence from China', *Emerging Markets Finance and Trade*, 57(8). Available at: https://doi.org/10.1080/1540496X.2019.1657401.

Xu, X. and Li, J. (2020) 'Asymmetric impacts of the policy and development of green credit on the debt financing cost and maturity of different types of enterprises in China', *Journal of Cleaner Production*, 264. Available at: https://doi.org/10.1016/j.jclepro.2020.121574.

Xu, X.L. *et al.* (2020) 'The Effects of Environmental Management and Debt Financing on Sustainable Financial Growth in the Tourism Industry', *SAGE Open*, 10(3). Available at: https://doi.org/10.1177/2158244020948530.

Xuezhou, W. *et al.* (2022) 'Does Firm Growth Impede or Expedite Insolvency Risk? A Mediated Moderation Model of Leverage Maturity and Potential Fixed Collaterals', *Frontiers in Environmental Science*, 10. Available at: https://doi.org/10.3389/fenvs.2022.841380.

Yáñez, S. *et al.* (2019) 'The sustainability report as an essential tool for the holistic and strategic vision of higher education institutions', *Journal of Cleaner Production*, 207. Available at: https://doi.org/10.1016/j.jclepro.2018.09.171.

Yang, X., Gan, H., *et al.* (2024) 'A study on the impact of enterprise digital evolution on outward foreign investments. ', *Sustainability*, 16(10), p. 4021.

Yang, X., Yang, T., *et al.* (2024) 'The Impact of ESG on Excessive Corporate Debt. ', *Sustainability*, 16(16), p. 6920.

Yao, J. jing, Qi, Y. ang and Guo, B. (2022) 'Corporate social responsibility, debt financing cost and enterprise innovation', *Scientific Reports*, 12(1). Available at: https://doi.org/10.1038/s41598-022-26076-3.

Yao, X. and Bao, X. (2024) 'Corporate Environmental Protection Investment and Debt Financing Costs: Evidence from China. ', *Sustainability*, 16(23), p. 10786.

Yeh, C.C. *et al.* (2020) 'Does corporate social responsibility affect cost of capital in China?', *Asia Pacific Management Review*, 25(1). Available at: https://doi.org/10.1016/j.apmrv.2019.04.001.

Zahid, R.M.A., Saleem, A. and Maqsood, U.S. (2023) 'ESG performance, capital financing decisions, and audit quality: empirical evidence from Chinese state-owned enterprises', *Environmental Science and Pollution Research*, 30(15). Available at: https://doi.org/10.1007/s11356-023-25345-6.

Zhang, Q., Lin, Y. and Cao, Y. (2024) 'From financialization to sustainability: the impact of climate risks on shadow banking activities in non-financial firms in China. ', *Sustainability*, 16(19), p. 8675.

Zhao, L. *et al.* (2022) 'Determinants of Financial Sustainability in Chinese Firms: A Quantile Regression Approach', *Sustainability (Switzerland)*, 14(3). Available at: https://doi.org/10.3390/su14031555.

Zhao, Y. *et al.* (2022) 'Equity financing intention of elderly care enterprises: Influence of institutional logic and operation mode', *Frontiers in Public Health*, 10. Available at: https://doi.org/10.3389/fpubh.2022.811876.

Zheng, H., Li, J. and Zhao, X. (2021) 'How does financial policy support the development of China's fishery? Characteristics, experience and prospects', *Marine Policy*, 132. Available at: https://doi.org/10.1016/j.marpol.2021.104678.

Zhu, J. and Liu, W. (2020) 'A tale of two databases: the use of Web of Science and Scopus in academic papers', *Scientometrics*, 123(1). Available at: https://doi.org/10.1007/s11192-020-03387-8.

Zhu, T., Liu, D. and Zhang, L. (2025) 'Does ESG Performance Help Corporate Deleveraging? Based on an Analysis of Excessive Corporate Debt. ', *Sustainability*, 17(3), p. 1274.

Ziolo, M. *et al.* (2019) 'How to design more sustainable financial systems: The roles of environmental, social, and governance factors in the decision-making process', *Sustainability (Switzerland)*, 11(20). Available at: https://doi.org/10.3390/su11205604.

Journal of Financial and Management Sciences, 2 (3) 194 –241, (2026)
DOI: https://doi.org/10.70970/ed3gdf08

Middle East Maritime Disruption and African Trade Resilience: A Chokepoint-to-Resilience Transmission Framework

Sixbert Sangwa[1]*; Faiz Ibrahim Bello[2]; Angel Keza[3]; Nakundwa Niisha Onimbo[4]; Deng Reech Bul Deng[5]; Abraham Abot Panom Makuei[6]; Jeremiah Nyaboga Onyango[7]; Divine Pacifique Ishimwe[8]; Jabea Nsombi Msola[9]; Esther Kasyoka Peter[10]; Ahmed Rashid Gafar Elhassan[11]; Kiiza Ivan Mugisha[12]; Arnaud Rutabana[13]; Ella Joeva Kaliza Mbanza[14]; Daniel Muhirwa[15]; Nuake Justice Junior Tsekpo[16]; Brave Alain Gahunda[17]; Mutinta Muleya[18]; Lisa Sheila Twahirwa Isimbi[19]; Bercy Samuel Inyamibwa[20]; Benitha Teta Ngarambe[21]; Shania Teta Umwali[22]; Hervine Ishimwe[23]; Ingrid Augustine Melingui Nkogo[24]; Nia Abigail Njeri Wangechi[25]; Mary Arny Ishimwe[26]; Diane Ntihabose[27]; Evans Wekesa[29]; Victoria Ishimwe[30]; Tiana Hawi Ogol[31]; Florence Fumie Kayode[32]; Olivier Ndayishimiye[33]

Received: April 6, 2026
Revised: July 8, 2026
Accepted: August 13, 2026
Published online: September 10, 2026

Abstract

Maritime chokepoints have become critical sites where geopolitical conflict is converted into trade cost, delay, uncertainty and unequal supply-chain exposure. This article develops and substantiates a Chokepoint-to-Resilience Transmission Framework explaining how conflict-related disruption around the Red Sea, Gulf of Aden, Suez Canal, Bab el-Mandeb, Cape of Good Hope route and Strait of Hormuz creates African trade vulnerability or resilience. The study uses a pragmatic critical-realist design that combines a completed PRISMA 2020-guided systematised evidence map, documentary policy synthesis and descriptive analysis of verified institutional indicators. The evidence map identified 62 records, screened 53 after removing duplicates and included 25 scholarly and institutional sources. Verified institutional evidence shows that Suez-linked rerouting can add approximately 12 days to a Shanghai-Rotterdam voyage, approximate a 30% transit-time shock, reduce effective container capacity by about 9% and increase containership arrivals around the Cape of Good Hope by 328% by gross tonnage by early March 2024 relative to early December 2023. Across Djibouti, Kenya, Tanzania and Sudan, reported Suez-route exposure ranges from 10% to 34% of foreign trade by volume, with a mean of 22.5% and coefficient of variation of 52.4%. The article integrates supply-chain resilience, time-as-trade-barrier economics, maritime connectivity, global value chains, trade facilitation and geoeconomic risk into an Africa-focused framework. African trade resilience requires route-risk monitoring, port productivity, digital customs, corridor redundancy, supplier diversification, data systems and strategic regional integration.

Keywords: African trade resilience; maritime chokepoints; Red Sea crisis; Suez Canal; Strait of Hormuz; maritime disruption; supply-chain resilience; trade facilitation

ssangwa@alueducation.com
Department of International Business and Trade, African Leadership University, Kigali, Rwanda
© The Author(s) 2026. Published by Journal of Financial and Management Sciences. This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at http://creativecommons.org/licences/by/4.0/legalcode

1. Introduction

1.1 Background and context

International business research can no longer treat trade as the frictionless movement of goods across abstract markets. Trade is materially routed through ports, canals, straits, corridors, customs systems, contracts, vessels, insurers and political spaces. Maritime chokepoints such as the Suez Canal, Bab el-Mandeb, the Red Sea corridor, the Cape of Good Hope route and the Strait of Hormuz are therefore not merely geographical passages. They are strategic infrastructures through which security risk, transport economics, energy dependence, port capacity, insurance pricing and state power converge. For International Business and Trade, this matters because firms do not trade through neutral space. They trade through corridors whose reliability is shaped by conflict, regulatory capacity, commercial concentration, logistics infrastructure and the capacity of firms and states to absorb disruption.

This article uses the term Middle East conflict-related maritime disruption to refer to the connected set of shipping risks created by the Red Sea crisis and attacks affecting the Gulf of Aden, Bab el-Mandeb, Red Sea and Suez Canal corridor, together with wider regional escalation and Strait of Hormuz shipping and energy-market risk. The concept is intentionally narrower than the total politics of the Middle East. It refers to the trade-relevant mechanisms through which conflict and security risk alter routing, transit time, freight cost, insurance exposure, energy prices, port demand and trade reliability.

The Red Sea crisis since late 2023 makes this problem unusually visible. UN Trade and Development reported that attacks affecting the Gulf of Aden, Red Sea and Suez Canal redirected vessels across major Asia-Europe and Asia-Atlantic lanes toward the Cape of Good Hope, increasing voyage distance, operational cost and logistics pressure (Bacrot & Faure, 2024).

That assessment estimated that rerouting from Shanghai to Rotterdam could add about 12 sailing days, that diversion around Africa represented roughly a 30% increase in transit time and that the shock could reduce effective global container shipping capacity by about 9% (Bacrot & Faure, 2024). UNCTAD later reported that global trade reached about US$35 trillion in 2025 but was expected to slow in 2026 because Middle East conflict and Strait of Hormuz shipping disruptions were likely to intensify trade-cost, energy-cost, inflation and geoeconomic pressures (UN Trade and Development, 2026).

These disruptions matter to Africa in two analytically distinct ways. First, African economies are exposed to external logistics shocks because many rely on long-distance maritime routes for imported fuel, fertilizer, food, intermediate goods, medicines, machinery and export access. Second, Africa is positioned inside the rerouting geography because the Cape of Good Hope becomes more important when Suez-linked passage becomes risky.

UNCTAD estimated that the Suez Canal accounts for around 10% of global seaborne trade by volume and 22% of containerized trade, while Europe accounts for approximately 26% of Africa's imports and 26% of Africa's exports by value (Bacrot & Faure, 2024). It also estimated that Suez-linked routes account for approximately 31% of Djibouti's foreign trade by volume, 15% of Kenya's, 10% of Tanzania's and 34% of Sudan's (Bacrot & Faure, 2024). These values do not prove causal impact, but they show that route dependence is uneven and therefore analytically researchable.

The same disruption is also ambiguous. It imposes costs through delay, insurance pressure, container scarcity, freight-rate volatility, energy exposure, fertilizer risk and port congestion, yet it may create short-term opportunities for ports along the Cape route.

UNCTAD reported that by early March 2024 vessel arrivals around the Cape of Good Hope increased sharply, including a 328% rise in containership arrivals by gross tonnage compared with early December 2023, while South African ports such as Durban and Cape Town faced both congestion and increased demand for bunkering and related services (Bacrot & Faure, 2024). This duality is central to the paper's contribution: one external shock can harm trade reliability while simultaneously increasing the strategic value of specific African ports.

Existing scholarship provides strong conceptual tools but has not yet fully integrated the current Middle East-linked maritime disruption into an Africa-focused trade-resilience framework. Supply-chain resilience literature explains how firms and systems anticipate, absorb, recover, adapt and transform after disruption (Christopher & Peck, 2004; Pettit et al., 2010; Wieland & Durach, 2021). Trade economics demonstrates that time itself is a trade barrier because delays raise inventory costs, weaken reliability and reduce competitiveness, especially for time-sensitive goods (Djankov et al., 2010; Hummels & Schaur, 2013). Maritime economics shows that liner shipping connectivity affects bilateral trade performance (Hoffmann et al., 2020). Global value chain theory explains why vulnerability is distributed unequally across firms, countries, sectors and governance positions (Gereffi et al., 2005). What remains underdeveloped is an integrated account of how conflict-driven chokepoint disruption is transmitted into African trade vulnerability or resilience through route dependence, port capacity, trade facilitation, sectoral exposure and managerial adaptation.

This article makes three contributions. First, it develops the Chokepoint-to-Resilience Transmission Framework, a mechanism-based model explaining how maritime security shocks become African trade vulnerability or resilience through route reallocation, time-cost pressure, exposure amplification and moderating institutional-managerial capacities.

Second, it provides a PRISMA-guided systematised evidence map that consolidates scholarly and institutional evidence on maritime chokepoints, trade costs, supply-chain resilience, trade facilitation, global value chains and African exposure. Third, it advances a policy-relevant interpretation of African trade resilience that is neither crisis sensationalism nor naive optimism: external shocks are unevenly damaging, but their final consequences are mediated by port connectivity, customs systems, corridor reliability, firm bargaining power and regional trade capacity.

1.2 Statement of the Problem

Although Middle East conflict-related maritime disruption has become one of the most significant contemporary risks to global trade, there remains insufficient Africa-focused conceptual and evidence-based understanding of how chokepoint disruption is transmitted into African trade vulnerability or resilience. Institutional evidence documents rerouting away from the Red Sea and Suez Canal toward the Cape of Good Hope, longer transit times, higher operational pressure, congestion at selected African ports and exposure of East African economies to Suez-linked trade routes (Bacrot & Faure, 2024; World Trade Organization, 2025).

UNCTAD's April 2026 update further identifies conflict in the Middle East and Strait of Hormuz disruptions as a short-term trade headwind through energy, logistics, inflation and geoeconomic channels (UN Trade and Development, 2026). However, the literature has not yet sufficiently connected these macro-level disruptions to African country and sector exposure, port and corridor readiness, trade facilitation implementation and firm-level adaptation strategies.

This gap matters because many African exporters and importers operate in thin-margin, infrastructure-constrained and time-sensitive supply chains where additional days, unreliable containers, higher insurance costs, fuel-price pressure and port congestion can reduce competitiveness, raise consumer prices and weaken food, energy and input security. If the problem is not examined systematically, firms and policymakers may continue to respond reactively to each crisis rather than building evidence-based resilience capabilities. This article addresses the gap by synthesising traceable evidence and developing a framework that explains how Red Sea, Suez Canal, Bab el-Mandeb, Cape of Good Hope and Strait of Hormuz-related disruption creates African trade exposure, and how that exposure can be moderated by institutions, infrastructure, regional coordination and managerial adaptation.

1.3 Research objectives

1.3.1 General objective

To develop and substantiate an integrated Chokepoint-to-Resilience Transmission Framework explaining how Middle East conflict-related maritime chokepoint disruptions create African trade vulnerability or resilience through route reallocation, time-cost pressure, exposure amplification and moderating institutional-managerial capacities.

1.3.2 Specific objectives

1. To describe the magnitude, timing and trade-logistics pattern of Red Sea, Suez Canal, Bab el-Mandeb, Cape of Good Hope and Strait of Hormuz-related disruptions using credible secondary evidence.
2. To synthesise how selected African economies, ports, corridors and sectors are exposed through route dependence, import dependence, export time-sensitivity, energy or fertilizer vulnerability and port or corridor capacity.
3. To integrate disruption-intensity indicators, exposure mechanisms and resilience capacities into a testable Africa-focused framework without claiming causal effects that are not supported by available data.

4. To derive theoretically grounded and evidence-informed managerial and policy implications for African trade resilience under persistent geopolitical uncertainty.

1.4 Research questions

The article is guided by three research questions that reflect its framework-based evidence-synthesis design:

RQ1. What were the magnitude, timing and trade-logistics patterns of Red Sea, Suez Canal, Bab el-Mandeb, Cape of Good Hope and Strait of Hormuz-related maritime disruptions from November 2023 to the evidence cut-off?

RQ2. Which selected African economies, ports, corridors and sectors appear most exposed to these disruptions, and through which mechanisms does exposure occur?

RQ3. How can disruption-intensity indicators, exposure mechanisms and resilience capacities be integrated into a testable framework for analysing African trade resilience under maritime chokepoint disruption?

Table 1. Alignment among research questions, objectives and evidence sources

Research question	Aligned objective	Evidence base	Analytical contribution
RQ1	Describe disruption magnitude, timing and logistics pattern	UNCTAD, WTO and institutional maritime evidence	Documents measurable disruption pressures without inferring untested causal effects
RQ2	Synthesise African exposure pathways	UNCTAD exposure estimates, port/corridor literature and documentary evidence	Explains heterogeneity by country, port, corridor and sector
RQ3	Develop a testable framework	Theoretical synthesis, operational definitions and evidence map	Distinguishes shock, mechanisms, moderators and outcomes for future empirical work

Note. The table aligns each research question with the article's objectives, evidence base and analytical contribution.

1.5 Framework propositions

Consistent with its framework-based evidence-synthesis design, this article advances four theoretical propositions rather than statistical hypotheses. The propositions synthesise the reviewed evidence by specifying how chokepoint disruption, route reallocation, exposure amplification, resilience capacity and distributional effects interact within the Chokepoint-to-Resilience Transmission Framework.

Table 2. Chokepoint-to-Resilience Transmission Framework propositions

Proposition	**Mechanism**	**Expected empirical implication**
P1	Chokepoint disruption induces route reallocation and transit-time pressure.	Higher disruption intensity should be associated with longer transit times, vessel diversion and schedule unreliability.
P2	Exposure amplification depends on route dependence, sectoral sensitivity and corridor dependence.	Countries and sectors with high Suez-route dependence, imported critical inputs or time-sensitive exports should show greater vulnerability.
P3	Resilience capacity moderates exposure.	Trade facilitation, port connectivity, logistics infrastructure and regional diversification should reduce the severity of observed vulnerability.
P4	Distributional effects are unequal.	Actors with stronger bargaining power, capital buffers and route alternatives should adapt more easily than small firms, land-linked economies and time-sensitive exporters.

Note. The propositions summarise the framework's mechanism-based logic and identify relationships that can be examined in subsequent empirical research.

1.6 Expected contributions

The theoretical contribution is a named Chokepoint-to-Resilience Transmission Framework that integrates supply-chain resilience, time-as-trade-barrier economics, maritime connectivity, global value chain governance, trade facilitation and geoeconomics into one Africa-focused account. The framework extends resilience theory beyond firm-level redundancy by examining how disruption travels through routes, ports, border systems, sectoral dependencies and regional corridors before becoming firm-level vulnerability or adaptation.

The methodological contribution lies in the article's transparent evidential boundaries. It combines peer-reviewed scholarship with authoritative institutional sources, reports verified descriptive indicators and documentary mechanisms, and reserves causal estimation for research designs with harmonised machine-readable data.

The practical contribution is a structured way for exporters, importers, freight forwarders, port users and trade-support institutions to translate geopolitical risk into operational decisions about route choice, supplier diversification, inventory buffers, insurance exposure, delivery commitments and customer communication. The policy contribution is to link trade resilience to port productivity, digital customs, corridor coordination, data systems, regional diversification and AfCFTA implementation.

1.7 Scope and delimitations

The study is delimited to maritime trade disruption associated with the Red Sea, Suez Canal, Bab el-Mandeb, Cape of Good Hope rerouting and Strait of Hormuz from November 2023 to 28 May 2026. It is not a military, diplomatic or theological analysis of the Middle East conflict. The unit of analysis is conceptual and comparative: countries, ports, corridors, sectors and trade-resilience mechanisms are examined through secondary evidence rather than through primary interviews or surveys. The article refers to selected African cases where traceable evidence exists, and avoids treating Africa as a uniform unit.

1.8 Operational definitions

Table 3. Operational definitions of key terms

Term	Operational meaning in this article
Maritime chokepoint	A narrow or strategically concentrated sea passage through which significant volumes of international trade move and where disruption can create wider cost, time and supply effects.
Trade resilience	The capacity of a trade system, port, corridor, sector, firm or economy to absorb, adapt to, recover from or transform after disruption while maintaining acceptable trade performance.
Disruption intensity	The observable severity of a shipping disturbance, captured through route diversion, reduced transits, added sailing time, freight pressure, port-call shifts, insurance risk or schedule unreliability.
Exposure amplification	The process through which route dependence, import dependence, time-sensitive exports, energy/fertilizer vulnerability, port congestion or corridor dependence magnify the effect of a maritime shock.
Resilience capacity	The moderating capability created by trade facilitation, port connectivity, logistics infrastructure, regional diversification, managerial flexibility and reliable trade data systems.

Note. Definitions are authors' operational definitions for this framework article, informed by supply-chain resilience, trade-cost, maritime connectivity and trade facilitation literatures.

2. Literature Review and Theoretical Framework

2.1 Search strategy and PRISMA overview

The review was conducted as a PRISMA 2020-guided systematised evidence map rather than a claim to exhaustive bibliometric coverage. This distinction is important. A systematic review normally seeks comprehensive coverage of a precisely bounded literature. A systematised evidence map uses transparent search, screening and synthesis procedures to organise the evidence base for a conceptual and policy-relevant article. This design matches the manuscript's contribution: it develops an integrated framework and synthesises traceable evidence rather than claiming to estimate causal effects.

Searches were recorded on 28 May 2026 in Google Scholar for the open scholarly search component, with DOI and bibliographic verification conducted through Crossref metadata, original publisher webpages and title-level publisher searches. Subscription-indexed database exporting from Scopus or Web of Science was not used for this systematised evidence map; this boundary is disclosed so that readers can replicate the search strategy within the same open-access search architecture. The scholarly searches used combinations of maritime chokepoints, Red Sea crisis, Suez Canal disruption, supply-chain resilience, geopolitical risk, trade costs, time delays, liner shipping connectivity, global value chains and African trade facilitation.

Institutional searches were conducted directly through the websites and search functions of UNCTAD, WTO, IMF PortWatch, UN Comtrade, the World Bank, the UN Global Survey on Digital and Sustainable Trade Facilitation and the Suez Canal Authority. Inclusion criteria required relevance to maritime disruption, chokepoints, geopolitical risk, supply-chain resilience, trade costs, port connectivity, trade facilitation or African trade vulnerability. Exclusion criteria removed duplicates, unsupported opinion pieces, military commentary without trade relevance, inaccessible records and sources with insufficient methodological transparency.

Table 4. PRISMA search strategy and record yield

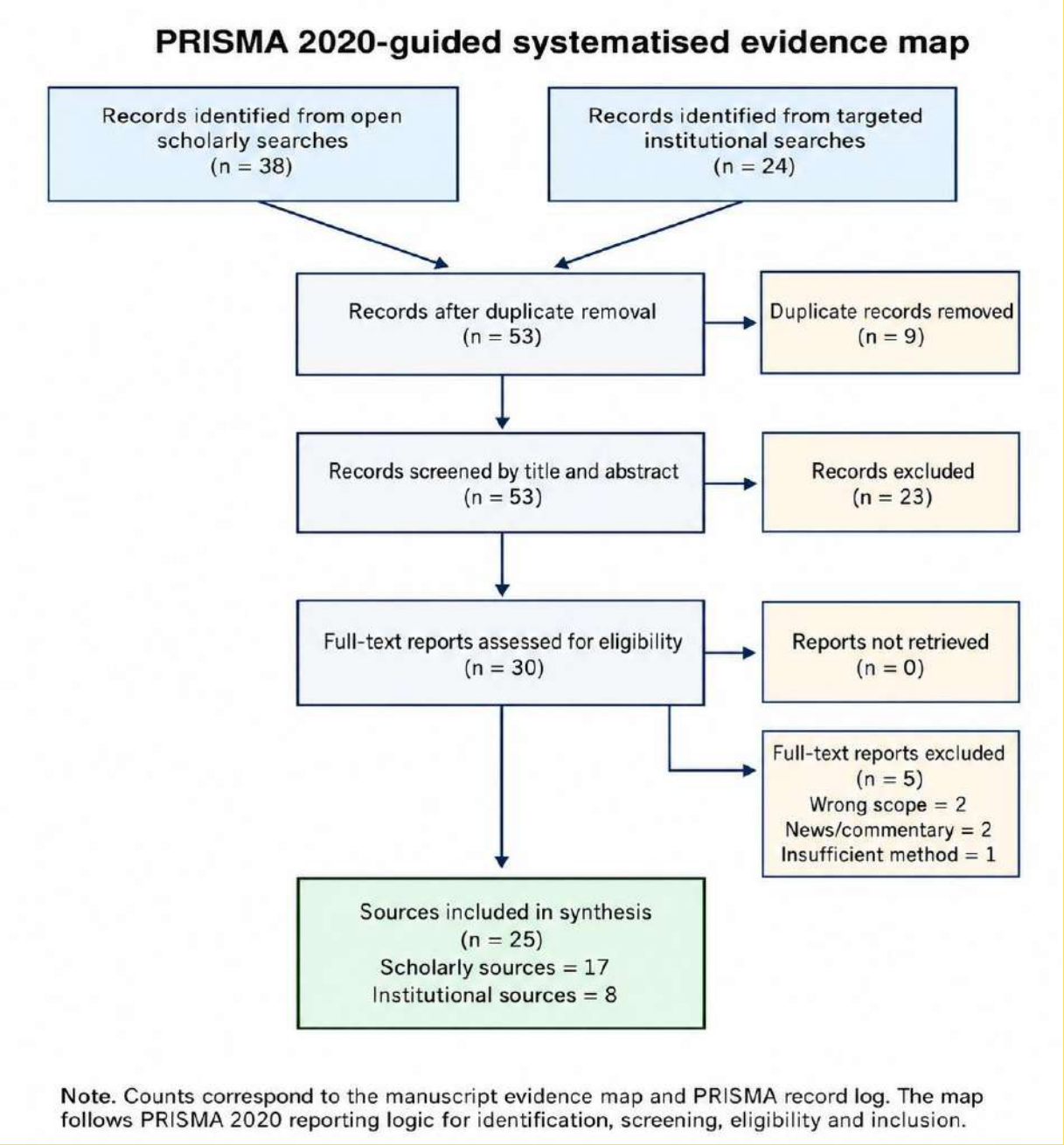
Search block	Search string or source family	Records identified	Records retained	Rationale
S1	"Red Sea crisis" AND shipping AND trade	6	3	Red Sea/Suez disruption and trade mechanism
S2	"Suez Canal" AND disruption AND Africa	5	3	Africa-specific routing exposure
S3	"maritime chokepoint" AND "supply chain resilience"	5	2	Chokepoint-resilience theory
S4	"geopolitical risk" AND maritime trade	5	2	Geoeconomic risk
S5	"trade facilitation" AND "supply chain resilience" AND Africa	4	2	Trade facilitation as resilience moderator
S6	"liner shipping connectivity" AND trade flows AND Africa	3	1	Connectivity and African trade
S7	"time as a trade barrier" AND trade costs	4	2	Trade-time theory
S8	"global value chains" AND resilience AND geopolitical risk	3	1	GVC asymmetry and resilience
S9	"Strait of Hormuz" AND shipping disruption AND trade	3	1	Energy and chokepoint disruption
Institutional searches	UNCTAD, WTO, IMF PortWatch, UN Comtrade, World Bank, UN trade facilitation sources, Suez Canal Authority	24	8	Official evidence and data-source triangulation

Note. Full-text records assessed and inclusion/exclusion decisions are listed in Appendix A. The search was designed for a systematised evidence map, not an exhaustive bibliometric review.

Search platform specification. Search blocks S1-S9 in Table 4 were executed in Google Scholar and then checked through Crossref and publisher webpages where DOI, title or publication-status verification was required. The institutional search block was executed through targeted searches of UNCTAD, WTO, IMF PortWatch, UN Comtrade, World Bank, the UN Global Survey on Digital and Sustainable Trade Facilitation and the Suez Canal Authority websites.

The evidence map identified 62 records. After 9 duplicates were removed, 53 records were screened by title and abstract. Twenty-three records were excluded at screening; 30 full-text records were assessed; five were excluded at full-text stage; and 25 sources were included in the synthesis. Figure 1 reports this flow in PRISMA 2020 format.

Figure 1. PRISMA 2020 flow diagram for the systematised evidence map



Note. Counts correspond to the evidence-map log in Appendix A. The figure follows the reporting logic of Page et al. (2021).

Table 5. Evidence appraisal criteria

Criterion	Operational question	Use in screening and synthesis
Authority	Is the source produced by a peer-reviewed outlet, recognised institution, official data provider or clearly identifiable expert body?	Prioritised peer-reviewed scholarship and official institutional evidence; downgraded unsupported commentary.
Accuracy	Are claims supported by data, methods, citations, or transparent reporting?	Retained sources with traceable figures, identifiable methodology, DOI, stable URL or official publication status.
Relevance	Does the source address maritime disruption, trade costs, resilience, connectivity, trade facilitation, GVCs or African exposure?	Excluded military or news commentary without a clear trade or logistics mechanism.
Currency	Is the source temporally appropriate for a dynamic disruption?	Used current institutional evidence for Red Sea/Suez/Hormuz context and foundational literature for theory.
Purpose	Does the source inform analysis rather than simply advocate or sensationalise?	Separated institutional policy claims from peer-reviewed theoretical claims and avoided unverified causal language.

Note. The appraisal criteria were used to assess both peer-reviewed and institutional sources. Institutional sources were retained only where authority, relevance and traceability were sufficient.

2.2 Maritime chokepoints and geopolitical trade risk

Maritime chokepoints matter because they compress global interdependence into narrow corridors. A disruption at a chokepoint can affect shipping schedules, inventory cycles, commodity prices, energy availability, marine insurance and port congestion far from the original security event. This characteristic gives maritime trade a geoeconomic dimension: the geography of circulation becomes a channel of power and vulnerability. Geopolitical risk scholarship explains that political violence and uncertainty can depress investment, raise risk premiums and disrupt cross-border exchange (Caldara & Iacoviello, 2022). In maritime trade, these effects become operational through route deviation, security surcharges, waiting time, fuel costs and uncertainty around arrival reliability.

The Red Sea and Suez cases are especially consequential because they connect Asia, Europe, the Mediterranean and Africa. Bab el-Mandeb is not just a regional security concern. It is part of a global containerized trade system whose efficiency depends on predictable passage. The Strait of Hormuz adds an energy dimension because it is central to global oil and liquefied natural gas flows. For African economies, the combined risk is therefore not only import delay. It includes fuel price exposure, fertilizer vulnerability, higher manufacturing input costs and increased uncertainty for export sectors that must meet contractual delivery windows.

2.3 Red Sea, Suez, Bab el-Mandeb, Cape of Good Hope and Hormuz disruption literature

Institutional evidence shows that the Red Sea disruption changed routing behaviour on major lanes. UNCTAD reported that shipping lines redirected vessels around the Cape of Good Hope, increasing distance and time, and that the Shanghai-Rotterdam route could gain around 12 sailing days (Bacrot & Faure, 2024). The same report describes the diversion as a supply shock equivalent to roughly a 30% increase in transit time and around a 9% reduction in effective global container shipping capacity. Maritime-economics scholarship similarly interprets the Red Sea crisis as a disruption to vessel operations, shipping networks and maritime supply chains rather than as a narrowly local security event (Notteboom et al., 2024).

WTO also recognises conflict-related disruption in Red Sea and Suez shipments as a factor affecting trade conditions (World Trade Organization, 2025).

The Cape of Good Hope rerouting creates a paradox for Africa. The same disruption that raises costs and delays for some trade flows can raise traffic and service demand for selected ports. UNCTAD's reported 328% increase in containership arrivals by gross tonnage around the Cape of Good Hope by early March 2024 illustrates this paradox (Bacrot & Faure, 2024). A sophisticated analysis must therefore avoid the simple narrative that Africa is only a passive victim of external shocks. Africa is exposed, but exposure is differentiated by geography, sector, port capacity and policy readiness.

2.4 African trade vulnerability and route dependence

African trade vulnerability is partly structural. Many economies depend on imported fuel, fertilizer, medicines, machinery, food and intermediate goods. Several export sectors are time-sensitive, including horticulture, fresh produce, tea, coffee, seafood and certain manufactured inputs linked to global value chains. Land-linked economies are exposed through corridor dependence, where a maritime delay can become an inland logistics delay through congested ports, customs backlogs, trucking availability, storage costs and exchange-rate pressure.

Route dependence is measurable but not homogeneous. UNCTAD's exposure estimates for Djibouti, Kenya, Tanzania and Sudan indicate that Suez-linked trade can represent a large share of foreign trade by volume (Bacrot & Faure, 2024). Sudan and Djibouti appear more exposed than Kenya and Tanzania in the cited estimates. Such heterogeneity justifies a purposive, theory-driven comparative logic rather than a continent-wide generalisation that ignores data availability and route-specific exposure.

2.5 Supply-chain resilience theory

Supply-chain resilience theory provides the manuscript's primary conceptual foundation. Christopher and Peck (2004) frame resilience as the ability of supply chains to recover from disturbance, emphasising visibility, velocity, flexibility, collaboration and risk awareness. Pettit et al. (2010) conceptualise resilience as the balance between vulnerabilities and capabilities, while Kamalahmadi and Parast (2016) show that the literature treats resilience as an enterprise and supply-chain capability built through preparedness, response, recovery, flexibility, redundancy, collaboration and learning.

Wieland and Durach (2021) deepen the discussion by distinguishing engineering and social-ecological perspectives on resilience. Ivanov and Dolgui (2020) extend resilience toward viability, arguing that intertwined supply networks require capacities that go beyond simple recovery to sustained functioning under severe disruption.

Applied to African trade, resilience is not simply whether goods eventually arrive. It concerns whether firms, ports, corridors and governments can maintain acceptable trade performance under stress. This includes alternative routing, inventory strategy, supplier diversification, port productivity, digital customs, reliable trade information, financial buffers and regional corridor coordination. The framework therefore treats resilience as four related capacities: absorption, adaptation, recovery and transformation.

2.6 Trade costs and time as a trade barrier

Trade economics has long recognised that costs are not limited to tariffs. Anderson and van Wincoop (2004) show that trade costs are central to international exchange, while Limão and Venables (2001), Francois and Manchin (2013), and Portugal-Perez and Wilson (2012) demonstrate the importance of infrastructure, institutions and trade facilitation for trade performance.

Djankov et al. (2010) show that time delays reduce trade, while Hummels and Schaur (2013) estimate that time costs behave like an ad valorem tariff equivalent. In the Red Sea and Suez context, delay is not merely administrative. It is geopolitical. A rerouted vessel creates extra distance, fuel use, crew time, schedule disruption, equipment imbalance and contractual uncertainty.

2.7 Maritime connectivity, ports and trade facilitation

Maritime connectivity shapes market access. Hoffmann et al. (2020) show that liner shipping bilateral connectivity affects bilateral trade flows, including evidence involving South Africa and Namibia. Port infrastructure and logistics performance similarly influence trade outcomes because ports are not passive nodes. They process, delay, price and sometimes absorb disruption. Notteboom and Rodrigue's (2005) port-regionalisation thesis is especially relevant because chokepoint disruption is transmitted not only through seaports but also through inland corridors, logistics zones and hinterland distribution systems. Notteboom, Pallis and Rodrigue (2021) further show that container shipping and ports respond to systemic disruption through network reconfiguration, capacity stress, operational adaptation and uneven resilience. When rerouting raises calls around the Cape, ports with stronger capacity may capture service opportunities, while congested ports may translate opportunity into bottleneck.

Trade facilitation provides the institutional side of resilience. Digital customs, risk management, agency coordination, pre-arrival processing, transparent rules and reliable border procedures reduce the amount of avoidable friction added to unavoidable external shocks. The manuscript therefore treats trade facilitation as a moderator: it cannot prevent Middle East conflict, but it can shape how deeply that conflict damages African trade performance.

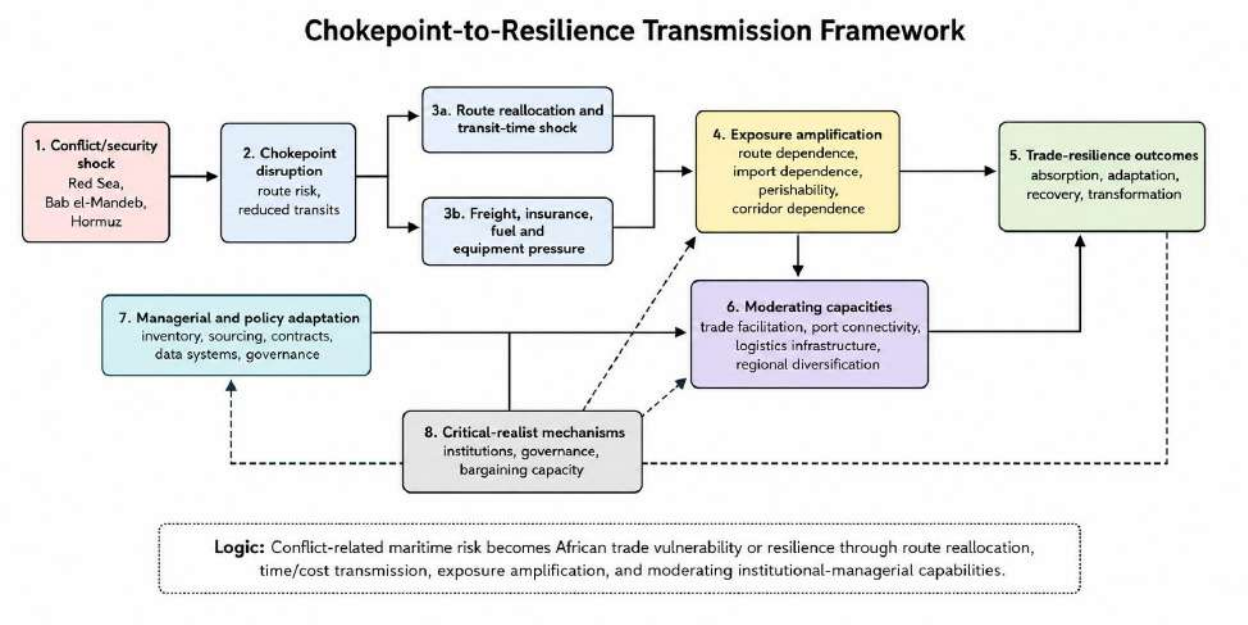
2.8 Global value chains and asymmetric vulnerability

Global value chain theory helps explain why trade shocks are unequal. Gereffi et al. (2005) show that production networks are governed through relationships that allocate power, value, information and risk unevenly. African firms in lower-margin or less powerful positions may have limited ability to pass freight increases to buyers or negotiate delivery flexibility. This matters because supply-chain resilience is not only technical. It is also political-economic. Firms with bargaining power can diversify routes, carry inventory, renegotiate contracts and absorb insurance premiums. Smaller firms may simply experience cost compression and lost reliability.

2.9 The Chokepoint-to-Resilience Transmission Framework

The Chokepoint-to-Resilience Transmission Framework links conflict-related maritime disruption to African trade-resilience outcomes through four mechanisms. First, chokepoint disruption changes route choice and transit time. Second, route changes produce freight-cost, insurance, fuel, equipment and scheduling pressure. Third, African exposure is amplified by route dependence, import dependence, export time-sensitivity, energy and fertilizer vulnerability, port congestion and corridor dependence. Fourth, resilience outcomes are moderated by trade facilitation, port connectivity, logistics infrastructure, regional diversification and managerial adaptation. Figure 2 visualises the model.

Figure 2. Chokepoint-to-Resilience Transmission Framework



Note. Authors' synthesis based on supply-chain resilience, trade-cost, maritime connectivity, trade facilitation, global value chain and geoeconomic risk literatures. The model separates shocks, pathways, mechanisms, moderators and outcomes.

2.10 Literature gap and theoretical contribution

The literature contains strong work on supply-chain resilience, time costs, maritime connectivity and global value chains, but it tends to treat these domains separately. The current disruption requires integration. A conflict in one region becomes an African trade problem through a chain of mechanisms: security risk becomes route change; route change becomes time and cost; time and cost interact with sectoral dependence; and exposure becomes resilience or vulnerability depending on institutional and managerial capacity. The theoretical contribution is therefore an integrated geoeconomic trade-resilience framework for analysing conflict-driven maritime disruption in Africa.

3. Methodology

3.1 Research philosophy and paradigm

The study adopts a pragmatic critical-realist orientation. Ontologically, the disruption has objective traces: vessel movements, port calls, freight-rate proxies, transit times, trade values and route changes exist independently of the researcher's interpretation. Epistemologically, however, these traces do not explain themselves. Their meaning is mediated by institutions, power relations, port governance, firm capacity, infrastructure, sectoral dependence and policy choice. A purely positivist design would risk reducing the phenomenon to traffic counts and coefficients. A purely interpretivist design would risk underplaying measurable logistics disruption. Pragmatic critical realism is therefore appropriate because it permits measurement while asking deeper causal questions about mechanisms and unequal capacities.

3.2 Research design

The study adopts a conceptual and evidence-informed framework design supported by a PRISMA-guided systematised evidence map and documentary policy synthesis. The analysis reports completed evidence mapping, source appraisal, documentary synthesis and descriptive extraction of verified institutional indicators. It does not estimate causal effects, regression models or panel relationships.

3.3 Data sources and evidence base

Data sources were selected on credibility, relevance, transparency and replicability. Priority sources included UNCTAD reports and statistics, IMF PortWatch, WTO trade outlooks and statistics, UN Comtrade, World Bank indicators, the UN Global Survey on Digital and Sustainable Trade Facilitation, the Suez Canal Authority and peer-reviewed literature on resilience, trade costs, ports, maritime connectivity, global value chains and geopolitical risk. Table 6 summarises the principal secondary-data sources and their methodological roles.

Table 6. Primary secondary-data sources and methodological role

Source	Owner	Variables or indicators	Use in article	Limitation
UNCTAD reports/statistics	UN Trade and Development	Rerouting, Suez exposure, global trade updates	Context and verified institutional indicators	Some values are report-based rather than downloadable panel data
IMF PortWatch	IMF and partners	Port calls, maritime trade flow estimates, chokepoints	Data-source architecture for future longitudinal analysis	Live extraction and harmonisation required for econometric testing
WTO trade outlook/statistics	World Trade Organization	Global trade conditions and Red Sea/Suez disruption context	Triangulation of trade context	Aggregate, not always Africa-port specific
UN Comtrade	United Nations	Country-commodity trade values	Trade-flow outcome source for future testing	Reporting lags and mirror-data issues
World Bank LPI 2.0	World Bank	Logistics speed, connectivity and reliability	Moderator of resilience capacity	May not align monthly with disruption timing
UN Global Survey on Digital and	UN Regional Commissio	Trade facilitation implementation measures	Institutional capacity moderator	Biennial survey periodicity

Sustainable Trade Facilitation	ns and UNCTAD			
Suez Canal Authority	Suez Canal Authority	Canal transits, tonnage and navigation statistics	Route-specific exposure context	Access frequency and variable definitions require verification

Note. The table distinguishes sources used as verified evidence in this article from data portals suitable for future econometric testing.

3.4 Case logic and exposure pathways

The population of interest is African economies, ports, corridors and sectors potentially affected by Red Sea, Suez, Bab el-Mandeb, Cape of Good Hope and Hormuz-related disruption. Cases are not treated as a random sample. They are selected conceptually because they represent distinct exposure pathways: direct route exposure, canal-revenue exposure, port-service opportunity, corridor dependence and energy or input vulnerability. Table 7 presents this purposive logic and makes the limits of each case explicit.

Table 7. Purposive case logic for secondary-data analysis

Case	Exposure pathway	Reason for inclusion	Key variables	Expected limitation
Egypt/Suez Canal	Direct chokepoint and canal-revenue exposure	Central route node linking Red Sea, Mediterranean and global trade	Canal transit, revenue, route diversion	Official data frequency may vary
Djibouti	High Suez-route exposure	UNCTAD reports 31% of foreign trade by volume through Suez	Suez dependence, port/corridor flows	Small economy and transshipment complexity
Kenya	East African route exposure and time-sensitive exports	UNCTAD reports 15% exposure; horticulture and tea relevance	Trade values, transit exposure, sector mix	Separating maritime shock from domestic factors
Tanzania	East African route exposure	UNCTAD reports 10% exposure; regional corridor relevance	Suez exposure, port/corridor data	Exposure may be less direct
Sudan	High Suez exposure and conflict vulnerability	UNCTAD reports 34% exposure	Route dependence, import vulnerability	Domestic conflict confounding
South Africa	Cape route opportunity and congestion risk	Cape rerouting increases vessel demand around South African ports	Port calls, congestion, bunkering demand	Port-specific data access and multiple congestion causes

Rwanda	Land-linked corridor dependence	Maritime shock transmitted via regional corridors	Import dependence, corridor time, trade facilitation	No direct seaport; indirect attribution

Note. Cases are selected by theoretical relevance and data availability rather than random sampling. The table does not claim continental representativeness.

3.5 Variable and construct operationalisation

The constructs are operationalised to clarify the theoretical model and the evidential scope of the synthesis. Table 8 distinguishes disruption intensity, exposure amplification, resilience capacity and trade-resilience outcomes by linking each construct to observable indicators, expected directionality and relevant data sources.

Table 8. Construct operationalisation for the Chokepoint-to-Resilience Transmission Framework

Construct	Operational indicators	Expected direction	Potential source	Analytical note
Disruption intensity	Reduced transits, route diversion, added days, port-call shifts, war-risk or insurance pressure	Higher values indicate stronger disruption	PortWatch, UNCTAD, Suez Canal Authority, shipping reports	Use multiple measures for robustness
Exposure amplification	Suez dependence, import dependence, time-sensitive exports, energy/fertilizer vulnerability, corridor dependence	Higher values indicate greater vulnerability	UNCTAD, UN Comtrade, WDI, port/corridor reports	Requires sector classification
Resilience capacity	Trade facilitation score, LSCI, LPI, port performance, corridor alternatives, data systems	Higher values expected to reduce vulnerability	UN Trade Facilitation Survey, UNCTADstat, World Bank, port authorities	May be lagged or infrequently updated
Trade-resilience outcomes	Continuity of trade flows, lower delay/cost sensitivity, recovery speed, adaptation, transformation	Negative outcomes expected during high disruption when resilience capacity is weak	Freight indexes, PortWatch, UN Comtrade, port data	Causal claims require controls

Note. The table identifies observable indicators that anchor the framework and clarify the evidential scope of the synthesis.

3.6 Evidence extraction and synthesis

Raw values from official reports were extracted without alteration and recorded in the evidence audit. For each figure used in the article, the source, reported value, interpretation and limitation were recorded. Documentary synthesis coded sources using mechanism-oriented categories drawn from the conceptual framework: route diversion, transit-time pressure, freight or insurance pressure, port congestion, energy or fertilizer exposure, trade facilitation, corridor resilience, regional diversification and managerial adaptation. This mechanism-based synthesis is appropriate for critical realist analysis because it seeks to explain how observable events become uneven outcomes through deeper structures and capabilities.

3.7 Reliability, validity, trustworthiness and robustness

Credibility is strengthened through source triangulation, transparent search and screening records, explicit inclusion and exclusion criteria, consistent operational definitions and cautious causal language. Construct validity is strengthened by distinguishing indicators from constructs. For example, a freight index is not the same as total logistics cost, and a port-call increase is not automatically evidence of improved port performance. Robustness is addressed conceptually by identifying alternative disruption measures, alternative exposure indicators and alternative explanations, including global demand shifts, energy price changes, domestic conflict, exchange-rate pressures, seasonal trade variation and port-specific governance failures.

3.8 Ethical considerations

The study uses secondary, non-human-subject data and therefore does not require informed consent from research participants. Ethical responsibility nevertheless remains. Researchers must represent data accurately, cite sources properly, avoid plagiarism, avoid invented statistics, disclose limitations and ensure that authorship reflects actual contribution and consent. The large co-authorship model requires transparent contribution statements, final approval by all listed authors and accountability for the integrity of the work.

4. Evidence Synthesis and Framework Findings

4.1 PRISMA evidence-map results

The evidence map identified 38 records through open scholarly searches and 24 records through targeted institutional searches, for a total of 62 records. After removing 9 duplicates, 53 records were screened by title and abstract. Twenty-three were excluded at screening. Thirty full-text reports were assessed for eligibility, none were unavailable and five were excluded after full-text assessment. The final synthesis included 25 sources, consisting of 17 scholarly studies and 8 institutional sources. Appendix A provides the record status summary and full-text decision log.

4.2 Maritime disruption pattern and verified institutional indicators

Verified institutional evidence indicates a disruption pattern characterised by route deviation, longer transit time, reduced effective container capacity, port pressure around the Cape route and uncertainty around energy-linked chokepoints. Table 9 reports the main verified indicators used in the evidence synthesis. These indicators are sufficient to establish measurable exposure pathways and plausible resilience pressures, but they are not treated as causal estimates of trade-flow loss.

Table 9. Reviewed secondary-data evidence extracted from official reports

Reviewed secondary-data point	Reported value	Source	Interpretive relevance
Suez Canal share of global seaborne trade by volume	10%	Bacrot & Faure (2024)	Shows systemic relevance of Suez route
Suez Canal share of containerized trade flows	22%	Bacrot & Faure (2024)	Shows high container-shipping relevance
Shanghai-Rotterdam rerouting via the Cape	About 12 additional sailing days	Bacrot & Faure (2024)	Converts maritime insecurity into time-as-trade-barrier effects
Diversion around Africa	About 30% transit-time increase and 9% effective capacity reduction	Bacrot & Faure (2024)	Explains schedule and capacity pressure beyond direct attack zones
Cape of Good Hope containership arrivals by gross tonnage	328% increase by early March 2024 relative to early December 2023	Bacrot & Faure (2024)	Shows alternative-route pressure and port-service opportunity
Global trade in 2025	About US$35 trillion, up about US$2.5 trillion from 2024	UN Trade and Development (2026)	Macro baseline for 2026 slowdown risk
Middle East/Hormuz disruptions	Identified as the current primary global trade headwind	UN Trade and Development (2026)	Connects chokepoint disruption to macro trade outlook
Red Sea/Suez shipments	Disrupted by regional conflict	World Trade Organization (2025)	Triangulates institutional recognition of disruption

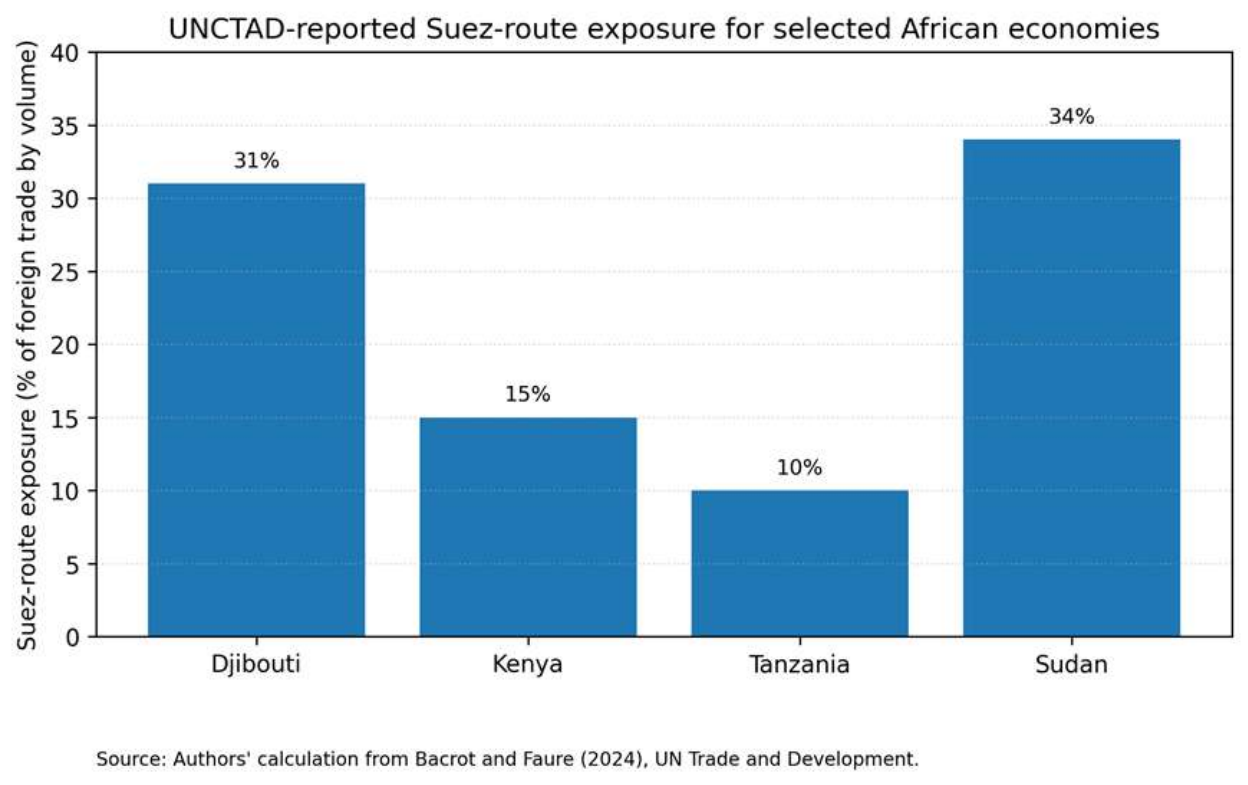
Note. Values are taken from cited official sources and listed as reported institutional indicators. They are not inferred from proprietary data.

4.3 African exposure heterogeneity

Exposure is uneven across African economies. UNCTAD's Suez-route exposure estimates for Djibouti, Kenya, Tanzania and Sudan range from 10% to 34% of foreign trade by volume (Bacrot & Faure, 2024). Figure 3 visualises the four country estimates. Table 10 reports descriptive statistics calculated from these values.

The mean is 22.50%, the median is 23.00%, the sample standard deviation is 11.79 percentage points, the range is 24 percentage points and the coefficient of variation is 52.4%. These descriptive statistics demonstrate heterogeneity. They do not establish causal impact, but they justify comparing highly exposed economies with moderately exposed economies and Cape-route ports.

Figure 3. UNCTAD-reported Suez-route exposure for selected African economies



Note. Authors' chart calculated from the UNCTAD estimates reported by Bacrot and Faure (2024). Values represent the share of each country's foreign trade by volume channelled through the Suez Canal.

Table 10. Descriptive statistics from UNCTAD Suez-route exposure estimates

Statistic	**Value**
N	4 countries
Mean Suez-route exposure	22.50%
Median Suez-route exposure	23.00%
Sample standard deviation	11.79 percentage points
Minimum	10%
Maximum	34%
Range	24 percentage points
Coefficient of variation	52.4%

Note. Authors' calculations from four country-level UNCTAD estimates: Djibouti 31%, Kenya 15%, Tanzania 10% and Sudan 34% (Bacrot & Faure, 2024).

4.4 Documentary policy synthesis

Documentary evidence points to five recurrent resilience priorities. Table 11 summarises these priorities and their managerial or policy implications. The synthesis is not a substitute for econometric estimation. It explains how authoritative institutions frame the mechanisms through which maritime disruption becomes trade vulnerability, port opportunity or resilience pressure.

Table 11. Documentary policy synthesis

Theme	Finding	Managerial or policy implication
Route diversification	Rerouting via the Cape reduces immediate security exposure but raises time, fuel, schedule and congestion costs.	Firms should compare route risk, delivery commitments, insurance terms and inventory buffers rather than simply choosing the shortest route.
Port readiness	Cape-route pressure can create short-term port-service demand but also congestion and reputational risk.	Port authorities should strengthen berth planning, bunkering coordination, digital port-call systems and hinterland links.
Trade facilitation	Volatile schedules increase the value of customs speed, digital documentation and border-agency coordination.	Governments should treat trade facilitation as resilience infrastructure, not only as administrative reform.
Energy and fertilizer channels	Hormuz and regional conflict risks may affect trade indirectly through fuel, fertilizer and inflationary channels.	Policy analysis should integrate maritime risk with food security, agriculture and industrial input planning.
Regional diversification	Land-linked and corridor-dependent economies are exposed through ports they do not control.	AfCFTA and corridor institutions should strengthen alternative corridors, data sharing and regional contingency planning.

Note. The synthesis is based on documentary coding of official institutional evidence and the mechanisms developed in the literature review.

4.5 Findings by research question

Table 12 summarises the evidence-based answer to each research question. The article distinguishes established descriptive evidence from framework propositions requiring future statistical testing. This distinction preserves the article's evidential boundary by separating verified descriptive evidence from framework propositions that require subsequent inferential testing.

Table 12. Summary of findings by research question

Research question	Evidence-based answer
RQ1	The reviewed evidence shows route diversion from Red Sea-Suez lanes toward the Cape of Good Hope, longer voyages, effective capacity pressure and wider energy/trade-cost risks connected to Middle East and Hormuz uncertainty.
RQ2	African exposure is uneven. Djibouti, Kenya, Tanzania and Sudan show different levels of Suez-route exposure, while South Africa faces alternative-route port-service opportunities and congestion risks. Land-linked economies may be indirectly exposed through regional corridors.
RQ3	The Chokepoint-to-Resilience Transmission Framework integrates disruption intensity, exposure amplification and moderating resilience capacities into a testable model. It specifies mechanisms that future studies can examine using PortWatch, freight-rate, port-authority, UN Comtrade and trade facilitation datasets.

Note. The table separates verified descriptive evidence from mechanisms that require future inferential testing.

5. Discussion

5.1 Interpretation of findings

The central interpretation is that Middle East conflict-related maritime disruption should be understood as a trade-resilience problem rather than as a distant geopolitical event. The transmission pathway is not mysterious: insecurity changes routes; route changes alter time, cost, reliability and insurance; these pressures interact with African exposure; and the final consequences depend on institutional and managerial capacity. This interpretation moves the debate beyond dramatic headlines toward measurable mechanisms.

5.2 Theoretical implications

The study extends supply-chain resilience theory by shifting the unit of analysis from the firm to the route-port-corridor-policy system. It extends time-as-trade-barrier theory by showing that delay can be geopolitically produced, not merely administratively produced. It extends global value chain analysis by emphasising that vulnerability depends on governance position and bargaining capacity. It extends trade facilitation theory by treating customs and corridor reforms as resilience capabilities rather than only efficiency reforms. The Chokepoint-to-Resilience Transmission Framework gives these extensions a common mechanism-based structure.

5.3 Comparison with prior literature

The findings are consistent with Christopher and Peck's (2004) emphasis on visibility and flexibility, Pettit et al.'s (2010) vulnerability-capability balance, and Wieland and Durach's (2021) argument that resilience can be viewed through multiple lenses. They also align with Djankov et al. (2010) and Hummels and Schaur (2013) by treating time as a real trade cost. The African contribution lies in integrating these literatures through the concrete geography of Red Sea, Suez, Bab el-Mandeb, Cape and Hormuz-linked disruption.

5.4 African trade-resilience mechanisms

African resilience mechanisms operate at several levels. Firms can diversify suppliers, revise contracts, improve demand forecasting, build targeted inventory buffers and strengthen freight-forwarding intelligence. Ports can improve berth productivity, yard management, digital documentation and congestion monitoring. Governments can support trade facilitation, alternative corridors, corridor observatories and transparent trade data systems. Regional institutions can strengthen interoperability, corridor governance and real-time information sharing. These mechanisms matter because resilience is not located in one actor. It is distributed across the trade system.

5.5 Managerial implications

Managers should treat geopolitical risk as an operational planning variable rather than an external news item. Exporters should map route dependence, assess customer delivery terms, renegotiate force majeure and insurance clauses, and consider inventory buffers where financially feasible. Importers should classify inputs by criticality, lead-time sensitivity and supplier substitutability. Freight forwarders should develop scenario-based route advice. Firms handling perishable exports should quantify the economic value of each additional day in transit and compare it with the cost of alternative routing or modal options.

5.6 Policy implications

Policy responses should not wait for crisis moments. Trade facilitation, port productivity, digital customs, risk-based inspection, corridor governance and data transparency are resilience investments. African governments and regional institutions should build route-risk dashboards, strengthen port-community systems, coordinate alternative corridors and integrate maritime disruption into food security, energy security and industrial policy planning. Such measures do not eliminate external shocks, but they reduce how deeply those shocks damage trade performance.

5.7 Implications for AfCFTA and regional corridor planning

The AfCFTA can contribute to resilience if it is implemented as more than tariff liberalisation. Intra-African trade requires functioning corridors, harmonised documentation, efficient borders, reliable port-hinterland links and trusted data systems. Maritime disruption shows why regional diversification matters. When external sea routes are stressed, regional sourcing and cross-border corridor efficiency can reduce vulnerability, but only if firms can rely on predictable procedures and infrastructure.

5.8 Critical reflection on inequality, dependency and geoeconomic power

A critical reading of the evidence shows that disruption is not socially neutral. Actors with capital, alternative suppliers, inventory capacity, insurance access and bargaining power can adapt more easily. Smaller firms, land-linked economies and time-sensitive exporters bear disproportionate burdens. A shipping line may recover costs through surcharges, while a small exporter may lose a delivery window. A port may gain calls but suffer congestion. A land-linked importer may face higher input prices without any direct role in the maritime event. This is why resilience cannot be reduced to managerial flexibility. It is also a question of development, infrastructure, institutional capacity and the unequal position of African economies within global trade systems.

5.9 Alternative explanations and evidential boundaries

The framework must be read alongside alternative explanations. Trade-flow changes during 2023-2026 may also reflect global demand shifts, commodity-price movements, exchange-rate pressures, domestic conflict, seasonal agricultural cycles, policy changes, port-specific governance failures and inventory decisions made before the disruption. The article therefore uses cautious language: it identifies exposure pathways, descriptive indicators and plausible mechanisms rather than claiming that maritime disruption alone caused observed trade outcomes. This evidential discipline strengthens, rather than weakens, the manuscript because it makes the model testable.

6. Conclusion

6.1 Summary

This article examined Middle East conflict-related maritime disruption as an African trade-resilience problem. Maritime chokepoints function as trade-risk transmission points when route concentration, conflict risk, trade-cost pressure, exposure amplification and unequal adaptive capacity combine. Verified evidence shows that Red Sea/Suez disruption lengthened voyages, reduced effective container capacity, shifted vessels toward the Cape of Good Hope and created heterogeneous African exposure through route dependence, port congestion, import costs and time-sensitive export vulnerability.

6.2 Contributions

The study contributes the Chokepoint-to-Resilience Transmission Framework, which integrates supply-chain resilience, trade-cost theory, maritime connectivity, trade facilitation, global value chain governance and geoeconomic analysis. It also contributes methodologically by demonstrating a transparent secondary-data framework article that uses traceable evidence, PRISMA records, data audit logic and cautious reporting. Its practical contribution is to translate maritime geopolitics into route-risk monitoring, port readiness, trade facilitation, corridor coordination and firm-level adaptation.

6.3 Recommendations

- African firms should develop route-risk dashboards and quantify the cost of delay by product category and customer contract.
- Port authorities should publish timely congestion, berth, dwell-time and bunkering indicators to support market decision-making.
- Trade ministries should integrate maritime disruption risk into trade facilitation, food security, industrial policy and AfCFTA implementation plans.
- Regional economic communities should strengthen corridor redundancy, cross-border

digital documentation and border-agency coordination.

- Researchers should replicate the evidence map in subscription databases where available and execute future statistical testing with updated machine-readable data.

6.4 Limitations

The manuscript is limited by data latency, uneven port-level reporting, difficulty attributing trade-flow changes exclusively to maritime disruption and limited public access to some proprietary freight-rate and insurance-risk indicators. These limitations define the evidential boundary. The article therefore distinguishes verified descriptive evidence from propositions requiring future inferential testing.

6.5 Future research

Future research should extract weekly or monthly PortWatch indicators, port authority data, freight-rate indexes, UN Comtrade commodity flows, LPI 2.0 indicators and trade facilitation scores to estimate pre-post changes, correlations and fixed-effects panel models. Qualitative extensions could examine firm-level adaptation through interviews, but such primary data would require ethics approval and a different design. Comparative studies could also examine whether African ports receiving diverted Cape traffic experience durable gains in connectivity or only temporary pressure without strategic upgrading.

Declarations

Author contributions. Sixbert Sangwa conceptualised the study, designed the methodological framework, supervised the collaborative evidence-mapping process, coordinated manuscript development, wrote the original draft, integrated revisions and serves as the corresponding author. The co-authors contributed to topic refinement, search-string testing, source identification, evidence discussion, PRISMA record checking, data-audit review, formative critique and manuscript review within the supervised course-based research process. Authorship is limited to contributors who made identifiable intellectual or documentary contributions, reviewed the final manuscript, approved its submission and accepted accountability for the integrity of the work.

Conflict of interest. The authors declare that they have no known financial or non-financial conflicts of interest in relation to this manuscript.

Funding. This research received no external funding.

Data availability. This study uses publicly available secondary sources. The accompanying workbook contains the PRISMA records, search log, data audit, variable operationalisation, and extracted evidence values. Additional machine-readable datasets generated through subsequent extraction and cleaning are available through the associated OSF project: https://doi.org/10.17605/OSF.IO/VXTRM, under a Creative Commons Attribution 4.0 International licence, subject to the licensing conditions of the original data sources.

Ethics statement. This study relied exclusively on secondary, non-human-subject data and did not involve direct interaction with research participants. Formal ethics approval and informed consent were therefore not required. The authors nevertheless observed ethical obligations concerning accurate data representation, proper citation, avoidance of fabricated statistics, respect for dataset licences, and transparent authorship attribution.

AI use statement. The authors used ChatGPT (GPT-5.5 Thinking, July 2026 web interface) only during the revision stage for language polishing, formatting consistency, readability checks and Word-document tracked-change preparation. The tool was not used to screen records independently, extract data, fabricate statistics, generate unsupported citations, conduct statistical analysis or replace authorial interpretation. All AI-assisted wording and formatting suggestions were reviewed, revised and verified by Sixbert Sangwa and the co-authors, who remain fully responsible for the accuracy, analysis, interpretation, citations and integrity of the manuscript.

Acknowledgements. The authors acknowledge the course-based discussions and formative review process that contributed to the development of this manuscript.

References

Anderson, J. E., & van Wincoop, E. (2004). Trade costs. Journal of Economic Literature, 42(3), 691-751. https://doi.org/10.1257/0022051042177649

Bacrot, C., & Faure, M.-A. (2024, April 17). Red Sea crisis and implications for trade facilitation in Africa. UN Trade and Development. https://unctad.org/news/red-sea-crisis-and-implications-trade-facilitation-africa

Caldara, D., & Iacoviello, M. (2022). Measuring geopolitical risk. American Economic Review, 112(4), 1194-1225. https://doi.org/10.1257/aer.20191823

Christopher, M., & Peck, H. (2004). Building the resilient supply chain. International Journal of Logistics Management, 15(2), 1-14. https://doi.org/10.1108/09574090410700275

Djankov, S., Freund, C., & Pham, C. S. (2010). Trading on time. The Review of Economics and Statistics, 92(1), 166-173. https://doi.org/10.1162/rest.2009.11498

Murungu, E., Ndahimana, S., Ruhamya, P., Ssempa, M., Ekosse, E., & Sangwa, S. (2025). *Reorienting global value chains under AfCFTA: The role of SEZs and emerging technologies in boosting value-added trade and firm upgrading*. *Science and Education, 6*(8), 99–123. https://doi.org/10.2139/ssrn.5409564

Francois, J., & Manchin, M. (2013). Institutions, infrastructure, and trade. World Development, 46, 165-175. https://doi.org/10.1016/j.worlddev.2013.02.009

Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. Review of International Political Economy, 12(1), 78-104. https://doi.org/10.1080/09692290500049805

Hoffmann, J., Saeed, N., & Sødal, S. (2020). Liner shipping bilateral connectivity and its impact on South Africa's bilateral trade flows. Maritime Economics & Logistics, 22, 473-499. https://doi.org/10.1057/s41278-019-00124-8

Hummels, D. L., & Schaur, G. (2013). Time as a trade barrier. American Economic Review, 103(7), 2935-2959. https://doi.org/10.1257/aer.103.7.2935

International Monetary Fund and partners. (2026). PortWatch. Retrieved May 28, 2026, from https://portwatch.imf.org/

Ivanov, D., & Dolgui, A. (2020). Viability of intertwined supply networks: Extending the supply chain resilience angles towards survivability. International Journal of Production Research, 58(10), 2904-2915. https://doi.org/10.1080/00207543.2020.1750727

Kamalahmadi, M., & Parast, M. M. (2016). A review of the literature on the principles of enterprise and supply chain resilience. International Journal of Production Economics, 171, 116-133. https://doi.org/10.1016/j.ijpe.2015.10.023

Limão, N., & Venables, A. J. (2001). Infrastructure, geographical disadvantage, transport costs, and trade. The World Bank Economic Review, 15(3), 451-479. https://doi.org/10.1093/wber/15.3.451

Notteboom, T. E., Haralambides, H., & Cullinane, K. (2024). The Red Sea crisis: Ramifications for vessel operations, shipping networks, and maritime supply chains. Maritime Economics & Logistics, 26(1), 1-20. https://doi.org/10.1057/s41278-024-00287-z

Notteboom, T. E., & Rodrigue, J.-P. (2005). Port regionalization: Towards a new phase in port development. Maritime Policy & Management, 32(3), 297-313. https://doi.org/10.1080/03088830500139885

Notteboom, T., Pallis, T., & Rodrigue, J.-P. (2021). Disruptions and resilience in global container shipping and ports: The COVID-19 pandemic versus the 2008-2009 financial crisis. Maritime Economics & Logistics, 23, 179-210. https://doi.org/10.1057/s41278-020-00180-5

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372, Article n71. https://doi.org/10.1136/bmj.n71

Pettit, T. J., Fiksel, J., & Croxton, K. L. (2010). Ensuring supply chain resilience: Development of a conceptual framework. Journal of Business Logistics, 31(1), 1-21. https://doi.org/10.1002/j.2158-1592.2010.tb00125.x

Portugal-Perez, A., & Wilson, J. S. (2012). Export performance and trade facilitation reform: Hard and soft infrastructure. World Development, 40(7), 1295-1307. https://doi.org/10.1016/j.worlddev.2011.10.021

Suez Canal Authority. (2026). Navigation and Suez Canal information. Retrieved May 28, 2026, from https://www.suezcanal.gov.eg/

UN Regional Commissions & UN Trade and Development. (2025). UN Global Survey on Digital and Sustainable Trade Facilitation. Retrieved May 28, 2026, from https://www.untfsurvey.org/

UN Trade and Development. (2026). Global trade update: April 2026. https://unctad.org/system/files/official-document/ditcinf2026d4_en.pdf

United Nations Statistics Division. (2026). UN Comtrade. Retrieved May 28, 2026, from https://comtradeplus.un.org/

Wieland, A., & Durach, C. F. (2021). Two perspectives on supply chain resilience. Journal of Business Logistics, 42(3), 315-322. https://doi.org/10.1111/jbl.12271

World Bank. (2025). Logistics Performance Indicators 2.0. Retrieved May 28, 2026, from https://lpi.worldbank.org/

World Trade Organization. (2025). Global trade outlook and statistics 2025. https://www.wto.org/english/res_e/booksp_e/trade_outlook25_e.pdf

Appendix A. PRISMA record status summary and full-text decision log

Table A1. PRISMA record status summary

PRISMA stage	Count	Traceability location
Records identified from open scholarly searches	38	Search-strategy table and record log
Records identified from institutional searches	24	Search-strategy table and record log
Duplicate records removed	9	Duplicate status in evidence-map log
Records screened	53	Title/abstract screening log
Records excluded at title/abstract	23	Screening exclusion rows
Full texts assessed for eligibility	30	Table A2
Reports excluded after full-text assessment	5	Table A2, excluded rows
Studies/reports included in synthesis	25	Table A2, included rows

Note. The table provides transparent PRISMA counts used in Figure 1.

The full full-text eligibility decision log is supplied as Supplementary File 1 so that the main article remains readable while retaining full PRISMA traceability. The supplementary log lists all 30 full-text records assessed, including the 25 included sources and 5 full-text exclusions with reasons.

Journal of Financial and Management Sciences, 2 (3) 242 –262, (2026)

DOI: https://doi.org/10.70970/fxyq7d50

Behavioural Segmentation of Credit-Constrained Households Using Unsupervised Machine Learning

Jean Paul Manirafasha, Eric Nizeyimana, David Hagumyuwumva

Received: May 22, 2026

Revised: July 8, 2026
Accepted: August 13, 2026
Published online: September 10, 2026

Abstract

Credit-constrained households are frequently treated as a homogeneous group in financial analysis, despite substantial heterogeneity in their financial behavior. This simplification limits the effectiveness of financial inclusion policies by obscuring important behavioral differences across households. This study addresses this limitation by developing an interpretable unsupervised machine learning framework to uncover latent behavioral segments among credit-constrained households using FinScope microdata from the Rwanda National Institute of Statistics (NISR). A purposive filtering approach is applied to isolate credit-constrained households, followed by trimmed variance feature selection to retain the most informative financial variables while mitigating the influence of extreme outliers. The selected variables are standardized and analyzed using K-Means clustering. Model evaluation results indicate that a three-cluster solution provides the optimal segmentation structure, as supported by the Elbow Method and a Silhouette Score of approximately 0.68, reflecting satisfactory cluster separation and internal cohesion. The resulting clusters reveal distinct behavioral profiles, including low-income debt-burdened households, high-income high-leverage households, and moderate-income wealth-accumulating households. These findings demonstrate that credit constraint is not a uniform condition but a multidimensional phenomenon shaped by diverse financial structures, highlighting deviations from traditional assumptions of homogeneous household behavior. In conclusion, the study provides a scalable and interpretable analytical framework that enhances behavioral segmentation in household finance and supports more targeted, evidence-based financial inclusion policies and institutional decision-making.

Keywords: Financial Inclusion, Credit-Constrained Households, K-Means Clustering, Behavioral Segmentation, Unsupervised Learning

jeanpaulfasha@gmail.com, eric.nizeyimana@auca.ac.rw, david.hagumuwumva@auca.ac.rw
Department of Big Data Analytics, Adventist University of Central Africa (AUCA), Kigali, Rwanda

© The Author(s) 2026. Published by Journal of Financial and Management Sciences. This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at http://creativecommons.org/licences/by/4.0/legalcode

1. Introduction

Household financial behavior is inherently heterogeneous, yet credit-constrained households are frequently treated as a homogeneous group in financial analysis and policy design. This simplification obscures critical differences in income stability, asset ownership, and debt exposure, thereby limiting the effectiveness of financial inclusion strategies. As financial systems become increasingly data-rich, the ability to accurately segment households based on underlying financial behavior has become a strategic priority for regulators and financial institutions seeking to design targeted and evidence-based interventions [1, 2].

However, the growing complexity of household financial data characterized by high dimensionality, non-linear relationships, and extreme wealth outliers poses significant challenges for traditional segmentation and econometric approaches. These methods typically rely on predefined outcome variables and are highly sensitive to multicollinearity and distributional distortions, leading to information loss and reduced interpretability [3, 4]. As a result, existing approaches are often insufficient for capturing latent heterogeneity within credit-constrained populations, particularly in emerging economy contexts where financial structures are more complex and less formalized.

Despite these advances, limited research has applied unsupervised machine learning techniques specifically to identify behavioral heterogeneity within credit-constrained households. This represents a critical gap, as such methods are well-suited for uncovering latent structures in high-dimensional financial data without requiring predefined labels.

In response, this study aims to develop an interpretable unsupervised machine learning framework to identify latent behavioral segments among credit-constrained households using FinScope data from Rwanda. The study applies a robust feature selection approach alongside clustering techniques to group households based on financial similarity rather than predefined classifications.

This study contributes to the literature in three ways. First, it provides empirical evidence that credit-constrained households are behaviorally heterogeneous. Second, it introduces a trimmed variance feature selection approach to improve clustering robustness in the presence of extreme financial values. Third, it offers policy-relevant insights by linking behavioral segments to targeted financial inclusion strategies.

2. Literature Review

Understanding household financial behaviour and credit access requires integrating perspectives from economics, finance, and data science. Financial inclusion is a multidimensional construct that extends beyond access to formal financial services to include the effective use of credit, savings, and risk management instruments for consumption smoothing and wealth accumulation [1, 2]. Accordingly, financial exclusion is not merely a lack of access, but a manifestation of constrained financial behaviour.

Traditional approaches to analysing household financial behaviour have relied heavily on demographic segmentation, classifying individuals based on observable characteristics such as income, age, or geographic location [3]. While operationally convenient, these approaches implicitly assume behavioural homogeneity within demographic groups and fail to capture latent differences in financial decision-making, particularly under conditions of credit constraint.

From a theoretical perspective, the Life-Cycle Hypothesis (LCH) and Permanent Income Hypothesis (PIH) provide foundational models of household financial behaviour [10, 11]. Both frameworks assume that individuals can smooth consumption over time through access to credit markets. However, this assumption is frequently violated in practice. In the presence of binding credit constraints, households are unable to borrow against future income, leading to deviations from optimal consumption behaviour.

Empirical evidence shows that such constraints result in precautionary savings, reduced consumption, and increased reliance on informal financial mechanisms [7].

These deviations underscore a critical limitation of classical economic theory: the assumption of frictionless financial markets. In reality, credit-constrained households exhibit heterogeneous behavioural responses depending on income stability, asset ownership, and access to financial services. This heterogeneity cannot be adequately captured using traditional demographic or theory-driven models.

In response, financial segmentation has evolved toward behaviourally informed approaches that aim to group individuals based on financial actions rather than static characteristics [3]. This shift reflects a broader recognition that financial vulnerability is driven by complex, multidimensional interactions that are not directly observable through conventional variables.

Empirical research has increasingly leveraged large-scale financial datasets; however, most studies do not explicitly isolate credit-constrained households as a distinct analytical category. For instance, Williams [13] provides descriptive insights into household debt dynamics but does not examine behavioural segmentation within constrained populations. Similarly, supervised machine learning approaches, such as those developed by White [5], focus on predicting outcomes like default risk, rather than identifying latent behavioural structures among financially vulnerable but non-defaulting households.

Recent studies have explored unsupervised learning techniques for financial segmentation. Chen et al. [12] apply K-Means clustering to transaction data, while Nguyen [9] uses principal component analysis to examine wealth structures.

However, these studies primarily focus on consumption patterns or dimensionality reduction and do not explicitly address behavioural heterogeneity within credit-constrained populations. Zhao et al. [8] further highlight the existence of a "missing middle," comprising households that are neither fully excluded nor fully integrated into formal credit markets, reinforcing the need for more nuanced analytical frameworks.

In the African context, Hall [6] demonstrates that behavioural financial patterns exhibit cross-market similarities, suggesting the applicability of data-driven segmentation methods. Nevertheless, existing studies continue to treat credit-constrained households as a relatively homogeneous group, limiting the identification of nuanced behavioural differences.

Taken together, the literature reveals two key gaps. First, there is limited application of unsupervised learning methods to explicitly analyse behavioural heterogeneity within credit-constrained populations. Second, existing approaches do not adequately address the challenges posed by high-dimensional financial data with extreme value distributions.

To address these gaps, this study conceptualises credit constraint as a continuum of behavioural manifestations rather than a binary condition. Under this framework, unsupervised machine learning techniques are employed to uncover latent behavioural segments, providing a more granular and empirically grounded understanding of household financial exclusion.

3. Data and Methodology

3.1 Data

This study uses secondary household-level data from the FinScope 2024 survey conducted by the Rwanda National Institute of Statistics. The dataset provides nationally representative information on household socio-economic conditions, including income, assets, liabilities, expenditure patterns, and access to formal and informal financial services.

The original dataset consists of 13,994 households and approximately 25 variables. For the purpose of this study, the analytical focus is restricted to credit-constrained households, defined as those that satisfy at least one of the following conditions: (i) reported denial of credit, (ii) discouraged from applying due to anticipated rejection, or (iii) limited access to formal credit services.

Applying these criteria yields a working sample of 4,458 households, which constitutes the effective population for the analysis. The household is treated as the unit of analysis, reflecting its role as the primary financial decision-making entity.

A subset of variables capturing key dimensions of financial behavior is selected, including income, assets, debt, and selected socio-demographic indicators. Missing values are handled using imputed variables provided within the dataset to preserve consistency. Continuous variables are subsequently standardized to ensure comparability across different measurement scales.

The resulting dataset forms a structured and analysis-ready input for the unsupervised learning pipeline.

4. Methodology

This study adopts an exploratory quantitative research design grounded in unsupervised machine learning to identify latent behavioral segments among credit-constrained households. The choice of this design is motivated by the absence of predefined outcome variables and the need to uncover intrinsic patterns directly from high-dimensional financial data. Unlike supervised approaches, which rely on labeled outcomes, the objective here is to reveal underlying structures in household financial behavior without prior assumptions. The analysis is therefore situated within a data-driven paradigm commonly used in computational social science and data mining.

The empirical analysis is based on secondary data obtained from the FinScope 2024 survey conducted by the Rwanda National Institute of Statistics. The dataset provides nationally representative information on household socio-economic and financial conditions, including income, assets, debt, expenditure patterns, and access to formal and informal financial services. The original dataset consists of 13,994 households and approximately 25 variables. For the purpose of this study, the focus is restricted to credit-constrained households, defined as those that have experienced at least one of the following conditions: denial of credit, discouragement from applying due to perceived rejection, or limited access to formal financial services. Applying these criteria yields a working sample of 4,458 households, which forms the analytical population. The household is treated as the unit of analysis, reflecting its role as the primary economic decision-making entity.

The methodological approach is implemented as a structured and sequential data transformation pipeline in which each stage produces an output that directly informs the subsequent step, ensuring coherence, transparency, and reproducibility throughout the analysis. The process begins with data preparation, where the dataset is filtered to isolate the target population of credit-constrained households, thereby reducing the analytical space from 13,994 to 4,458 observations. Following this population filtering, relevant variables capturing key dimensions of household financial behavior—such as income, assets, debt, and selected socio-demographic indicators—are extracted. Missing values are handled using imputed variables provided within the dataset to preserve consistency and minimize information loss.

To ensure comparability across variables measured on different scales, all continuous variables are standardized using z-score normalization, allowing each feature to contribute proportionally to subsequent analysis. The transformation is defined as:

$$Z_{ij} = (X_{ij} - \mu_j) / \sigma_j$$

where X_{ij} represents the value of variable j for household i, μ_j is the mean of variable j, and σ_j is the corresponding standard deviation. This normalization step produces a scale-invariant dataset, which is essential for subsequent variance-based feature selection and distance-based clustering.

Following standardization, feature selection is conducted to reduce dimensionality and improve the signal-to-noise ratio in the data. Given the presence of extreme values typical of financial datasets, a trimmed variance approach is applied. This involves excluding observations from both tails of each variable distribution prior to computing variance, thereby ensuring that variability reflects typical household behavior rather than outliers. The variance of each feature is computed as:

$$s^2 = (1 / (n - 1)) \Sigma_{i=1}^{n} (x_i - \bar{x})^2$$

where x_i represents the trimmed observations and $\bar{x}$ is the trimmed mean. Features exhibiting higher trimmed variance are retained, as they capture greater heterogeneity in financial behavior, while low-variance variables are excluded. This process reduces the dataset from approximately 25 variables to a smaller set of informative features, ultimately yielding a core subset of variables that serve as the input for clustering.

The refined and standardized dataset is then used to perform clustering using the K-Means algorithm. The objective of K-Means is to partition the households into K groups such that within-cluster similarity is maximized and between-cluster similarity is minimized. This is operationalized by minimizing the within-cluster sum of squared distances between observations and their respective cluster centroids:

$$\min \sum_{k=1}^{K} \sum_{x_i \in C_k} \|x_i - \mu_k\|^2$$

where C_k denotes the set of observations in cluster k and μ_k represents the centroid of that cluster. The algorithm is initialized using the K-Means++ method to improve convergence and reduce sensitivity to initial centroid selection. Multiple random initializations are performed to ensure stability of the clustering solution. At this stage, households are grouped based on similarity in their financial profiles, generating preliminary cluster structures that reflect latent behavioral patterns.

To determine the optimal number of clusters, internal validation techniques are employed. Specifically, the elbow method is used to examine the rate of decrease in within-cluster variance as the number of clusters increases, while the Silhouette score is used to assess the degree of separation between clusters. These complementary metrics ensure that the selected clustering solution achieves a balance between compactness and separation, thereby enhancing both statistical validity and interpretability.

Once the optimal clustering structure is established, the results are further examined through visualization and interpretation. Dimensionality reduction techniques are used to project the high-dimensional data into a lower-dimensional space for visualization purposes, facilitating the identification of cluster separation patterns. The resulting clusters are then profiled based on their financial characteristics, allowing for economic interpretation of each segment. This step transforms the clustering output into meaningful insights that can inform financial inclusion strategies and policy design.

To ensure robustness, the entire analytical process is designed to be reproducible and internally consistent. Validity is supported through the use of theoretically grounded variables and established clustering evaluation metrics, while reliability is enhanced by the use of standardized data, consistent preprocessing procedures, and repeated model runs to confirm stability of results. Ethical considerations are addressed through the use of anonymized secondary data and adherence to principles of responsible data handling and non-discriminatory interpretation.

Overall, the methodology integrates data filtering, standardization, feature selection, clustering, validation, and interpretation into a coherent analytical framework in which each stage builds directly upon the previous one. This structured pipeline ensures that the analytical process remains logically connected, methodologically rigorous, and fully reproducible, thereby enabling the robust identification of latent behavioral segments among credit-constrained households.

5. Results

Following the data preparation and filtering procedures, the final analytical sample consists of 4,458 credit-constrained households described by a reduced set of high-informative financial variables. Initial exploratory analysis reveals substantial dispersion in key indicators such as income, assets, and debt, with pronounced right-skewness and the presence of extreme values. This confirms that household financial data are highly heterogeneous and justifies the application of robust feature selection techniques to avoid distortion from outliers.

To address this, a trimmed variance approach was applied to all candidate variables. The results show clear differentiation in variability across financial indicators. Asset-related variables exhibit the highest trimmed variance, with total assets (1.76×10^{12}), houses (7.33×10^{11}), and net worth (4.77×10^{11}) dominating the distribution, followed by debt (4.41×10^{11}) and income (6.99×10^{10}). In contrast, variables such as rent (5.85×10^{8}) and equity (1.57×10^{9}) display comparatively low variability, indicating limited discriminatory power for segmentation. Based on this criterion, five variables—income, debt, net worth, houses, and total assets—were retained as the core features for clustering, as they capture the most significant variation in household financial behavior.

5.1 Trimmed Variance Feature Selection

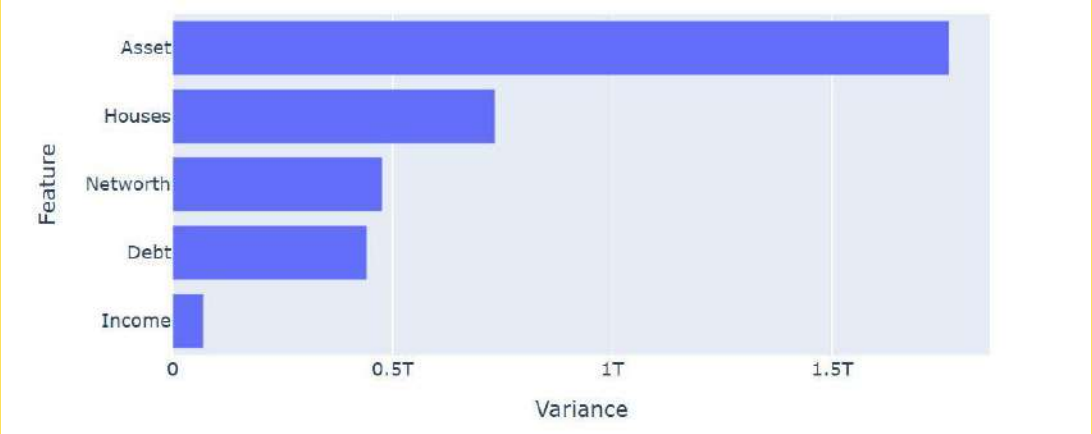


Figure 1*: Distribution of selected high-variance variables after trimming*

The optimal number of clusters was determined using both the elbow method and Silhouette analysis. The inertia curve shows a pronounced decline between K = 1 and K = 3, after which the marginal reduction becomes negligible, indicating an elbow point at K = 3. Complementary to this, the Silhouette score reaches approximately 0.85 at K = 2 and 0.68 at K = 3. While K = 2 provides slightly higher cohesion, K = 3 offers a more informative segmentation structure with acceptable separation and improved interpretability. Based on this trade-off, K = 3 was selected as the optimal clustering solution.

5.2 Determination of the Optimal Number of Clusters

K-Means Model: Inertia vs number of clusters



Figure 2*: Inertia as a function of the number of clusters (Elbow Method)*

Silhouette analysis was conducted to assess the quality of cluster separation. As shown in Figure 2, the Silhouette Score reaches a high value of approximately 0.85 at K = 2 and 0.68 at K = 3, indicating strong intra-cluster cohesion and clear inter-cluster separation.

5.3 K-Means Model: Silhouette Score vs Number of Clusters

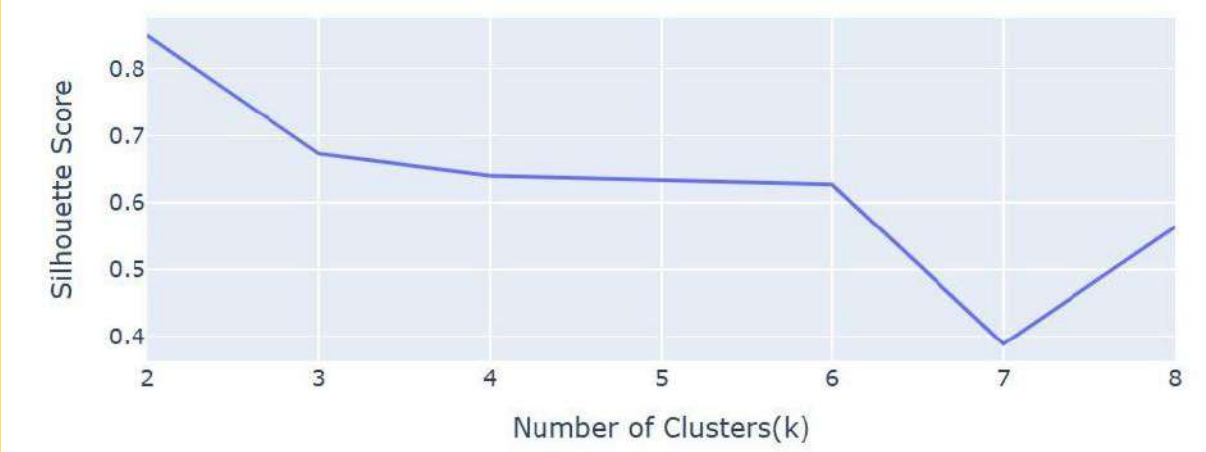


***Figure 3**: Silhouette Score across different numbers of clusters*

Based on both the Elbow Method and Silhouette analysis, K = 3 is selected as the optimal number of clusters. This choice balances model simplicity, interpretability, and clustering performance, ensuring that the resulting segments are both statistically meaningful and economically interpretable.

5.4 Cluster Naming and Financial Interpretation

The K-Means algorithm was then applied using the selected features and optimal cluster size. The resulting clustering structure demonstrates clear separation in the feature space, as confirmed by dimensionality reduction visualization. The clusters exhibit minimal overlap and well-defined boundaries, indicating that the algorithm successfully identified distinct behavioral groups within the dataset. Stability checks using multiple initializations confirm the robustness of the clustering solution.

5.5 Mean Household Finances by Cluster



***Figure 4**: Mean financial indicators across clusters*

Figure 4 illustrates clear differences in financial structure across clusters. Cluster 1 exhibits the highest levels of income, assets, and debt, indicating a high-capacity but highly leveraged financial profile. In contrast, Cluster 0 shows consistently low values across all financial indicators, reflecting severe financial constraints and limited capacity for financial accumulation. Cluster 2 occupies an intermediate position, indicating a transitional group experiencing gradual wealth accumulation and relatively balanced financial conditions.

5.6 PCA Representation of Clusters

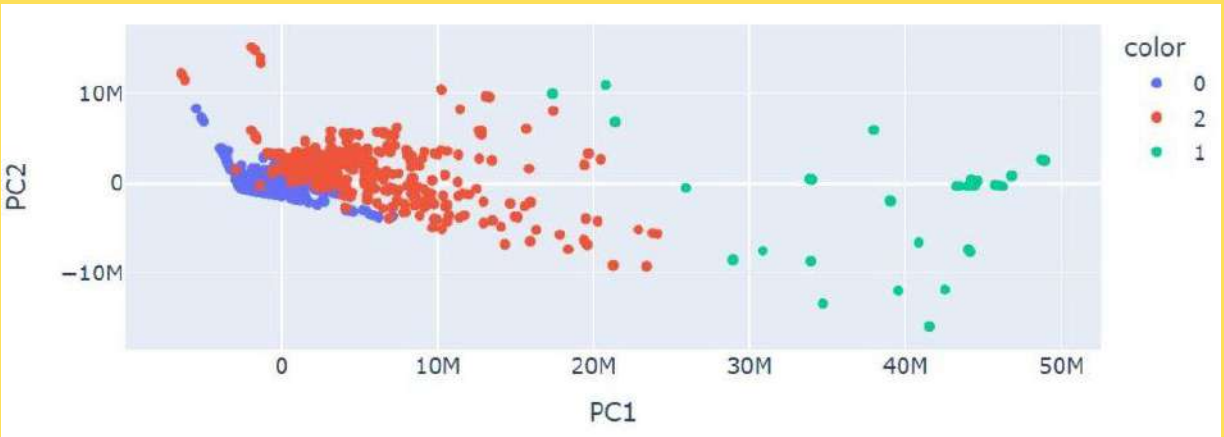


***Figure 5**: PCA projection of households showing cluster separation*

Figure 5 presents a three-dimensional PCA projection of the clustered data. The visual ization shows clear separation between the three clusters, with limited overlap, indicating that the clustering algorithm successfully identified distinct groups within the dataset.

Comparative analysis across clusters highlights substantial structural differences in financial behavior. The contrast between low-income constrained households and asset-rich but leveraged households demonstrates that credit constraint does not arise from a single underlying condition. Instead, it reflects multiple financial realities, including income insufficiency, leverage pressure, and transitional financial growth.

Overall, the empirical results demonstrate that credit-constrained households are not homogeneous but instead form distinct behavioral segments with fundamentally different financial structures. The combination of robust feature selection, statistically validated clustering, and clear financial differentiation provides strong empirical support for the segmentation framework and establishes a solid foundation for subsequent interpretation and policy analysis.

6 Discussion and conclusion

The empirical results provide clear and internally consistent evidence that credit-constrained households exhibit substantial heterogeneity in their financial structures and behavioral patterns. Using a final analytical sample of 4,458 households, the clustering model identifies three statistically distinct segments (K = 3), a choice supported by the Elbow Method and a Silhouette score of 0.68, indicating strong cluster cohesion and separation. These results demonstrate that the identified clusters are not only computational artifacts but reflect structurally meaningful differences in household financial behavior.

A closer examination of the cluster profiles reveals economically interpretable patterns. Cluster 0, representing the most financially constrained group, is characterized by low average income (Rwf 460,800), moderate debt (Rwf 330,800), and very low net worth (Rwf 222,700). This cluster exhibits minimal asset ownership and limited financial buffers, indicating severe liquidity constraints and high vulnerability to economic shocks. In this segment, credit constraint is primarily driven by insufficient financial capacity and restricted access to productive financial opportunities.

In contrast, Cluster 1 represents a high-capacity but highly leveraged segment. Households in this group report high average income (Rwf 2.89 million), substantial debt levels (Rwf 6.88 million), and high net worth (Rwf 21.86 million). Despite their strong asset base, the disproportionately high debt burden indicates elevated financial risk and potential exposure to repayment stress. This finding highlights a critical nuance: credit constraint does not necessarily imply low wealth but may instead reflect structural inefficiencies in credit allocation or risk management within financially active households.

Cluster 2 captures an intermediate and transitional group, with moderate income (Rwf 1.16 million), moderate debt (Rwf 2.79 million), and net worth of Rwf 3.27 million. This segment reflects households undergoing gradual wealth accumulation, balancing income generation with manageable levels of financial exposure. The presence of this cluster suggests that credit constraint evolves along a continuum, rather than existing as a fixed condition, with households potentially transitioning across financial states over time.

These empirical findings extend theoretical expectations from the Life-Cycle Hypothesis and the Permanent Income Hypothesis. While these models assume access to credit markets that facilitates consumption smoothing, the results demonstrate that credit constraints disrupt this mechanism, leading to observable deviations such as low-income households exhibiting constrained consumption, asset-rich households maintaining high leverage, and transitional households balancing competing financial pressures. This indicates that real-world financial behavior under constraint is shaped by both capacity limitations and structural market frictions.

Methodologically, the study demonstrates the effectiveness of combining trimmed variance feature selection with K-Means clustering in high-dimensional financial datasets. The feature selection process reduces the dataset from approximately 25 variables to 15 variables, and ultimately to 5 core financial indicators (income, debt, net worth, houses, assets), ensuring that clustering is driven by the most informative dimensions of financial behavior. This contributes to both the stability and interpretability of the model, as evidenced by the clear statistical separation between clusters.

From a policy and institutional perspective, the results provide strong justification for moving beyond uniform financial inclusion strategies. The quantitative differences across clusters indicate that a one-size-fits-all approach is inefficient. Instead, Cluster 0 requires income support and financial protection mechanisms, Cluster 1 requires debt regulation and risk management interventions, and Cluster 2 benefits from asset-building and financial growth programs. This segmentation-based framework allows for more precise targeting of interventions and more efficient allocation of financial resources.

In conclusion, the study establishes that credit-constrained households are structurally heterogeneous, with three distinct financial profiles supported by strong statistical evidence. By integrating robust feature selection, clustering, and validation within a coherent analytical pipeline, the research provides both a methodological contribution and actionable empirical insights. The findings underscore the importance of data-driven, segment-specific approaches in financial inclusion policy and demonstrate the value of unsupervised machine learning in uncovering latent behavioral structures within complex socio-economic data.

References

[1] Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality and the poor. Journal of Economic Growth, 12(1), 27–49.

[2] Allen, F., Demirgüç-Kunt, A., Klapper, L., & Peria, M. S. M. (2016). Financial inclusion: Global evidence. World Bank Economic Review, 30(1), 2–30.

[3] Kumar, A. (2021). Clustering algorithms in banking: A review. International Journal of Bank Marketing, 39(2), 230–255.

[4] Deaton, A. (1991). Saving and liquidity constraints. Econometrica, 59(5), 1221–1248.

[5] White, B. (2019). Demographic shifts and household debt: Evidence from the SCF. Journal of Applied Econometrics, 34(6), 900–920.

[6] Hall, A. (2025). AI-driven policymaking in Africa. African Development Review, 37(1), 10–25.

[7] Thompson, S. (2020). Behavioral manifestations of credit constraints. Journal of Consumer Research, 47(5), 789–805.

[8] Zhao, X., et al. (2021). Exploring the "missing middle" in credit markets. Journal of Financial Services Research, 60(2), 195–220.

[9] Nguyen, T. (2023). Dimensionality reduction in household wealth surveys. Computational Economics, 41(4), 567–589.

[10] Modigliani, F., & Brumberg, R. (1954). Utility analysis and the consumption function. In Post-Keynesian Economics, 3(2), 388–436.

[11] Friedman, M. (1957). A Theory of the Consumption Function. Princeton University Press.

[12] Chen, L., et al. (2022). Unsupervised learning for credit risk: A K-Means approach. FinTech Review, 8(3), 101–115.

[13] Williams, R. (2019). The 2019 Survey of Consumer Finances: A methodological overview. Federal Reserve Bulletin, 105(3), 1–35.

Journal of Financial and Management Sciences, 2 (3) 263 –294, (2026)

DOI: https://doi.org/10.70970/k8teb088

Bridging the Regional Disparities in Startup Development under the Innovative Startup Act: A Descriptive Phenomenological Study.

Jonaline L. Granada

Received: August 1, 2026

Revised: August 8, 2026
Accepted: August 13, 2026
Published online: September 10, 2026

Abstract

This phenomenological study examined how startup founders and institutional actors across selected Philippine regions experienced and made meaning of their access to support under the Innovative Startup Act (Republic Act No. 11337). The study addressed policy, research, and management gaps concerning the concentration of program benefits in the National Capital Region (NCR). Anchored in interpretivism and framed by Krugman's spatial inequality theory, the resource-based view, the entrepreneurial ecosystem model, and institutional theory, the study used a descriptive phenomenological design and the Modified Van Kaam method (Moustakas, 1994). The researcher conducted individual and key-informant interviews with twenty-four participants: twelve founders who received Startup Grant Fund (SGF) or Startup Venture Fund (SVF) financing, and twelve program officers, incubator managers, and policy actors, sampled for maximum regional and ecosystem variation. Twenty themes emerged. Regional inequity was found to arise less from discriminatory program design than from the self-reinforcing concentration of ecosystem density, institutional capacity, and information flow in Metro Manila. Founders experienced formal inclusion alongside experiential distance: decisive barriers were compound and pre-application; the most durable program value — capability, networks, and legitimacy — was invisible to short-term evaluation metrics; and compliance costs fell hardest on the smallest ventures. Participants located genuine equity in sustained institutional presence rather than mere national availability of a program. Correcting regional disparity requires transforming implementation rather than revising the enabling law. The study recommends financial-management interventions addressing allocation, entry cost, appraisal horizon, disbursement design, and post-grant sustainability. Aligned with Sustainable Development Goals 8, 9, and 10, this study contributes an original founder-level, first-person account of regional access to Philippine startup policy, supporting the design of more inclusive innovation ecosystems.

Keywords: Innovative Startup Act; Startup Grant Fund; Startup Venture Fund; startup ecosystem; regional inequality; innovation policy; sustainable development goals; startup development

jonalinelgranada@iskolarngbayan.pup.edu.ph

Graduate School, Polytechnic University of the Philippines, Manila, Philippines© The Author(s) 2026. Published by Journal of Financial and Management Sciences. This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at http://creativecommons.org/licences/by/4.0/legalcode

1. Introduction

Startups are central to innovation, job creation, and economic growth. In the Philippines, Republic Act No. 11337, the Innovative Startup Act (ISA), was enacted to expand access to funding, mentorship, and regulatory relief for early-stage ventures through instruments such as the Startup Grant Fund (SGF) and the Startup Venture Fund (SVF). Despite this national mandate, program benefits remain heavily concentrated in the National Capital Region (NCR), raising concerns that the law's inclusive intent is not being realized equitably across the archipelago.

Regional inequality in innovation activity is a globally documented structural phenomenon rather than an incidental feature of developing-economy growth. Complex economic activities disproportionately cluster in metropolitan centers, producing self-reinforcing concentration effects that are sometimes efficient and sometimes a correctable policy failure. In the Philippine startup ecosystem, this concentration is clearly visible in the distribution of ISA-funded ventures.

This study addressed a specific research gap: while the literature explains regional disparities and general access barriers well, it offers little first-hand, founder-level evidence tracing how individual ISA beneficiaries and institutional actors in Philippine regions actually experience access, barriers, support, and program effectiveness, and how those experiences translate into fixable features of program design. The study was guided by five research questions concerning (1) regional access to ISA funding, (2) barriers to equitable access, (3) experiences of financial and technical support, (4) perceived program effectiveness, and (5) proposed policy improvements.

The purpose of this study was therefore to generate a founder- and institution-level phenomenological account of regional ISA access and to translate that account, through the lens of financial management, into actionable, evidence-based recommendations aligned with Sustainable Development Goals 8 (Decent Work and Economic Growth), 9 (Industry, Innovation, and Infrastructure), and 10 (Reduced Inequalities).

2. Literature Review

The reviewed literature clusters around four complementary theoretical traditions, each explaining a distinct dimension of the phenomenon under investigation.

Spatial Inequality Theory. Krugman's (1991) new economic geography argues that increasing returns, labor-market pooling, and knowledge spillovers generate cumulative agglomeration processes that concentrate economic activity in specific locations, creating self-reinforcing core-periphery structures over time. Audretsch and Feldman (1996) show that knowledge spillovers are geographically bounded, so proximity to knowledge-producing institutions substantially increases innovative activity. In this study's framework, spatial inequality functions as a primary input variable shaping a startup's exposure to knowledge networks, capital markets, and institutional support.

Resource-Based View. Barney's (1991) Resource-Based View (RBV) proposes that sustained competitive advantage derives from valuable, rare, inimitable, and non-substitutable (VRIN) resources. Applied to regional startup development, the RBV explains why startups in resource-rich urban environments consistently outperform peripheral counterparts, and clarifies why programs such as the SGF and SVF are intended to redress compounding resource deficits in underserved regions.

Entrepreneurial Ecosystem Model. Isenberg's (2010) ecosystem framework, refined by Stam (2015) and complemented by Cooke's (1992) Regional Innovation Systems theory and Porter's (1990) clustering thesis, conceptualizes the enabling environment for entrepreneurship as a multi-domain system of policy, finance, culture, human capital, infrastructure, and markets whose coherent integration — not any single element — determines ecosystem quality and program effectiveness.

Institutional Theory. North's (1990) foundational work, extended by Wurth et al. (2023), establishes that formal rules and informal norms are the primary determinants of economic performance differences across regions, and that program effectiveness depends on regional administrative capacity, inter-agency coordination, and policy execution rather than on the formal text of the law alone.

Taken together, these four theories have each been tested separately in other countries and contexts, but they have rarely been applied jointly, within a single Philippine study, to examine one national program such as the ISA from spatial, firm-level, ecosystem, and institutional angles simultaneously. Local Philippine evidence, including Bonifacio (2025), indicates that ISA-type programs tend to help unevenly and are hardest to access outside major hubs, but no study had yet used in-depth, first-hand interviews to capture how ISA beneficiaries and non-beneficiaries in non-NCR regions personally experience the program, or tied specific implementation gaps to specific, fixable program features. This study was designed to fill that gap by using all four theories side by side as a single integrated framework, so that spatial, firm-level, ecosystem, and institutional explanations of regional gaps could be examined against the same body of interview evidence. Table 1 summarizes how each theory was integrated into the study's variables and research questions.

Table 1. Theoretical Framework Integration

Theory	Core Claim	Variable in This Study	RQs Addressed
Spatial Inequality Theory (Krugman, 1991)	Cumulative causation concentrates innovation in established hubs; peripheral regions face structural disadvantage	Regional disparity (independent variable)	RQ1
Resource-Based View (Barney, 1991)	Firms with VRIN resources sustain competitive advantage; resource-poor contexts compound disadvantage	Startup resource endowment (mediating variable)	RQ2, RQ4
Entrepreneurial Ecosystem Model (Isenberg, 2010; Stam, 2015)	Multi-domain ecosystem coherence determines startup success; no single element is sufficient	Ecosystem quality (contextual variable)	RQ3, RQ4
Institutional Theory (North, 1990; Wurth et al., 2023)	Formal rules produce variable outcomes depending on regional institutional capacity and informal norms	Program effectiveness (dependent variable)	RQ2, RQ4, RQ5

Figure 1 illustrates the conceptual chain linking these structural disparities to eventual policy gaps, which directly informed the study's interview protocol and analytic strategy.

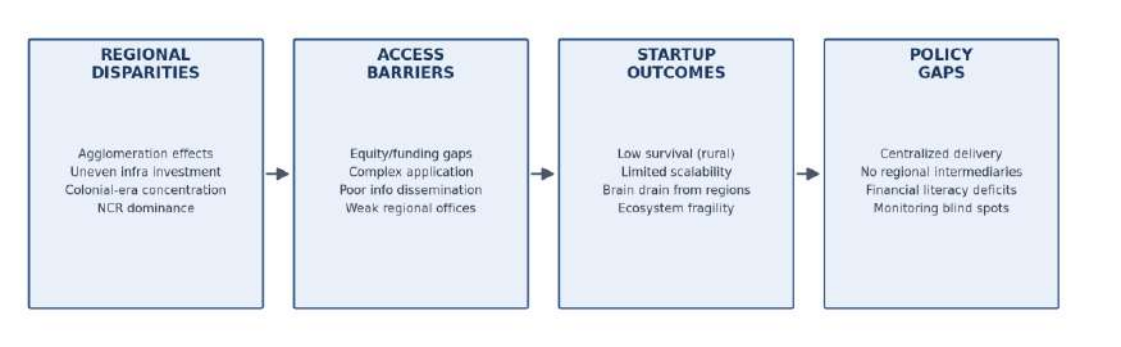


Figure 1. Conceptual Chain: Disparities → Access → Outcomes → Policy Gaps

3. Methodology

3.1 Research Design

This study is grounded in the interpretivist philosophical tradition, which holds that social reality is subjective, meaning-laden, and accessible only through systematic interpretation of human experience (Creswell & Poth, 2018). This stance is expressed through a descriptive phenomenological design following the Modified Van Kaam method (Moustakas, 1994), which provides the disciplined analytic procedure for gathering, reducing, and synthesizing participant accounts into a composite description of the shared essence of experience. Descriptive phenomenology was selected over ethnography, grounded theory, case study, and narrative inquiry because the research questions were meaning-centered and experiential rather than theory-generating or culturally interpretive.

3.2 Sampling and Participants

Using maximum variation sampling, the researcher recruited twenty-four participants comprising two groups. Group 1 consisted of twelve startup founders who had received SGF or SVF financing, spanning seven technology-driven sectors (supply chain technology, educational technology, travel technology, biotechnology, legal technology, food technology, and trade technology) and drawn across funded and unfunded statuses and urban and rural regions. Group 2 consisted of twelve institutional key informants — program officers, bureau directors, and incubator or enabler managers — with direct portfolio responsibility for SGF/SVF administration, evaluation, or policy formulation. Across all participants, the researcher documented startup sector and stage, geographic region, years of operation, founder educational background, prior familiarity with government funding programs, and organizational status under RA 11337 as contextual anchors rather than statistical categories.

3.3 Instrumentation and Procedure

Data were generated through semi-structured, in-depth individual and key-informant interviews of 30–45 minutes, guided by an interview protocol that underwent expert content validation (with a computed scale-level content validity index) and pilot testing with three participants who were not included in the main data set. Each session closed with a reflective question inviting participants to add anything unaddressed, consistent with Moustakas's (1994) guidance on honoring participant contribution at closure.

3.4 Data Analysis

Data analysis followed a two-tiered analytic framework. The primary procedure was the Modified Van Kaam method (Moustakas, 1994): epoché and bracketing, horizontalization, reduction and elimination, meaning-unit clustering, individual textural and structural descriptions, and synthesis into a composite textural-structural description (the essence), as shown in Figure 2.

Braun and Clarke's (2021) Reflexive Thematic Analysis was applied as a supplementary procedure to identify recurring language patterns and experiential convergences. Coding was inductive and grounded in participant language, beginning with descriptive coding and proceeding to interpretive coding; open, axial, and selective grounded-theory coding procedures were intentionally excluded to preserve methodological consistency with descriptive phenomenology. Codes and transcript segments were documented in a coding manual retained as part of the audit trail, and candidate themes were evaluated for relevance, internal coherence, and distinctiveness before being finalized.

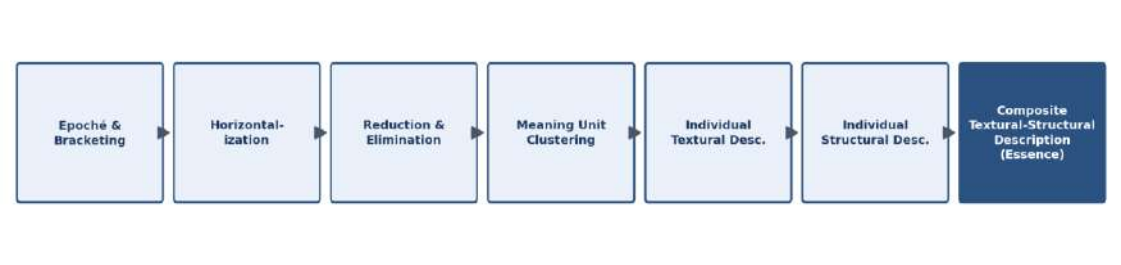


Figure 2. Data Analysis Flowchart (Modified Van Kaam Method)

3.5 Ethical Considerations

Prior to data collection, the researcher secured approval from the host institution's Research Ethics Committee (REC), which reviewed the full research protocol, data collection instruments, data management plan, and conflict-of-interest declaration. All participants provided free, prior, and informed consent consistent with the Data Privacy Act of 2012 (RA 10173); participation was voluntary, uncoerced, and withdrawable at any stage without penalty. Participant data were treated with strict confidentiality: no real names, institutional affiliations, or geographic identifiers were disclosed, and participants were assigned alphanumeric codes (S-1 to S-12 for founders; K-1 to K-12 for key informants) throughout analysis and reporting.

3.6 Trustworthiness and Rigor

Consistent with Lincoln and Guba (1985), the study established credibility through member checking, prolonged engagement, triangulation across interviews and documentary evidence (RA 11337, its Implementing Rules and Regulations, and agency program reports), and peer debriefing with the thesis adviser and a colleague; dependability and confirmability through an extensive audit trail (transcripts, coding manuals, theme maps, and reflexive journals); and transferability through thick, contextually anchored description of each regional setting and participant group, rather than any claim to statistical generalization.

4. Results

Twenty themes emerged across the five research questions, summarized below by research question and consolidated in Tables 2 through 6.

RQ1. Regional Access to ISA Funding

Program data and participant accounts confirmed that most funded startups are NCR-based, while participation from Luzon outside NCR, the Visayas, and Mindanao remains comparatively low. Participants did not attribute this concentration to policy bias; they traced it to differences in application volume, ecosystem density, intermediary presence, and informational reach. Four themes emerged: the experience of invisible walls (experiential exclusion from a geography many founders cannot access), non-NCR participation and gradual regional expansion (conditional belonging as infrastructure investment slowly translates into participation), the gap between policy promise and structural outcome (institutional sincerity meeting structural inertia), and discovery through networks (information as a social resource distributed by proximity rather than institutional design). Table 2 summarizes the theme structure for Research Question 1.

Table 2. RQ1 Theme Summary — Regional Access to ISA Funding

Theme	Core Meaning Unit	Policy Implication
1a. The Experience of Invisible Walls	Experiential exclusion — the national innovation agenda unfolds in a geography many founders cannot access	Establish regional equity benchmarks; report disaggregated funding data annually
1b. Non-NCR Participation & Gradual Expansion	Conditional belonging — participation expanding but structurally constrained by ecosystem inertia	Sustain TBI investment; pair infrastructure with ecosystem-readiness programs
1c. Promise vs. Possibility Gap	Institutional sincerity meeting structural inertia — reform intent precedes ecosystem reality	Set measurable regional participation targets; report against them publicly
1d. Discovery Through Networks	Information as social resource distributed by proximity, not institutional accessibility	Centralized notification system; proactive regional outreach

RQ2. Barriers to Equitable Access

Four interrelated, cumulative barrier categories were identified: structural and ecosystem constraints (absence of incubators, laboratories, co-working spaces, investors, and mentors in many regions, compounded by talent migration to Metro Manila); information asymmetry (program information that was formally public but did not reach founders outside established networks, with some regional offices themselves initially unaware of ISA initiatives); institutional and administrative constraints (extensive documentation, milestone-based reimbursement, upfront capital requirements, and incubation or registration prerequisites disproportionately burdensome for early-stage and provincial ventures); and psychological and socio-cultural barriers (self-doubt, fear of rejection, intimidation by formal processes, and social preference for stable employment). A founder must typically overcome awareness barriers, then confirm that basic ecosystem infrastructure exists, then navigate a system calibrated to more mature ventures, and finally overcome an internal confidence threshold, as summarized in Table 3.

Table 3. RQ2 Major Barriers to Equitable Access

Barrier Category	Key Issue	Policy Implication
2a. Structural & Ecosystem	Absence of TBIs, co-working spaces, labs, and mentors in regional areas; talent migration to NCR — foundational infrastructure void prevents startup formation	Invest in regional TBI staffing and co-location hubs
2b. Information Asymmetry	Awareness confined to existing networks; some regional offices themselves unaware — information spreads through proximity, not policy	Establish centralized notification system; targeted regional campaigns
2c. Institutional & Administrative	Extensive documentation, milestone-based reimbursement, incubation prerequisites, minimum registration age — system calibrated to NCR-mature startups screens out early-stage regional applicants	Tiered application pathway; proportional compliance
2d. Psychological & Socio-Cultural	Self-doubt, fear of rejection, opportunity cost of entrepreneurship over stable employment — motivational threshold prevents qualified founders from applying	Early-stage mentorship programs; success-story visibility campaigns

RQ3. Experiences of Financial and Technical Support

Participants described affirmative feedback (support functioning as an enabling encounter and point of ecosystem entry), mixed feedback (support that was bounded — sufficient for a defined research-and-development component but inadequate for sustaining a broader venture), and balancing feedback (support accompanied by high compliance costs and uneven guidance). One key informant quantified this compliance burden directly, noting that roughly ₱500,000 of a ₱5 million grant may be spent on accounting and compliance services rather than on business growth. Table 4 summarizes these support-experience themes.

Table 4. RQ3 Support Experience Theme Summary

Theme	Core Meaning Unit	Policy Implication
3a. Affirmative — Enabling Encounters	Threshold recognition — the national innovation system sees and endorses a founder's work for the first time	Maintain and expand incubator-mediated delivery; leverage institutional legitimacy as program design feature
3b. Mixed — Bounded Enabling	Support valuable within its parameters yet unable to address the full scope of early-stage needs	Expand grant scope to include operational runway; shift technical guidance from compliance to adaptive mentoring
3c. Balancing — Compliance Burden	High compliance costs; lengthy application timelines; limited structured pre-grant guidance	Simplify documentation; introduce proactive guidance from application stage; reduce milestone-based financial exposure

RQ4. Perceived Program Effectiveness

The most enduring reported benefit was capability accumulation — financial management, compliance discipline, proposal writing, and strategic planning — that outlasted the grant period itself. Immediate revenue growth was limited, as commercialization typically lagged behind product development. Participation improved legitimacy, visibility, and ecosystem integration, described by founders as decisive in subsequent funding and partnership discussions. Effectiveness was moderated by regional ecosystem conditions and administrative bottlenecks, and was systematically understated by evaluation windows shorter than the period over which developmental value becomes visible, as detailed in Table 5.

Table 5. RQ4 Effectiveness Dimensions

Theme	Core Meaning Unit	Policy Implication
4a. ISA as Lifeline	Existential continuity — funding as the condition making it possible to remain in the startup journey	Sustain early-stage grant levels; prioritize sectors excluded from private capital
4b. Developmental Compression	ISA collapses the temporal distance between aspiration and actualization; compressed innovation timelines	Report development velocity as an official success metric alongside revenue
4c. Learning as Outcome	Transformative capability — the most durable value is not what was funded but what was built	Include capability-building indicators in program evaluation
4d. Short-Term Metrics vs. Long-Term Value	Temporal inversion — the program creates preconditions for commercial success, not commercial success itself	Shift evaluation to 3–5-year post-grant windows; supplement output metrics with capability indicators

RQ5. Proposed Policy Improvements

Participants proposed reforms across five areas: governance and information flow (harmonized workflows, empowered regional offices, centralized notification); decentralized and data-driven allocation (regional diagnostics, earmarked funding, sector-based allocation); simplified access (low-friction initial applications, smaller entry-level grants, standardized evaluation); localized ecosystem development (aligning innovation calls with regional problem spaces, strengthening technology business incubators (TBIs) as information hubs, embedding startup education in higher education); and financial sustainability and regulatory flexibility (startup-appropriate regulatory treatment, operational subsidies, and structured post-grant transition pathways), summarized in Table 6.

Table 6. RQ5 Theme Overview — Proposed Policy Improvements

Theme	Key Issue	Policy Implication
5a. Governance & Information Flow	National policy intent not consistently translated at regional and municipal levels	Harmonize inter-agency mandates; centralized notification system; LGU focal persons
5b. Decentralized, Data-Driven Allocation	Formally neutral allocation rules produce structurally biased outcomes	Earmark regional budgets; composite scoring adjusted for ecosystem maturity
5c. Simplified Access Mechanisms	Compliance burden calibrated to NCR-mature startups, not early-stage ventures	Tiered, phased applications; low-friction pre-qualification; proportional documentation
5d. Localized Ecosystem Development	Absence of local mentors, TBIs, and problem-oriented support structures	Embed startup support in universities and LGUs; align calls with regional industries
5e. Financial Sustainability & Regulatory Flexibility	Structured beginning with unstructured ending — support stops where continuity is most needed	Startup-specific tax frameworks; bundled non-cash support; clear SGF-to-SVF transition pathway

Figure 3 consolidates all twenty themes under their corresponding research questions, illustrating the overall thematic architecture from which the study's conclusions and recommendations were derived.

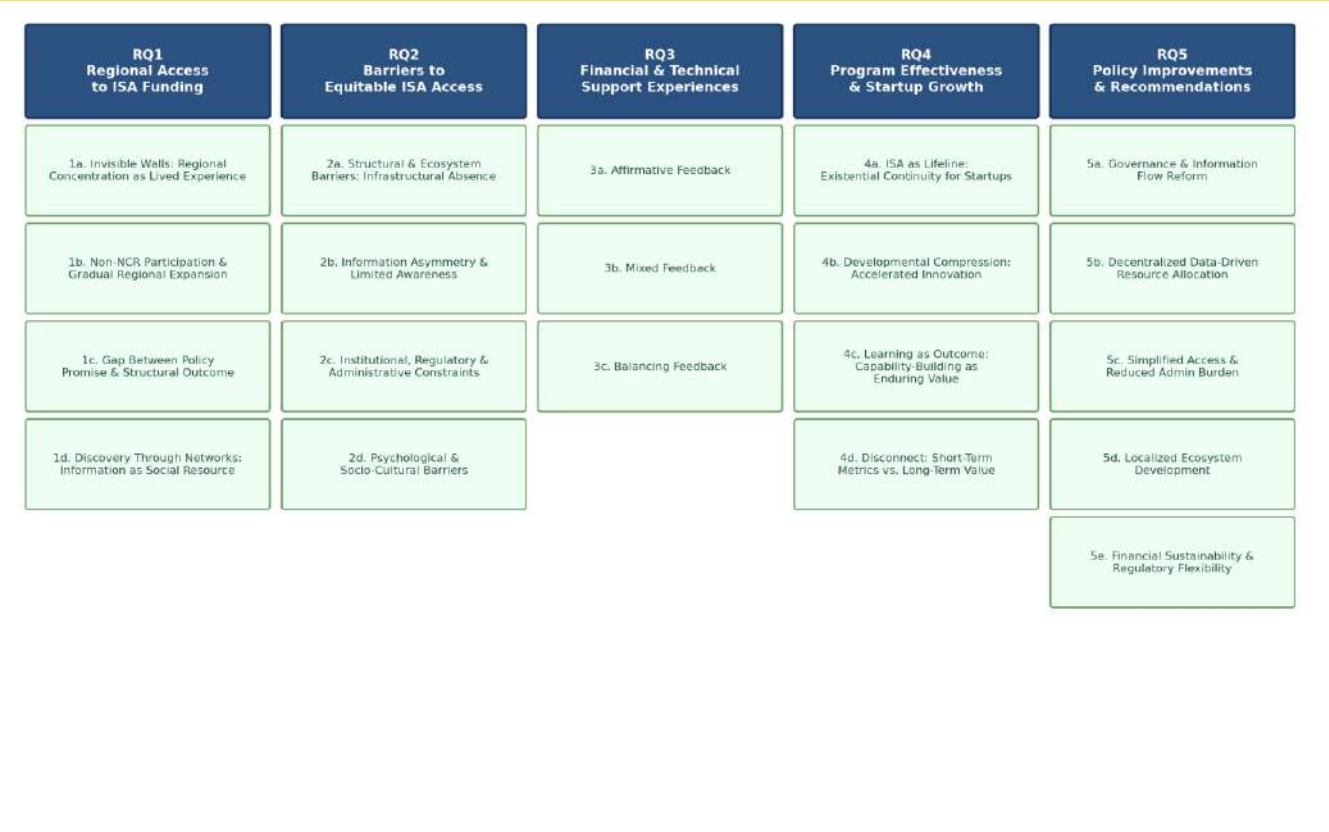


Figure 3. Thematic Findings Map

5. Discussion

The findings, read together, disclose a single underlying pattern: participants did not experience NCR concentration as intentional bias but as the cumulative outcome of structural conditions — ecosystem density, intermediary presence, and network proximity — that are themselves concentrated in Metro Manila. This is directly consistent with Krugman's (1991) Spatial Inequality Theory, and mirrors dynamics documented in innovation financing in other developing economies where capital cities dominate startup funding. The finding that institutional intent (TBI placement, explicit non-NCR prioritization) has outpaced measured outcomes extends Institutional Theory by showing that formal decentralization is a necessary but not sufficient condition for equitable access. The finding that information travels through informal networks rather than structured channels reflects the Resource-Based View: knowledge and network access function as intangible resources whose distribution mirrors, rather than corrects, existing ecosystem concentration.

Barriers under RQ2 extend the theoretical framework further. Structural and administrative barriers show that regional founders lack not only physical ecosystem infrastructure but also the intangible administrative and legal capital that the ISA's compliance architecture implicitly assumes. Information asymmetry is best explained by Akerlof's (1970) information asymmetry theory and Rogers' (2003) innovation diffusion theory — frameworks not part of the study's original design but made necessary by the data — which together explain why unequal access to information distorts participation even when a program is formally open to all. Psychological and socio-cultural barriers draw on Human Capital Theory (Becker, 1964) and Ajzen's (1991) Theory of Planned Behavior to explain why structurally available opportunity is not always psychologically available opportunity.

Table 7 maps each theoretical prediction against the study's evidence: Spatial Inequality Theory was confirmed and extended, as NCR dominance proved structurally self-reinforcing across program cycles; the Resource-Based View was confirmed, as capability gaps — not geography alone — determined how fully founders absorbed ISA benefits; the Entrepreneurial Ecosystem Model was confirmed and extended, as intermediaries such as TBIs and incubators emerged as the decisive translators of national policy into regional outcomes; and Institutional Theory was confirmed, as administrative architecture operated as a regressive equity constraint independent of policy intent.

Table 7. How Findings Confirm, Extend, or Nuance the Theoretical Framework

Theory	**Core Prediction**	**Confirmed / Extended / Nuanced**	**Key Evidence**
Spatial Inequality Theory (Krugman, 1991)	Agglomeration concentrates innovation and capital in urban hubs	Confirmed and extended: NCR dominance is structurally self-reinforcing across program cycles	Themes 1a–1c
Resource-Based View (Barney, 1991)	Resource deficits disadvantage peripheral firms	Confirmed: capability gaps (not geography alone) determine ISA benefit absorption	Themes 3b, 4c
Entrepreneurial Ecosystem Model (Isenberg, 2010)	Ecosystem coherence determines policy effectiveness	Confirmed and extended: intermediaries (TBIs, incubators) are decisive translators of policy into outcomes	Themes 1d, 2a, 3a
Institutional Theory (North, 1990; Wurth et al., 2023)	Formal rules produce uneven outcomes where informal institutional capacity varies	Confirmed: administrative architecture operates as a regressive equity constraint independent of policy intent	Themes 2c, 3c

These findings should be interpreted in light of the study's scope. Participants were drawn from successful SGF/SVF recipients and institutional actors; founders whose applications were denied, and those who did not apply because of perceived barriers, were not included. The study may therefore overrepresent the experiences of successful applicants while underrepresenting the barriers faced by those excluded from funding altogether. As a qualitative, interpretivist inquiry, the study does not claim statistical generalizability; it offers analytical transferability to comparable policy and ecosystem contexts, particularly other developing-country archipelagos examining startup access disparities or regional inequality in government grant programs. Future research that includes denied applicants and non-applicant founders is recommended to more fully examine these barriers.

6. Recommendations

The following recommendations are derived directly from the study's conclusions and are framed through the lens of financial management. Each recommendation reinterprets a conclusion as a financial problem of allocation, cost, timing, measurement, or sustainability, and proposes a corresponding financial-management intervention.

- Institute target-based regional allocation with public performance monitoring: publish an annual, disaggregated funding scorecard by region and set explicit per-region allocation targets, reviewed each cycle.
- Reform disbursement and compliance: release a 20–30% mobilization advance on grant signing and adopt a compliance and reporting schedule tiered to grant size, easing working-capital constraints on the smallest ventures.
- Provide grantee financial coaching: issue a standardized Day-1 budgeting and liquidation onboarding kit paired with structured financial-management coaching at award.

- Redesign evaluation to a longer horizon: track developmental outcomes (capability, follow-on funding, partnerships, survival) at 1, 3, and 5 years post-grant, and monitor cash runway, burn rate, and grant-dependency ratio.
- Deliver regional pre-application readiness programs in grant literacy, financial documentation, and budget preparation, led by TBIs with LGU co-hosting.
- Embed a weighted problem-founder-fit criterion in the SGF/SVF evaluation rubric, and monitor its effect on the regional distribution of awards.
- Build lasting regional capacity through a blended-finance vehicle pooling national, LGU, and private capital to fund standing regional financial-intermediation capacity rather than one-off grants.
- Institute post-grant sustainability financing: pair revenue-diversification coaching with a defined bridge-financing or follow-on pathway to close the post-grant funding gap.
- Institutionalize regional participatory governance through standing regional advisory councils with a formal mandate over program design, allocation priorities, and periodic review.

These measures share a single financial logic: each conclusion of the study points to a financial-access problem of allocation, entry cost, appraisal horizon, transaction and working-capital cost, or long-term sustainability, and each is addressed through a corresponding financial-management instrument. Because several measures require no additional appropriation or legislative amendment, and because each redirects an existing process rather than creating a new one, the recommendations are both practical for immediate adoption and structurally consequential for advancing the equitable access that Republic Act No. 11337 intends. Table 8 presents the full Strategic Recommendations Matrix, sequencing these measures by implementation horizon.

Table 8. Strategic Recommendations Matrix

Recommendation & Mechanism	Responsible Agencies	Expected Outputs	Horizon
Reform disbursement and compliance — release a 20–30% mobilization advance on signing; tiered compliance schedule by grant size	DOST-PCIEERD (SGF); DTI-NDC (SVF); DBM; COA	Amended circular issued; ≥90% of new grantees receive an advance; lighter reporting load for small grants	Year 1 (Immediate)
Provide grantee financial coaching — Day-1 budgeting pack plus ≥2 coaching sessions at award	DOST; DTI; DICT; TBIs	Onboarding kit distributed at award; reduced rejection and liquidation-error rates	Year 1 (Immediate)
Launch a regional allocation scorecard — public dashboard of funding by region, sector, and instrument	DOST; DTI; DICT	Baseline scorecard published; regional targets set; annual variance reported	Year 1 (Immediate)
Deliver regional pre-application readiness programs — grant literacy, financial documentation, budget preparation	TBIs (lead); DOST; LGUs	Readiness programs delivered per region; rise in non-NCR applications	Years 2–3 (Medium)
Redesign evaluation to a long horizon — track outcomes at 1, 3, and 5 years; monitor runway, burn rate, grant-dependency	DOST; DTI; DICT (M&E units)	New M&E framework adopted; longitudinal and financial-health data collected	Years 2–3 (Medium)

Recommendation & Mechanism	Responsible Agencies	Expected Outputs	Horizon
Embed a problem-founder-fit screen in the SGF/SVF evaluation rubric	DOST; DTI; DICT	Updated evaluation rubric; award-distribution effect tracked	Years 2–3 (Medium)
Establish blended-finance regional capacity — pool national, LGU, and private capital for standing regional intermediation	DOST; DTI; DICT; DBM; LGUs; private co-investors	Operational blended-finance vehicle; regional support hubs established	Years 3–5 (Long-term)
Institute post-grant sustainability financing — revenue-diversification coaching paired with a bridge-financing pathway	DOST; DTI; DICT; DBM; TBIs; private capital	Sustainability track operating; measurable drop in grant-dependency	Years 3–5 (Long-term)
Institutionalize regional participatory governance — standing regional advisory councils	DOST; DTI; DICT; LGUs	Regional advisory councils convened; documented participatory design and review	Years 3–5 (Long-term)

Acknowledgments

The researcher thanks the panel members for their valuable insights, constructive comments, and recommendations, and extends special appreciation to the research adviser for her patience, expertise, and steadfast guidance throughout this study. This research received no external or institutional funding and was conducted as part of the requirements for the degree of Master in Business Administration, Major in Financial Management, at the Polytechnic University of the Philippines.

References

(APA 7th edition style)

Akerlof, G. A. (1970). The market for “lemons”: Quality uncertainty and the market mechanism. Quarterly Journal of Economics, 84(3), 488–500.

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211.

Audretsch, D. B., & Belitski, M. (2021). Knowledge complexity and firm performance: Evidence from the European SMEs. Journal of Knowledge Management, 25(4), 693–713.

Audretsch, D. B., & Feldman, M. P. (1996). R&D spillovers and the geography of innovation and production. American Economic Review, 86(3), 630–640.

Barney, J. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99–120.

Becker, G. S. (1964). Human capital: A theoretical and empirical analysis, with special reference to education. University of Chicago Press.

Bonifacio, A. M. (2025). Uneven ground: Perceptions of Philippine startup support programs [Unpublished manuscript].

Braun, V., & Clarke, V. (2021). Thematic analysis: A practical guide. SAGE Publications.

Cooke, P. (1992). Regional innovation systems: Competitive regulation in the new Europe. Geoforum, 23(3), 365–382.

Creswell, J. W., & Poth, C. N. (2018). Qualitative inquiry and research design: Choosing among five approaches (4th ed.). SAGE Publications.

Guimon, J. (2018). Government strategies to attract R&D-intensive FDI. Journal of Technology Transfer, 43, 61–82.

Hartmann, D., Bezerra, M., Lodolo, B., & Pinheiro, F. (2022). International trade, economic complexity, and the persistence of regional inequality. World Development, 156, 105892.

Isenberg, D. J. (2010). How to start an entrepreneurial revolution. Harvard Business Review, 88(6), 40–50.

Krugman, P. (1991). Increasing returns and economic geography. Journal of Political

Economy, 99(3), 483–499.

Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic inquiry. SAGE Publications.

Lumba, A., Reyes, C., & Santos, M. (2025). Regional startup ecosystems in the Philippines: A phenomenological account. Philippine Journal of Business and Entrepreneurship, 12(1), 44–62.

Moustakas, C. (1994). Phenomenological research methods. SAGE Publications.

North, D. C. (1990). Institutions, institutional change and economic performance. Cambridge University Press.

Porter, M. E. (1990). The competitive advantage of nations. Harvard Business Review, 68(2), 73–93.

Republic Act No. 11337. (2019). Innovative Startup Act. Congress of the Philippines.

Republic Act No. 10173. (2012). Data Privacy Act of 2012. Congress of the Philippines.

Rogers, E. M. (2003). Diffusion of innovations (5th ed.). Free Press.

Stam, E. (2015). Entrepreneurial ecosystems and regional policy: A sympathetic critique. European Planning Studies, 23(9), 1759–1769.

Wurth, B., Stam, E., & Spigel, B. (2023). Toward an entrepreneurial ecosystem research program. Entrepreneurship Theory and Practice, 47(3), 729–778.

List of Tables

All tables are numbered consecutively and presented in full within the body of the manuscript, at the point of first reference, as follows:

- Table 1. Theoretical Framework Integration — Literature Review
- Table 2. RQ1 Theme Summary — Regional Access to ISA Funding — Results
- Table 3. RQ2 Major Barriers to Equitable Access — Results
- Table 4. RQ3 Support Experience Theme Summary — Results
- Table 5. RQ4 Effectiveness Dimensions — Results
- Table 6. RQ5 Theme Overview — Proposed Policy Improvements — Results
- Table 7. How Findings Confirm, Extend, or Nuance the Theoretical Framework — Discussion
- Table 8. Strategic Recommendations Matrix — Recommendations

Figure Legends

Figure 1. Conceptual Chain: Disparities → Access → Outcomes → Policy Gaps. Depicts the causal pathway from regional structural disparities, through access barriers, to startup outcomes and resulting policy gaps. Presented in the Literature Review.

Figure 2. Data Analysis Flowchart (Modified Van Kaam Method). Depicts the analytic sequence from epoché and bracketing through horizontalization, reduction and elimination, meaning-unit clustering, individual textural and structural descriptions, to the composite textural-structural description (essence). Presented in the Methodology.

Figure 3. Thematic Findings Map. Depicts all twenty themes organized under their corresponding research questions (RQ1–RQ5), illustrating the overall thematic architecture of the study. Presented in the Results.

Figures

All figures are presented in full within the body of the manuscript, at the point of first reference (Literature Review, Methodology, and Results, respectively). They are reproduced together below for consolidated reference.



Figure 1. Conceptual Chain: Disparities → Access → Outcomes → Policy Gaps

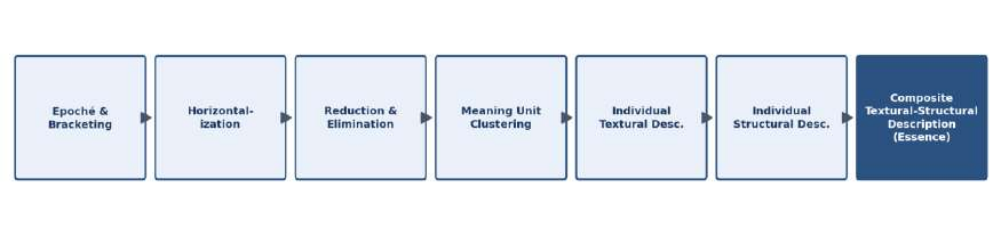


Figure 2. Data Analysis Flowchart (Modified Van Kaam Method)

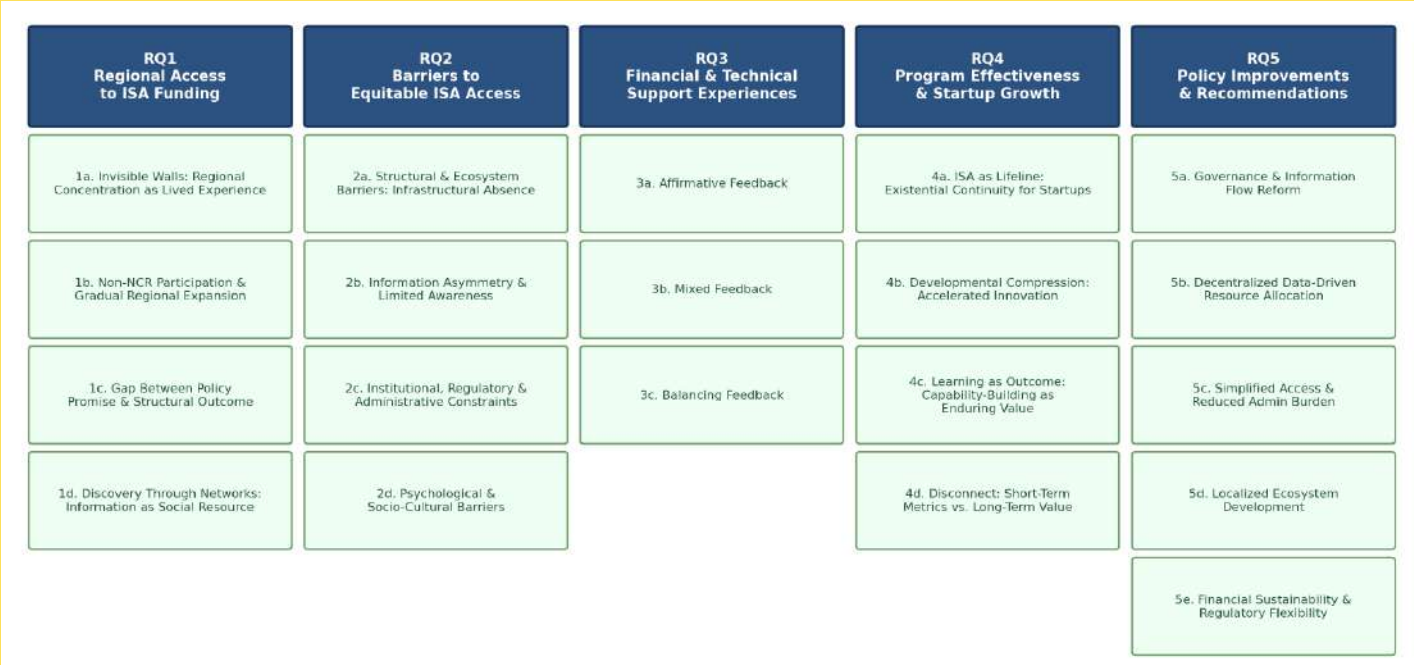


Figure 3. Thematic Findings Map

Journal of Financial and Management Sciences, 2 (3) 295 –329, (2026)

DOI: https://doi.org/10.70970/qdg3jv26

Accounting Implications of the OECD Pillar Two Global Minimum Tax: A Systematic Literature Review

Mahwish Ayub

Received: August 14, 2026

Revised: August 22, 2026
Accepted: August 30, 2026
Published online: September 10, 2026

Abstract

The OECD/G20 Inclusive Framework's Pillar Two Global Anti-Base Erosion (GloBE) rules introduce a 15% global minimum effective tax rate for large multinational enterprises (MNEs), operationalised through the Income Inclusion Rule, the Undertaxed Profits Rule, and Qualified Domestic Minimum Top-up Taxes. Because GloBE Income is derived directly from the financial accounting net income used in consolidated financial statements, Pillar Two embeds an unusually deep interdependence between tax law and financial reporting. This paper presents a systematic literature review (SLR) of the accounting implications of Pillar Two, synthesising academic, standard-setting, and professional literature published between December 2021 and mid-2026.

Guided by a conceptual framework linking GloBE design features, standard-setter response, and accounting and market outcomes, and following PRISMA-informed screening and thematic synthesis, the review adopts a critical realist research philosophy and an abductive approach to qualitative, document-based synthesis.

The review identifies five interlocking themes: (1) the use of financial accounting income as a tax base and its implications for reporting quality; (2) the mechanics and complexity of the Total Deferred Tax Adjustment Amount; (3) the divergent but currently converged treatment of Pillar Two top-up taxes under IAS 12 and ASC 740, both of which rely on temporary recognition exceptions; (4) disclosure, interim-reporting, and systems-integration burdens; and (5) emerging effects on effective-tax-rate volatility, earnings-management incentives, and capital-market valuation. Empirical evidence on real-world implementation outcomes remains scarce, concentrated instead in conceptual, regulatory, and early observational work, with the first dedicated peer-reviewed SLR on Pillar Two (focused on digital-reporting infrastructure rather than accounting recognition) appearing only in early 2026.

The synthesis is constrained by the limited volume of peer-reviewed empirical scholarship available as of mid-2026 and leans more heavily on conceptual and regulatory sources than a mature-topic SLR would. The paper closes with an agenda for archival, cross-country, and capital-market research that the 2024–2026 implementation period now makes feasible.

This is the first systematic review to synthesise the accounting-recognition, measurement, and reporting-quality dimension of Pillar Two, as distinct from the adjacent and more developed literature on digital-reporting compliance infrastructure, and it offers implications for standard-setters, preparers, auditors, and investors.

Keywords: Pillar Two; global minimum tax; GloBE rules; deferred tax; IAS 12; ASC 740; financial reporting; book-tax conformity; systematic literature review

manahiljam@gmail.com
Department of Management Sciences, Capital University of Science and Technology (CUST), Islamabad, Pakistan
© The Author(s) 2026. Published by Journal of Financial and Management Sciences. This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at http://creativecommons.org/licences/by/4.0/legalcode

1. Introduction

Organisation for Economic Co-operation and Development's Base Erosion and Profit Shifting (BEPS) 2.0 project culminated in the October 2021 political agreement on a two-pillar solution to the tax challenges of a digitalised, globally integrated economy. Pillar Two establishes the Global Anti-Base Erosion (GloBE) rules, which require in-scope MNE groups, generally those with consolidated revenues of €750 million or more in at least two of the four preceding fiscal years, to be subject to a minimum 15% effective tax rate (ETR) on a jurisdiction-by-jurisdiction basis. Top-up tax is collected primarily through the Income Inclusion Rule (IIR), the Undertaxed Profits Rule (UTPR), and domestically legislated Qualified Domestic Minimum Top-up Taxes (QDMTTs).

A distinctive and, in the history of international tax reform, largely unprecedented feature of the GloBE rules is their reliance on financial accounting information as the starting point for the tax base. GloBE Income begins with the financial accounting net income or loss used in the ultimate parent entity's consolidated financial statements, subject to a defined set of adjustments. Covered Taxes likewise begin from current tax expense and are adjusted by a Total Deferred Tax Adjustment Amount that draws on deferred tax accounting principles but modifies them substantially, most notably by recasting deferred tax movements to the lower of the 15% minimum rate or the domestic statutory rate.

This deliberate coupling of tax base and financial accounting income raises questions that sit squarely within accounting research and practice rather than tax policy alone. How do the GloBE rules interact with existing deferred tax standards under IAS 12 and ASC 740? What are the implications for deferred tax assets and liabilities, valuation allowances, interim reporting, and disclosure?

Does anchoring a minimum tax to accounting numbers create incentives that could impair the quality and information content of financial reporting, echoing older debates about book-tax conformity? And how have preparers, auditors, and standard-setters responded operationally in the first reporting cycles since January 2024?

1.1 Research gap

Despite an expanding volume of practitioner guidance from the Big Four accounting networks, the IASB, the FASB, and successive rounds of OECD Administrative Guidance issued through 2024–2026, rigorous academic synthesis of the accounting dimension of Pillar Two remains limited relative to its practical significance. Only one closely related systematic review has been published to date, and it addresses the digital-reporting infrastructure that supports GloBE compliance, XBRL, Country-by-Country Reporting, and the IFRS Taxonomy (Anjarwi et al., 2026), rather than accounting recognition, measurement, or reporting quality. No dedicated systematic literature review has yet synthesised the accounting-recognition dimension of Pillar Two: how GloBE Income interacts with IAS 12 and ASC 740, what the resulting deferred tax and disclosure consequences are, and what these imply for reporting quality and capital markets. This gap is the specific problem the present paper addresses.

1.2 Contribution

This paper closes that gap by making three contributions to the accounting and tax literature:

- A structured synthesis of the fragmented conceptual, regulatory, and early observational literature on Pillar Two accounting, organised through an explicit conceptual framework (Figure 1) rather than presented as an unstructured narrative.
- An explicit mapping of convergence and residual divergence between IAS 12 and ASC 740 treatments of Pillar Two top-up taxes, clarifying why the two frameworks currently produce aligned outcomes through different doctrinal routes, and how durable that alignment is likely to be.

- A concrete research agenda for the archival, cross-country, and capital-markets studies that the 2024–2026 implementation period now makes feasible for the first time, building on the gap identified in Section 1.1.

1.3 Research questions

These contributions are organised around four research questions that structure the synthesis in Section 4:

- RQ1: How does the use of consolidated financial accounting income as the GloBE tax base affect financial reporting quality and preparer incentives?
- RQ2: What recognition, measurement, and disclosure choices have the IASB and the FASB made for Pillar Two top-up taxes under IAS 12 and ASC 740, respectively, and how durable is the current convergence between them?
- RQ3: What operational and disclosure burdens does GloBE compliance impose on preparers and auditors, and how are these documented in the literature to date?
- RQ4: What effects does Pillar Two have, or is it expected to have, on effective-tax-rate volatility, earnings-management incentives, and capital-market valuation?

1.4 Structure of the paper

Section 2 provides institutional and regulatory background on the GloBE mechanics most relevant to accounting. Section 3 sets out the review methodology and the conceptual framework guiding the synthesis. Section 4 presents the thematic findings, organised around RQ1–RQ4. Section 5 discusses the findings in light of accounting theory and the existing empirical gap. Section 6 draws out implications for key stakeholder groups. Section 7 sets a future research agenda, and Section 8 concludes.

2. Institutional and Regulatory Background

Before turning to the accounting literature, it is necessary to set out the GloBE mechanics in enough technical detail to make the accounting issues in Section 4 legible, and to fix the institutional timeline against which that literature has developed, since the accounting treatment of Pillar Two has itself evolved rapidly and unevenly across jurisdictions and standard-setters.

2.1 Scope and charging mechanism

The GloBE rules apply to MNE groups with consolidated revenue of €750 million or more in at least two of the four fiscal years immediately preceding the tested year, as reported in the ultimate parent entity's consolidated financial statements (OECD, 2021). Three charging rules operate in a deliberate hierarchy. The Income Inclusion Rule (IIR) is the primary mechanism: it requires the ultimate parent entity (or, where the parent's jurisdiction has not implemented the IIR, the next intermediate parent that has) to bring to tax its allocable share of any low-taxed income arising in a constituent entity located in a low-tax jurisdiction.

The Undertaxed Profits Rule (UTPR) operates as a backstop, reallocating any residual top-up tax not collected under an IIR among UTPR-implementing jurisdictions, using a substance-based allocation key (broadly, tangible assets and headcount) and collecting it through a denial of deduction or an equivalent domestic mechanism. Qualified Domestic Minimum Top-up Taxes (QDMTTs) sit ahead of both: a jurisdiction that has legislated a QDMTT collects any top-up tax attributable to low-taxed income arising within its own borders before that amount would otherwise be picked up by a foreign parent's IIR, which is the principal reason QDMTT adoption has spread quickly, it allows the taxing jurisdiction, rather than a foreign parent jurisdiction, to retain the associated revenue.

2.2 Computation of GloBE income and the jurisdictional effective tax rate

The ETR test that drives the entire mechanism is performed jurisdiction-by-jurisdiction, not at the consolidated group level, so that a blended group ETR above 15% provides no protection against a top-up charge in an individual low-tax jurisdiction. For each jurisdiction, GloBE Income or Loss is the aggregate of the constituent entities' financial accounting net income or loss, adjusted for a defined list of items (net taxes, excluded dividends and equity gains, certain international shipping income, and asymmetric foreign-currency gains and losses, among others), and the jurisdictional ETR is calculated as Adjusted Covered Taxes divided by Net GloBE Income for that jurisdiction. Where the jurisdictional ETR is below 15%, a Top-up Tax Percentage equal to 15% minus the jurisdictional ETR applies to the jurisdiction's Excess Profit to determine the top-up tax due.

2.3 The substance-based income exclusion

A commercially significant feature of the design is the Substance-Based Income Exclusion (SBIE), which reduces Net GloBE Income to Excess Profit before the top-up percentage is applied, and thereby shields income attributable to genuine local activity rather than mobile profit. The SBIE is the sum of a payroll carve-out (a percentage of eligible payroll costs for employees performing activities in the jurisdiction) and a tangible-asset carve-out (a percentage of the carrying value of eligible tangible assets located there), both measured from consolidated financial accounting data.

At steady state the carve-out settles at 5% of payroll and 5% of tangible assets, but a ten-year transition period beginning in fiscal year 2023 applies materially higher rates — 10% of payroll and 8% of tangible assets in the first transition year, stepping down annually to the 5%/5% steady state by 2033. Any unused SBIE cannot be carried forward, and a group may elect annually not to claim it for a given jurisdiction.

Because both carve-out bases are drawn from carrying values and payroll costs recognised under the group's financial accounting policies, ordinary accounting choices around asset recognition, componentisation, and lease capitalisation feed directly into the top-up tax calculation, a further, and less widely discussed, channel through which financial accounting judgement now has direct cash-tax consequences.

2.4 Covered taxes and the deferred tax adjustment

Two structural features of Covered Taxes are central to everything that follows in Section 4. First, GloBE Income is a book-based, not a tax-based, construct: it starts from consolidated financial accounting income and layers on the comparatively short list of adjustments described in Section 2.2, rather than being built up from local tax-return concepts as under prior international tax regimes such as the U.S. GILTI rules.

Second, Covered Taxes are not simply current tax expense; they incorporate a Total Deferred Tax Adjustment Amount that recasts existing deferred tax movements to the lower of the 15% minimum rate and the applicable domestic rate, and carves out specific categories (uncertain tax positions, uncontrollable equity gains and losses, and taxes on excluded income, among others), as progressively clarified through successive rounds of OECD Administrative Guidance (OECD, 2022–2026). Together with the SBIE mechanics in Section 2.3, these features mean that ordinary changes in accounting estimates, valuation allowances, useful-life assumptions, revenue-recognition timing, and asset carrying values, can, for the first time, move a group's cash tax liability under a supranational minimum tax regime.

2.5 Regulatory timeline

The pace and sequencing of standard-setting and jurisdictional enactment is itself a finding of relevance to Section 4, since it explains why the accounting literature remains concentrated in conceptual and regulatory work rather than archival empirical studies.

Table 1. Regulatory timeline for Pillar Two accounting standard-setting.

Date	Development
Dec 2021	OECD/G20 Inclusive Framework publishes the GloBE Model Rules (Pillar Two), setting a 15% minimum effective tax rate for in-scope MNE groups with consolidated revenue of €750 million or more.
May 2023	IASB issues narrow-scope Amendments to IAS 12, introducing a mandatory temporary exception from recognising and disclosing deferred taxes arising from Pillar Two legislation, together with targeted interim disclosures.
2023	FASB staff concludes that the GloBE minimum tax functions as an alternative minimum tax under ASC 740; deferred tax assets and liabilities are not recognised or adjusted for anticipated Pillar Two effects, and top-up tax is treated as a period cost.
Jan 2024	Income Inclusion Rule and Qualified Domestic Minimum Top-up Taxes take effect in most early-adopting jurisdictions (e.g., EU member states, UK); transitional CbCR safe-harbour rules become operative.
2024–2025	Progressive enactment of the Undertaxed Profits Rule across jurisdictions; OECD issues successive rounds of Administrative Guidance clarifying deferred tax recasting, purchase-accounting

Date	Development
	adjustments, and safe-harbour mechanics.
2025–2026	First annual reporting cycles incorporating Pillar Two current-tax disclosures; over half of large listed groups reviewed in market surveys report quantified Pillar Two impacts; simplified ETR safe-harbour thresholds rise to 16% (2025) and 17% (2026).

3. Methodology

This review follows a structured approach informed by PRISMA guidelines and recent methodological practice for systematic literature reviews in accounting and management research, consistent with the approach recently applied to the adjacent question of digital-reporting infrastructure for Pillar Two. Following Saunders, Lewis and Thornhill's (2019) research-onion logic, the chapter first sets out the philosophical and methodological choices underpinning the review (Sections 3.1–3.2) before describing the search, screening, and synthesis procedures through which those choices were operationalised (Sections 3.3–3.6) and the conceptual framework that resulted from them (Section 3.7).

3.1 Research philosophy and paradigm

A systematic literature review is itself a piece of research and therefore carries philosophical commitments that need to be made explicit rather than assumed. Two objects of study are combined in this review, and each pulls toward a different position on Saunders et al.'s (2019) research-onion continuum from positivism to interpretivism. On one hand, the review catalogues verifiable, document-based facts: the text of the OECD Model Rules, the IASB's Amendments to IAS 12, the FASB staff's ASC 740 conclusions, and the findings reported in peer-reviewed articles are treated as an external, observable reality that exists independently of the reviewer and can, in principle, be checked by any other researcher consulting the same primary sources.

This element of the review sits closest to an objectivist ontology and a positivist epistemology, in which knowledge is accumulated through the systematic, replicable observation of documented fact.

On the other hand, the process of grouping those facts into themes, deciding, for example, that Hanlon's (2023) reporting-quality concerns and the pre-existing book-tax conformity literature belong to the same analytical category, necessarily involves interpretive judgement that a different reviewer, working from the same source material, could in principle organise differently. This element of the review is more consistent with an interpretivist epistemology, in which meaning is constructed through the researcher's engagement with the material rather than simply read off it.

Rather than resolve this tension by denying one half of it, the review adopts the moderate, or critical realist, position increasingly favoured in accounting and management systematic reviews (Tranfield, Denyer, & Smart, 2003; Denyer & Tranfield, 2009): an objective regulatory and academic reality is assumed to exist and to constrain what can legitimately be claimed, while the thematic structure imposed on that reality is acknowledged as an interpretive construction that is made transparent, through the explicit search protocol in Section 3.3, the inclusion and exclusion criteria in Section 3.4, and the conceptual framework in Section 3.7, precisely so that it can be audited and, if necessary, contested by other researchers.

3.2 Research approach and methodological choice

The review adopts an abductive research approach, moving iteratively between the literature and an evolving conceptual structure rather than following a purely deductive path (testing a framework fixed in advance) or a purely inductive one (allowing themes to emerge with no prior structure at all).

In practice, initial candidate themes were drawn deductively from the institutional and regulatory background developed in Section 2, the expectation, grounded in the mechanics of GloBE Income and the Total Deferred Tax Adjustment Amount, that accounting recognition, disclosure, and reporting-quality issues would dominate the literature, and were then refined inductively through line-by-line thematic coding of the retained sources, broadly following the thematic-analysis logic set out by Braun and Clarke (2006) for qualitative synthesis. This abductive movement between framework and evidence is what ultimately produced the conceptual framework in Section 3.7 and Figure 1: an ex-ante structure was proposed, tested against the coded material, and revised before being presented as the organising device for Section 4.

Methodologically, the review is a qualitative, document-based systematic review rather than a meta-analysis. A meta-analytic strategy, which statistically pools effect sizes across studies, was not methodologically appropriate given the near-total absence of archival empirical studies identified in Section 3.5, there is, at present, no comparable set of quantitative effect sizes to pool. A narrative or qualitative synthesis strategy was therefore the only choice consistent with the current state of the literature, a limitation that is itself part of the review's contribution, since it documents precisely where the empirical gap lies for the research agenda in Section 7.

3.3 Search strategy

Searches were conducted across Scopus, Web of Science, SSRN, and Google Scholar, supplemented by targeted searches of the technical repositories of the IASB, the FASB, the OECD, and the Big Four professional-services networks (Deloitte, EY, KPMG, PwC). Search strings combined the terms “Pillar Two” OR “GloBE” OR “global minimum tax” with “accounting” OR “deferred tax” OR “IAS 12” OR “ASC 740” OR “financial reporting” OR “effective tax rate” OR “book-tax conformity.” Coverage was restricted to material published between December 2021, when the OECD Model Rules were released, and mid-2026.

3.4 Inclusion and exclusion criteria

Table 2. Inclusion and exclusion criteria applied during screening.

Inclusion criteria	Exclusion criteria
Peer-reviewed journal articles and high-quality working papers (SSRN, NBER) addressing accounting recognition, measurement, presentation, or disclosure aspects of Pillar Two	Papers addressing only tax-policy, revenue-estimation, or trade-competitiveness aspects of Pillar Two with no accounting content
Official standard-setter pronouncements and basis-for-conclusions documents (IASB, FASB, OECD Inclusive Framework)	Marketing collateral or software-vendor material with no substantive technical analysis
Major professional-services technical publications (Big Four and comparable networks) offering substantive interpretive analysis	Non-English-language sources without an available translation
Publications dated between the release of the OECD Model Rules (December 2021) and mid-2026	Duplicate publications or successive reissues of the same technical alert without new analytical content

3.5 Screening, quality appraisal, and synthesis

Titles and abstracts were first screened for relevance to accounting recognition, measurement, presentation, or disclosure; full texts of retained records were then reviewed in detail. Because peer-reviewed empirical studies on Pillar Two accounting remain scarce — most jurisdictions began applying the rules only from fiscal years beginning on or after 1 January 2024 — the review deliberately combines three literature strata: (i) conceptual and analytical academic papers, most prominently the discussion papers by Hanlon (2023) and Hanlon and Nessa (2023); (ii) authoritative regulatory and standard-setting material, including IASB and FASB pronouncements and OECD Administrative Guidance; and (iii) high-quality practitioner technical analysis used, cautiously, as a proxy for implementation practice where peer-reviewed evidence is not yet available.

Consistent with the abductive approach described in Section 3.2, themes were developed inductively through iterative coding and then cross-checked against the structure of the one closely related published SLR identified in the search (on digital-reporting infrastructure for the global minimum tax), to ensure the present review's thematic boundaries are complementary rather than duplicative.

3.6 Limitations of the search

The review's principal limitation is temporal: because widespread application of the GloBE rules began only in 2024, and UTPR application followed in 2025, the archival empirical literature that would normally anchor an accounting SLR is still emerging. The synthesis therefore leans more heavily on conceptual and regulatory sources than a mature-topic SLR would, a feature that is itself one of the review's findings rather than merely a constraint on it.

3.7 Conceptual framework guiding the synthesis

To organise the coding process described in Section 3.5 and to structure the presentation of findings in Section 4, the review adopts the conceptual framework in Figure 1. The framework treats three GloBE design features, the use of financial accounting income as the tax base, the substance-based income exclusion, and the Total Deferred Tax Adjustment Amount, as the inputs that standard-setters have had to accommodate.

It treats the IAS 12 temporary exception and the ASC 740 alternative-minimum-tax characterisation as the mediating standard-setter response through which those inputs are translated into reported numbers. It treats reporting quality, effective-tax-rate volatility, disclosure and systems burden, and capital-market valuation effects as the accounting and market outcomes that the literature has begun to theorise and, to a limited extent, observe.

Finally, the framework treats agency theory, institutional theory, and information economics, developed further in Section 5, as moderating lenses that shape how the input–response–outcome chain is interpreted, rather than as an additional empirical construct. Sections 4.1 through 4.5 are organised to move systematically from left to right across this framework.

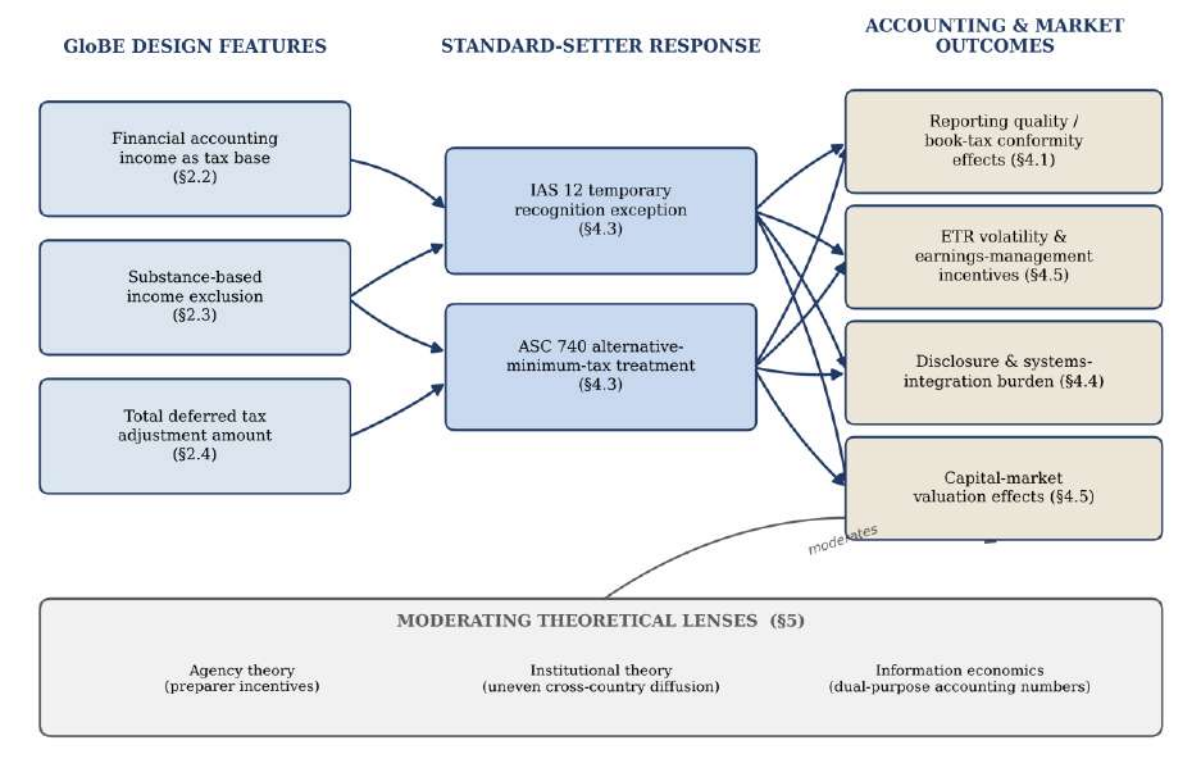


Figure 1. Conceptual framework linking GloBE design features, standard-setter response, and accounting/market outcomes.

4. Thematic Findings

Consistent with the conceptual framework in Figure 1, this section synthesises the literature in five parts, moving from the design features that make Pillar Two an accounting problem (Sections 4.1–4.2), through the standard-setter response that currently governs recognition and measurement (Section 4.3), to the disclosure, market, and reporting-quality consequences documented or anticipated in the literature (Sections 4.4–4.5). Each subsection is mapped to the research question it primarily addresses, and Table 3 summarises the studies most central to each theme before the narrative synthesis follows.

Table 3. Literature synthesis matrix by theme.

Theme (RQ)	**Key source(s)**	**Focus**	**Contribution / gap addressed here**
Accounting income as tax base (RQ1)	Hanlon (2023); Hanlon & Nessa (2023)	Conceptual analysis of reporting-quality and complexity risks from using book income as a supranational tax base	Anchors Section 4.1; extended here by linking explicitly to the pre-existing book-tax conformity literature
Book-tax conformity (RQ1)	Hanlon & Shevlin (2005); Hanlon, Maydew & Shevlin (2008)	Empirical evidence that greater book-tax conformity reduces earnings informativeness	Provides the theoretical baseline against which Pillar Two's partial conformity effect can be tested empirically
Recognition under IAS 12 / ASC 740 (RQ2)	IASB (2023); FASB staff (2023); EY (2023); PwC (2025)	Standard-setting response: temporary IAS 12 exception; ASC 740 alternative-minimum-tax characterisation	Anchors Section 4.3; mapped here as a formal input–response relationship in Figure 1 rather than described separately by framework
Disclosure & systems burden (RQ3)	Anjarwi, Che Azmi, Hidayat, Ranatarisza & Ningsih (2026)	PRISMA-guided review of digital-reporting infrastructure (XBRL, CbCR, IFRS Taxonomy) supporting GloBE	Closest existing SLR; this review treats it as a complementary systems-level companion to the

Theme (RQ)	Key source(s)	Focus	Contribution / gap addressed here
		compliance	accounting-recognition synthesis in Section 4
ETR volatility, incentives, valuation (RQ4)	Faulhaber (2023); Devereux, Vella & Wardell-Burrus (2022); Tørsløv, Wier & Zucman (2023)	Substance-based income exclusion as an "escape hatch"; jurisdictional incentive responses; scale of pre-existing profit shifting	Anchors Section 4.5; used here to motivate the archival research agenda in Section 7

4.1 Financial accounting income as the GloBE base (RQ1)

GloBE Income begins with the financial accounting net income or loss of constituent entities, the input at the top-left of Figure 1. Hanlon (2023) provides the most cited discussion of the problems this creates, arguing that using accounting numbers as an explicit component of a supranational tax base risks degrading the quality and capital-market usefulness of financial accounting information, and that it introduces new complexity and compliance cost while placing additional pressure on preparers' judgement in areas involving estimates and accruals. Hanlon and Nessa (2023) extend this analysis, examining the auditor, standard-setter, and financial-statement-user implications of a regime in which materiality thresholds calibrated for general-purpose financial reporting may be inappropriate for a tax base.

This concern connects to an older and well-established literature on book-tax conformity. Hanlon and Shevlin (2005) frame the foundational trade-off: increasing the alignment between taxable income and book income can reduce opportunities for aggressive tax-motivated accounting, but Hanlon, Maydew and Shevlin (2008) show empirically that greater book-tax conformity is also associated with a loss of earnings informativeness, because managers facing a shared base have weaker incentives, and less latitude, to convey private information through accounting choices. Pillar Two effectively creates a novel and partial form of book-tax conformity at the level of a supranational minimum tax rather than the domestic tax base, and the SLR finds that this parallel has not yet been systematically tested — the central empirical gap that motivates RQ1 and, in turn, the first item of the research agenda in Section 7.

4.2 Deferred tax adjustments under the GloBE rules (RQ1)

The second design-feature input in Figure 1, the Total Deferred Tax Adjustment Amount, compounds the reporting-quality concern raised in Section 4.1 rather than operating independently of it. Covered Taxes are adjusted by this amount, which recasts deferred tax assets and liabilities to the lower of the 15% minimum rate and the applicable domestic rate, excludes specific categories (deferred taxes on excluded income, uncertain tax positions, and certain accruals), and imposes distinct rules for pre-transition-year deferred tax attributes and recapture. Successive OECD Administrative Guidance releases (2023–2026) have progressively addressed divergences between accounting carrying values and GloBE carrying values, purchase-accounting adjustments following business combinations, and the treatment of intra-group transactions.

The literature converges on the view that these rules impose significant computational complexity, requiring MNEs to maintain a parallel, GloBE-specific deferred tax ledger alongside existing tax-provision and consolidation systems, a point professional commentary has likened to maintaining a third set of books. For the reporting-quality question raised in Section 4.1, this matters beyond mere compliance cost: because the recasting calculation is itself judgement-laden (it depends on existing deferred tax balances that are, in turn, a product of accounting estimates), the deferred tax adjustment amount is a second, largely unexamined channel through which preparer judgement now has direct cash-tax consequences, alongside the SBIE channel identified in Section 2.3.

4.3 Recognition and measurement under IAS 12 and ASC 740 (RQ2)

Both the IASB and the FASB have treated Pillar Two top-up taxes as income taxes within the scope of their respective standards, but through different technical routes that currently produce converged outcomes, the standard-setter response node in Figure 1. In May 2023 the IASB issued narrow-scope Amendments to IAS 12 introducing a mandatory temporary exception from recognising and disclosing deferred taxes arising from Pillar Two legislation, including QDMTTs, together with targeted disclosure of current tax expense related to Pillar Two. The Amendments carry no specified end date; the IASB's Basis for Conclusions notes that it was not possible, at the time of issuance, to determine how much further work would be needed before entities could reliably apply ordinary IAS 12 principles to Pillar Two deferred taxes.

Under U.S. GAAP, the FASB staff separately concluded that the GloBE minimum tax operates as an alternative minimum tax within the meaning of ASC 740. As a consequence, reporting entities do not recognise or adjust deferred tax assets and liabilities for the estimated future effects of Pillar Two, and top-up tax is instead recognised as a period cost affecting the effective tax rate in the year the GloBE obligation arises; valuation-allowance assessments generally need not incorporate anticipated Pillar Two effects.

The durability question posed in RQ2 can now be answered directly: because the IAS 12 exception has no sunset date, the two frameworks are expected to remain practically converged on this point for the foreseeable future, even though they arrive at that convergence through different doctrinal reasoning — a mandatory exception under IFRS versus an AMT characterisation under U.S. GAAP. This is a convergence of outcome rather than of principle, and it is fragile in one specific sense: an AMT characterisation under ASC 740 is a factual, not a permanent, conclusion, so that any future redesign of the GloBE rules that made them look less like a minimum tax and more like an ordinary income tax could, in principle, force FASB staff to revisit the classification independently of whatever the IASB does with its exception.

4.4 Disclosure, interim reporting, and operational challenges (RQ3)

Entities applying the IAS 12 exception must disclose that they have applied it and must separately disclose current tax expense related to Pillar Two once legislation is in effect, alongside qualitative and quantitative exposure disclosures before that point. U.S. public companies must additionally consider Pillar Two effects within effective-tax-rate reconciliations under ASU 2023-09 and related MD&A and risk-factor discussions. Market-level review evidence indicates that the first full reporting cycle incorporating quantitative Pillar Two disclosures occurred in 2025–2026, with more than half of large listed groups surveyed already reflecting quantified impacts in their financial statements.

The operational literature emphasises data and systems challenges: mapping data across multiple ERPs and charts of accounts, obtaining entity-level financial data at the granularity required for jurisdictional ETR calculations, integrating consolidation systems with dedicated tax-provision engines, and managing elections under the transitional CbCR safe harbour (with its simplified ETR threshold rising from 15% in FY2024 to 16% in FY2025 and 17% in FY2026).

A newly published systematic review of digital-reporting infrastructure for the global minimum tax, drawing on 54 peer-reviewed studies through PRISMA-guided synthesis, corroborates this theme from an information-systems perspective, finding that XBRL, CbCR, and IFRS Taxonomy infrastructure function as compliance enablers whose robustness varies sharply with jurisdictional governance capacity, a concern with particular relevance for multinational groups operating across both high- and low-capacity tax administrations. Read against RQ3, this evidence base remains largely descriptive: it documents that burden exists and where it concentrates, but not yet how it varies systematically with group size, industry, or existing systems maturity, a gap noted again in Section 7.

4.5 Reporting quality, incentives, and capital-market implications (RQ4)

Because raising a jurisdiction's ETR to avoid top-up tax mechanically reduces reported accounting income under some structuring responses, MNEs face a trade-off between tax-minimisation and capital-market reporting objectives. Faulhaber (2023) argues that Pillar Two's substance-based income exclusion, itself the product of three earlier strands of international tax reform, functions as a built-in escape hatch that allows jurisdictions with genuine economic substance to retain competitively low headline tax rates, tempering claims that Pillar Two ends tax competition outright. Devereux, Vella and Wardell-Burrus (2022) analyse how the ordering of the IIR and UTPR interacts with jurisdictions' incentives to adjust domestic tax design, including through QDMTT adoption, which in turn feeds back into the deferred tax recasting mechanics discussed in Section 4.2.

The scale of the profit-shifting problem that Pillar Two is designed to address is itself well documented empirically: Tørsløv, Wier and Zucman (2023) estimate that roughly a third of multinational profits are shifted to low-tax jurisdictions globally, a baseline against which the SBIE's dampening effect on the regime's revenue and behavioural impact can be judged.

Early market-facing analysis has also begun to examine equity-valuation consequences, asking which listed multinationals face material cash-tax and earnings-per-share effects as UTPR and QDMTT rules phase in, and noting that investors may not receive granular disclosure of these effects until top-up tax obligations actually crystallise.

Taken together with the reporting-quality concerns in Section 4.1, the literature anticipates increased effective-tax-rate volatility as jurisdictions phase in rules at different speeds and as transitional safe harbours expire, alongside new, as yet empirically untested, incentives around the timing of temporary differences and substance-based income exclusion calculations. For RQ4 specifically, the review finds a marked asymmetry in the evidence base: the incentive-based, analytical literature (Faulhaber, 2023; Devereux et al., 2022) is comparatively mature, while the archival, capital-markets literature that would actually test these incentives against reported outcomes has not yet appeared, the single largest evidence gap identified across all four research questions.

Taken together, Sections 4.1–4.5 answer RQ1–RQ4 at the level the current literature allows: conceptually and regulatorily for RQ1 and RQ2, where standard-setters and analytical theorists have already produced developed positions, and only provisionally for RQ3 and RQ4, where the underlying archival and market evidence has not yet caught up with the rules themselves. Section 5 interprets this pattern of findings against the conceptual framework in Figure 1 and the theoretical lenses introduced in Section 3.1.

5. Discussion

5.1 Synthesis across themes

Mapped back onto the conceptual framework in Figure 1, the findings in Section 4 trace a coherent input–response–outcome chain rather than five unrelated observations. Read together, the five themes converge on three structural observations. First, Pillar Two creates an unprecedented interdependence between tax and financial accounting systems, in which ordinary accounting judgement now has direct cash-tax consequences at a supranational level through at least two distinct channels, the substance-based income exclusion (Section 2.3) and the Total Deferred Tax Adjustment Amount (Section 4.2), a dynamic accounting theory would predict to generate exactly the kind of book-tax conformity trade-off documented in the pre-Pillar-Two literature on earnings informativeness.

Second, the deferred tax mechanics are highly technical and compliance-intensive, and standard-setters on both sides of the Atlantic have responded not with permanent redesign of deferred tax recognition principles but with temporary, open-ended exceptions. This is a pragmatic response that has, for now, successfully avoided the two boards diverging in reported outcomes, a genuinely positive finding for comparability that should not be understated, but it is also a conceptually unresolved position that leaves open how entities should eventually account for Pillar Two deferred taxes once, or if, the exceptions are withdrawn, and it rests, as Section 4.3 notes, on a factual AMT characterisation under U.S. GAAP that is less durable in principle than the open-ended IAS 12 exception.

Third, empirical evidence on behavioural responses and capital-market effects remains scarce, not because researchers lack interest but because widespread application only began in 2024–2025, with the first UTPR cycles and the first full year of quantitative disclosure only recently completed.

This scarcity is itself asymmetric, as Section 4.5 shows: it is most acute for RQ3 and RQ4, where testable archival evidence should now be obtainable, and least acute for RQ1 and RQ2, which have already attracted sustained conceptual and regulatory attention.

5.2 Theoretical interpretation

Several theoretical lenses recur, explicitly or implicitly, across the literature reviewed, corresponding to the moderating band in Figure 1. Agency theory helps explain preparer incentives when tax-minimisation and capital-market reporting goals diverge under a book-based minimum tax: preparers face a genuine trade-off, documented conceptually in Section 4.1 and 4.5 but not yet tested against actual reported behaviour.

Institutional theory is useful for understanding the uneven diffusion of QDMTT adoption and digital-reporting infrastructure across jurisdictions with differing governance capacity, a point reinforced by the parallel 2026 SLR on digital-reporting infrastructure (Anjarwi et al., 2026) and consistent with the jurisdictional-incentive analysis in Devereux et al. (2022).

Information economics motivates the reporting-quality concern at the centre of the book-tax conformity literature: when accounting numbers are made to serve a dual purpose, informing capital markets and determining a supranational tax liability, their information content for either purpose may be compromised, echoing the empirical finding in Hanlon, Maydew and Shevlin (2008) that conformity reduces earnings informativeness.

5.3 Positioning relative to the existing literature

The present review's central contribution relative to the adjacent, systems-focused 2026 SLR is to locate the recognition-and-measurement, reporting-quality dimension of Pillar Two within the broader accounting literature, rather than treating Pillar Two solely as a compliance-infrastructure problem.

The two reviews are complementary rather than competing: Anjarwi et al. (2026) document how the data required for GloBE compliance flows through digital-reporting systems, while the present review documents what that data means once it is recognised, measured, and disclosed under IAS 12 and ASC 740. A reader interested in the full life cycle of a Pillar Two number, from source system to recognised deferred tax balance to disclosed effective tax rate, needs both reviews rather than either in isolation.

A final caveat on the strength of the evidence underlying this synthesis is warranted. The conclusions reached for RQ1 and RQ2 rest on a comparatively strong evidentiary base: authoritative standard-setter text for RQ2, and a well-established pre-Pillar-Two empirical literature on book-tax conformity that offers a tested analogy, if not yet a direct test, for RQ1. The conclusions reached for RQ3 and RQ4, by contrast, rest substantially on practitioner survey evidence and analytical argument rather than peer-reviewed archival findings, and should be read as plausible hypotheses that the research agenda in Section 7 is designed to test, not as established empirical results.

6. Implications

For standard-setters, the priority is to monitor how the temporary IAS 12 and ASC 740 exceptions perform in practice and to consider, once sufficient implementation experience accumulates, whether permanent guidance on the interaction between ordinary deferred tax principles and Pillar Two deferred taxes is warranted, particularly given that the IAS 12 exception currently carries no sunset date.

For preparers and auditors, the literature points toward sustained investment in integrated data platforms that connect consolidation, tax-provision, and CbCR systems; in internal controls specifically designed around GloBE calculations and elections (including safe-harbour elections); and in disclosure processes capable of meeting both the qualitative exposure disclosures required before legislation takes effect and the quantitative current-tax disclosures required once it does.

For investors and analysts, the expectation of increased effective-tax-rate volatility as jurisdictions phase in UTPR and QDMTT rules at different speeds, combined with the complexity of the new tax footnote disclosures, implies a need for revised models of what constitutes a sustainable, comparable ETR across multinational peer groups.

For researchers, the 2024–2026 implementation period offers what is, in effect, a natural experiment for studying book-tax interactions under a supranational minimum tax: archival researchers can now observe actual reported ETRs, deferred tax balances, and disclosure choices under a regime whose accounting treatment was, until recently, only theorised.

7. Limitations and Future Research Agenda

This review is itself constrained by the limited volume of peer-reviewed empirical scholarship available as of mid-2026, a constraint that mirrors the immaturity of the underlying literature rather than a gap in search execution. Five priorities emerge for future research:

- Archival studies of the impact of Pillar Two on reported effective tax rates, deferred tax balances, and earnings quality using the 2024–2026 reporting cycles now available.
- Cross-country comparisons of QDMTT design choices and their accounting consequences, extending the theoretical work of Devereux, Vella and Wardell-Burrus (2022) into empirical territory.
- Qualitative and survey research on implementation costs, systems investment, and organisational responses within tax and finance functions.
- Event-study and valuation research examining capital-market reactions to Pillar Two-related disclosures, building on early practitioner analysis of equity-valuation exposure.
- Research on the interaction of Pillar Two with adjacent reforms — public country-by-country reporting, the EU's CSRD tax-transparency requirements, and domestic digital-services taxes, an area where the digital-reporting infrastructure literature and the accounting-recognition literature reviewed here are likely to increasingly intersect.

8. Conclusion

This paper set out to close a specific gap identified in Section 1.1: the absence of a dedicated systematic review of the accounting-recognition dimension of the OECD's Pillar Two global minimum tax, as distinct from the adjacent and more empirically developed literature on digital-reporting compliance infrastructure. Guided by the conceptual framework in Figure 1 and organised around the four research questions set out in Section 1.3, the review has shown that Pillar Two's defining feature , anchoring a supranational minimum tax base directly in consolidated financial accounting income, creates an unprecedented interdependence between tax law and financial reporting (RQ1), that the IASB and FASB have so far responded with temporary, open-ended recognition exceptions that converge on outcome but diverge in doctrine (RQ2), that this has generated substantial disclosure and systems-integration burden for preparers and auditors (RQ3), and that effective-tax-rate volatility, earnings-management incentives, and capital-market effects remain largely anticipated rather than empirically documented (RQ4).

In addressing these questions, the paper makes the three contributions set out in Section 1.2: a structured synthesis of a literature that had not previously been organised around an explicit conceptual framework; an explicit mapping of where IAS 12 and ASC 740 currently converge and where that convergence may prove fragile; and a research agenda that identifies precisely where archival, cross-country, and capital-markets evidence is now obtainable but has not yet been produced. Taken together, these contributions reposition Pillar Two from a topic treated primarily as a compliance and systems problem, the framing of the one existing adjacent SLR, to one that is squarely an accounting-recognition and reporting-quality problem, with its own theoretical grounding in agency theory, institutional theory, and information economics (Section 5).

Pillar Two represents one of the most significant developments in international taxation in decades, and its consequences for financial accounting and reporting are equally significant. The regime creates simultaneous technical challenges for preparers and auditors and genuine opportunities for accounting researchers, and it does so at a moment, the 2024–2026 implementation period, when the archival data needed to study those opportunities empirically is, for the first time, becoming available. The research agenda set out in Section 7 is intended as a starting point for that empirical programme, not a substitute for it.

References

Anjarwi, A. W., Che Azmi, A., Hidayat, K., Ranatarisza, M. M., & Ningsih, D. N. C. (2026). Digital reporting and the global minimum tax: OECD Pillar Two implementation. Policy Design and Practice, 9(1), 299–324.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101.

Denyer, D., & Tranfield, D. (2009). Producing a systematic review. In D. A. Buchanan & A. Bryman (Eds.), The Sage Handbook of Organizational Research Methods (pp. 671–689). Sage.

Devereux, M., Vella, J., & Wardell-Burrus, H. (2022). Pillar 2: Rule order, incentives, and tax competition. Working paper, Oxford University Centre for Business Taxation.

EY. (2023). Amendments to IAS 12 — International tax reform: Pillar Two model rules. EY Global IFRS Technical Resources.

Faulhaber, L. V. (2023). Pillar Two's built-in escape hatch. National Tax Journal, 76(1), 193–232.

Financial Accounting Standards Board (FASB) staff. (2023). Staff guidance on the application of ASC 740 to the OECD Pillar Two (GloBE) minimum tax.

Hanlon, M. (2023). The use of accounting information in the tax base in the Pillar 2 global minimum tax: A discussion of the rules, potential problems, and possible alternatives. Fiscal Studies, 44(1), 37–52.

Hanlon, M., & Nessa, M. (2023). The use of financial accounting information in the OECD BEPS 2.0 project: A discussion of the rules and concerns. National Tax Journal, 76(1), 193–232.

Hanlon, M., Maydew, E. L., & Shevlin, T. (2008). An unintended consequence of book-tax conformity: A loss of earnings informativeness. Journal of Accounting and Economics, 46(2–3), 294–311.

Hanlon, M., & Shevlin, T. (2005). Book-tax conformity for corporate income: An introduction to the issues. In J. M. Poterba (Ed.), Tax Policy and the Economy (Vol. 19, pp. 101–134).

NBER.

International Accounting Standards Board (IASB). (2023). Amendments to IAS 12 — International tax reform: Pillar Two model rules.

Organisation for Economic Co-operation and Development (OECD). (2021). Tax challenges arising from the digitalisation of the economy — Global anti-base erosion model rules (Pillar Two).

Organisation for Economic Co-operation and Development (OECD). (2022–2026). Administrative Guidance on the global anti-base erosion (GloBE) rules (successive releases).

PwC. (2025). Global implementation of Pillar Two: Impact on deferred taxes and financial statement disclosures. PwC Viewpoint In Depth.

Saunders, M., Lewis, P., & Thornhill, A. (2019). Research Methods for Business Students (8th ed.). Pearson.

Tørsløv, T., Wier, L., & Zucman, G. (2023). The missing profits of nations. Review of Economic Studies, 90(3), 1499–1534.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. British Journal of Management, 14(3), 207–222.

Journal of Financial and Management Sciences, 2 (3) 330 –347, (2026)

DOI: https://doi.org/10.70970/kfhr4e38

Deploying Automated Shut-Off Technology and Water Filtration Systems to reduce water loss caused bybdamaged pipelines in Rwanda

Rumanzi Jean De Dieu, Dr. Nteziriza Nkerabahizi Josbert

Received: September 6, 2026

Accepted: September 8, 2026
Published online: September 10, 2026

Abstract

Water loss and water quality deterioration remain major challenges for water utilities, particularly where pipeline leakages, damaged infrastructure, and delayed fault response contribute to Non-Revenue Water (NRW) and contamination risks. This study designed, developed, and evaluated an Internet of Things (IoT)-based automated shut-off and water filtration system for WASAC Remera Branch, Rwanda. A Design-Based Research (DBR) approach combined with experimental testing was adopted. Data were collected through observation, interviews with WASAC technical personnel, system measurements, and experimental testing. The developed prototype integrated an ESP32 microcontroller, flow and pressure sensors, leak detection sensors, automated control components, communication technologies, a water filtration unit, and a web-based monitoring platform. Rule-based algorithms were applied to sensor readings to identify abnormal pipeline conditions and automatically initiate appropriate response actions. Findings from functional testing demonstrated that the system successfully detected leakage conditions, monitored pipeline parameters, generated alerts, recorded system events, and initiated automated shut-off actions when abnormal conditions were detected. The integration of automated monitoring, rapid leak response, and water filtration provided a practical mechanism for minimizing the consequences of pipeline failures while supporting water quality management. The study concluded that integrating IoT-based monitoring, automated shut-off technology, and water filtration provides a promising approach to improving smart water distribution management. It recommends that WASAC conduct further field testing in selected high-risk distribution zones before considering wider implementation.

Keywords: Automated Shut-Off System, Water Filtration System, Internet of Things (IoT), Water Loss, Pipeline Leakage, Water Quality, Smart Water Management.

jeandedieurumanzi@gmail.com

Department of Infromation Technology, University of Kigali, Rwanda

© The Author(s) 2026. Published by Journal of Financial and Management Sciences. This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at http://creativecommons.org/licences/by/4.0/legalcode

1. Introduction

Water loss and deterioration of water quality remain major challenges in water distribution systems worldwide. Non-Revenue Water (NRW), arising from pipeline leakages, bursts, infrastructure failures, and operational inefficiencies, reduces the sustainability and efficiency of water utilities. Damaged pipelines may also allow contaminants to enter distribution networks, creating additional risks to water quality. Globally, aging infrastructure, delayed leakage detection, and dependence on manual monitoring continue to contribute to water wastage, particularly in developing countries where real-time monitoring technologies remain limited (International Water Association [IWA], 2022; World Bank, 2021).

Recent developments in the Internet of Things (IoT), embedded systems, automation, and water treatment technologies provide opportunities for addressing these challenges. IoT-enabled sensors can continuously monitor flow and pressure conditions, while automated shut-off mechanisms can rapidly isolate damaged pipeline sections when abnormal conditions are detected. Water filtration technologies can further support the removal of impurities and contaminants. Integrating these technologies therefore provides a potential approach for reducing water loss, protecting water quality, and improving the operational efficiency of water distribution systems (Singh & Turaga, 2020; Akhter & Ahmed, 2020).

In Rwanda, the Water and Sanitation Corporation (WASAC) has made progress in expanding water access and improving water infrastructure; however, pipeline leakages, water losses, and water quality management remain important operational concerns. **At WASAC Remera Branch,** damaged pipelines and delayed fault response can contribute to unnecessary water wastage, increased operational costs, and potential contamination. Existing monitoring and control practices largely depend on manual intervention, which limits rapid fault detection and response (WASAC, 2024).

The problem addressed by this study was therefore the limited capacity of the existing water distribution system to provide real-time detection and automated response to damaged pipelines. Manual identification and isolation of pipeline failures can delay corrective actions, increase water loss, interrupt water services, and expose the distribution system to water quality risks. An integrated solution combining real-time monitoring, automated pipeline isolation, and water filtration was therefore required to improve water distribution management at WASAC Remera Branch.

Accordingly, this study aimed to design and deploy an IoT-based automated shut-off technology integrated with a water filtration system to reduce water loss and improve water quality caused by damaged pipelines at WASAC Remera Branch. Specifically, the study sought to:

i. Analyze the major causes of water loss and water contamination in WASAC Remera Branch pipeline networks.
ii. Design an IoT-based automated shut-off system for detecting and isolating damaged pipelines.
iii. Develop and integrate a water filtration system for improving water quality within the distribution network.
iv. Implement and test the proposed automated shut-off and water filtration prototype.
v. Evaluate the effectiveness of the proposed system in reducing water loss, improving water quality, and enhancing operational efficiency.
vi.

2. LITERATURE REVIEW

This section reviews the key concepts, theoretical foundations, and empirical studies related to IoT-based automated shut-off systems and water filtration. It also presents the conceptual framework and identifies the research gap addressed by the study.

2.1 Conceptual Review

2.1.1 Automated Shut-Off Systems

Automated shut-off systems use sensors, controllers, communication modules, and actuators to detect abnormal pipeline conditions and automatically regulate water flow. These systems support rapid isolation of damaged pipeline sections, thereby reducing water loss, operational costs, and dependence on manual intervention (Ahmed & Hassan, 2023; Patel et al., 2024).

2.1.2 Water Filtration Systems

Water filtration systems remove physical, chemical, and biological contaminants using technologies such as sediment filters, activated carbon, and membrane filtration. Their integration with automated monitoring systems can improve water quality, particularly where damaged pipelines create contamination risks (Zhang & Li, 2023; Johnson et al., 2024).

2.1.3 Internet of Things (IoT) and Smart Water Management

IoT enables interconnected sensors and devices to collect, transmit, and process real-time information. Within water distribution systems, IoT supports continuous monitoring of flow, pressure, and pipeline conditions, allowing faster detection and response to faults (Khan et al., 2023; Singh & Verma, 2024).

2.1.4 Water Loss, Pipeline Leakage and Water Quality

Water loss results from leakages, pipeline bursts, meter inaccuracies, unauthorized consumption, and operational inefficiencies. Pipeline damage can also allow contaminants to enter distribution networks, affecting water quality and increasing operational costs. Real-time leak detection, automated isolation, and filtration therefore provide complementary approaches for reducing NRW and protecting water quality (World Water Council, 2023; Ncube & Moyo, 2024; WHO, 2023).

2.2 Theoretical Review

The study was informed by **Systems Theory, Diffusion of Innovation Theory, Technology Acceptance Model (TAM), and Control Systems Theory**. Systems Theory explains how sensors, controllers, communication modules, valves, and filtration components operate as an integrated system. Diffusion of Innovation Theory and TAM explain the adoption and acceptance of technological innovations, while Control Systems Theory explains how sensor feedback can trigger automated corrective actions when abnormal pipeline conditions are detected.

2.3 Empirical Review

Empirical studies indicate that aging infrastructure, corrosion, excessive pressure, inadequate maintenance, and delayed fault detection contribute to water loss and contamination (Ncube & Moyo, 2024; Garcia et al., 2023; Patel et al., 2023). Other studies demonstrate that IoT-enabled flow and pressure monitoring improves leak detection and response time, while filtration technologies improve water quality (Zhang & Li, 2023; Johnson et al., 2024; Chen & Wang, 2024). However, many existing solutions address monitoring, automated control, or filtration separately rather than integrating them within one system.

2.4 Conceptual Framework

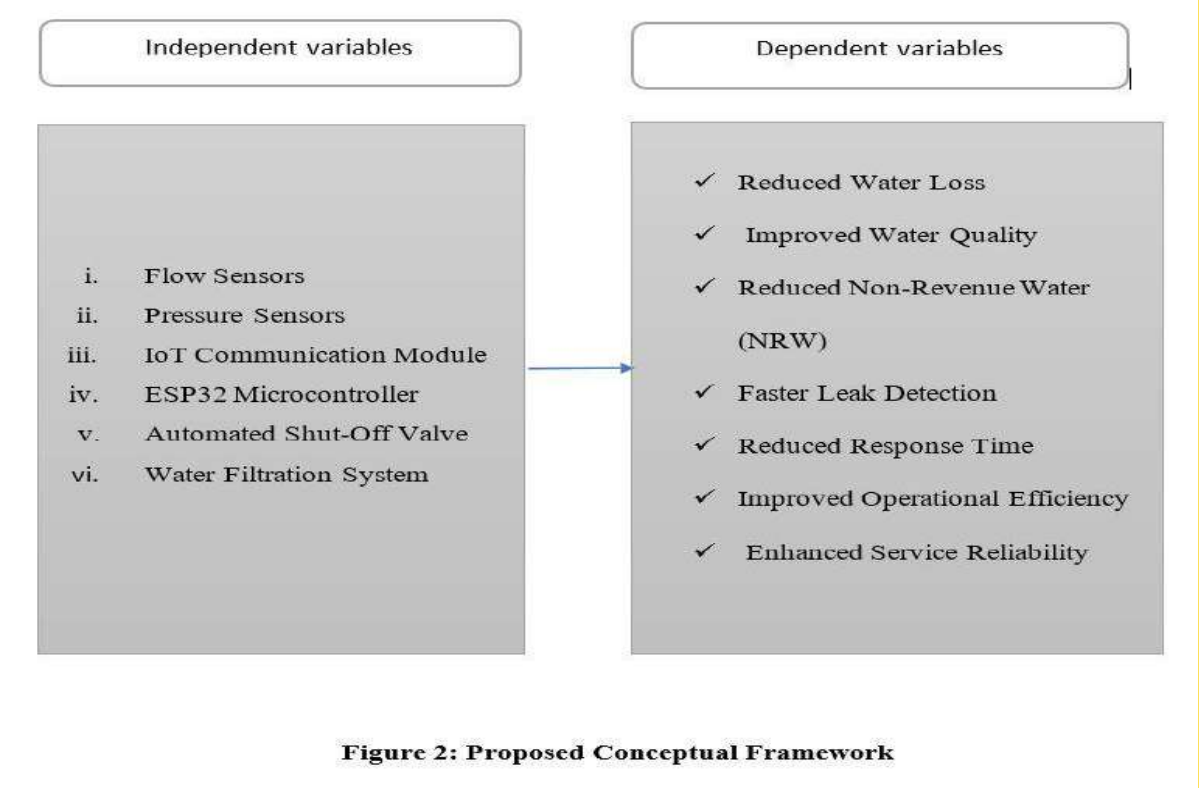


Figure 2: Proposed Conceptual Framework

2.5 Research Gap

Existing studies have demonstrated the effectiveness of IoT monitoring, leak detection, automated control, and water filtration; however, these technologies are commonly investigated independently. Limited research has integrated real-time pipeline monitoring, automated leak isolation, and water filtration within a single system, particularly within Rwanda's public water utility environment. This study addressed this gap by developing and evaluating an integrated IoT-based automated shut-off and water filtration system for WASAC Remera Branch.

3. Methodology

3.1 Research Design

The study adopted a Design-Based Research (DBR) approach combined with an experimental research design. DBR guided the identification of the water distribution problem, development of the IoT-based solution, and refinement of the prototype through testing. Experimental testing was conducted using simulated leakage conditions to assess the system's ability to detect pipeline failures and automatically activate shut-off actions.

3.2 Sampling

Purposive sampling was used to select approximately 20–30 WASAC engineers, technicians, and operational staff with relevant experience in water distribution and pipeline management. Selected pipeline sections and simulated leakage scenarios were also used for prototype evaluation.

3.3 Data Collection

Both qualitative and quantitative data were collected through observation, interviews, and experimental testing. An interview guide and observation checklist were used alongside flow and pressure sensors and system-generated logs. The system recorded flow rates, pressure measurements, leakage events, valve activation, and response times.

3.4 System Development and Implementation

The prototype integrated flow and pressure sensors, an ESP32 microcontroller, Wi-Fi/GSM communication, an automated shut-off valve, a filtration unit, and a web-based monitoring dashboard. The ESP32 processed sensor readings using predefined rules and automatically closed the valve when abnormal flow or pressure conditions indicated leakage. The system also transmitted alerts, updated the dashboard, and stored leakage events.

The Agile development methodology guided requirements identification, system design,

development, integration, and testing. Arduino IDE was used for ESP32 programming, while PHP/Laravel, MySQL, HTML, CSS, JavaScript, and Bootstrap supported development of the monitoring platform.

3.5 Data Analysis

Qualitative interview data were analyzed using thematic analysis, while quantitative prototype data were analyzed using descriptive statistics, including frequencies, percentages, averages, and response times. System performance was evaluated using indicators such as leak detection accuracy, response time, valve activation success rate, and system reliability.

3.6 Ethical Considerations

Permission was obtained from relevant authorities, participation was voluntary, and respondents were informed about the study. Confidentiality, privacy, transparency, and research integrity were maintained throughout data collection, analysis, and reporting.

4. Findings and Discussion

4.1 Analysis of the Existing Water Distribution System

The findings showed that the existing water distribution system at WASAC Remera Branch largely depended on manual monitoring, routine inspections, customer reports, and manual operation of isolation valves. Consequently, pipeline leakages could remain undetected until considerable water loss had occurred, contributing to increased Non-Revenue Water (NRW), maintenance costs, service interruptions, and potential water contamination. These limitations demonstrated the need for real-time monitoring and automated fault response.

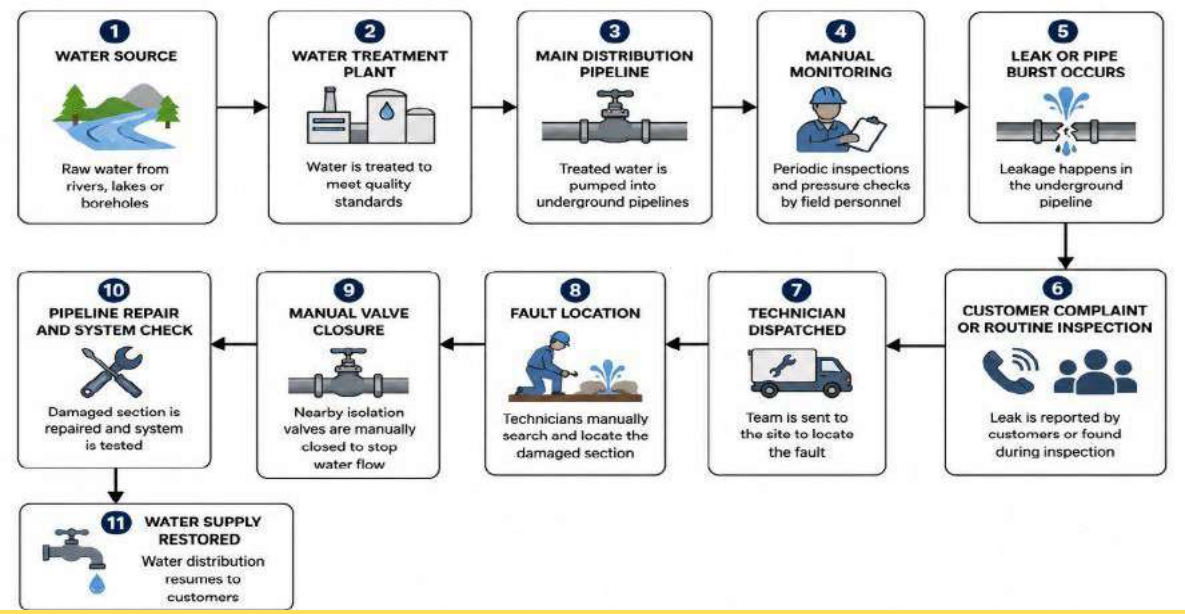


Figure2: Existing Water Distribution System Workflow

4.2 Development of the Proposed IoT-Based System

The developed system integrated flow, pressure, humidity, and leak sensors with an ESP32 microcontroller, automated shut-off valve, communication technologies, and a multi-stage filtration unit. Sensor information was processed in real time, enabling the system to detect abnormal conditions and automatically isolate damaged pipeline sections. The filtration unit incorporated sediment filtration, activated carbon, and ion exchange resin to support water quality improvement.

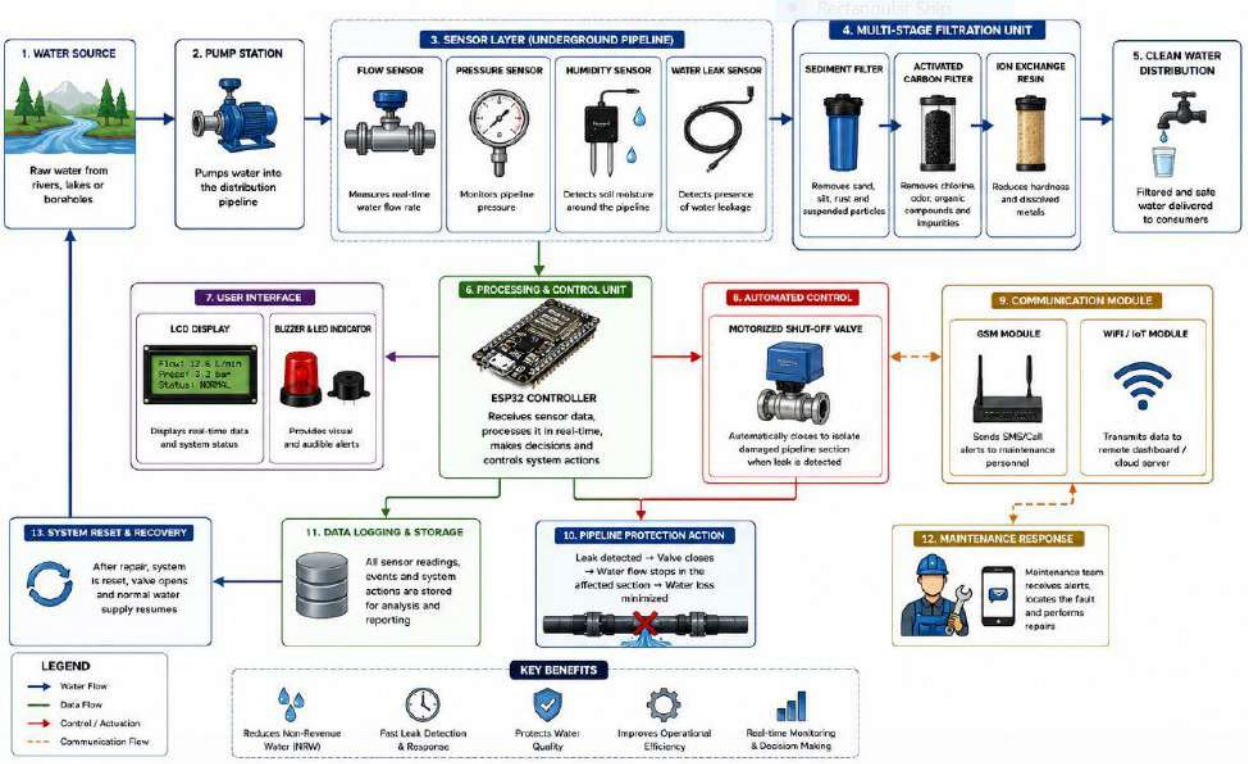


Figure3: Overall System Architecture of the Proposed Smart Underground Water Filtration System

4.3 Prototype Implementation

The prototype successfully integrated the physical pipeline, sensing devices, ESP32 controller, filtration unit, motorized valve, monitoring display, and communication components. This implementation demonstrated the practical integration of real-time monitoring, automated leak detection, shut-off control, and water filtration within a single system.

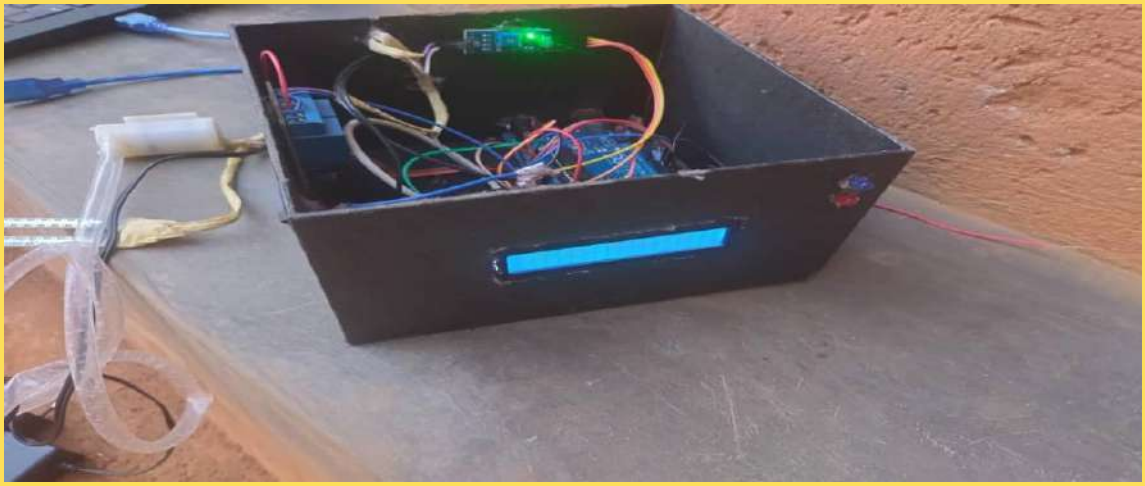


Figure4: Final Developed Prototype

4.4 Leak Detection and Automated Shut-Off Results

Functional testing showed that the flow, pressure, humidity, and water leak sensors operated successfully. When leakage was detected, the ESP32 processed the abnormal condition and automatically activated the motorized shut-off valve. The system also generated alerts and provided monitoring information, demonstrating its ability to respond automatically to pipeline failures.

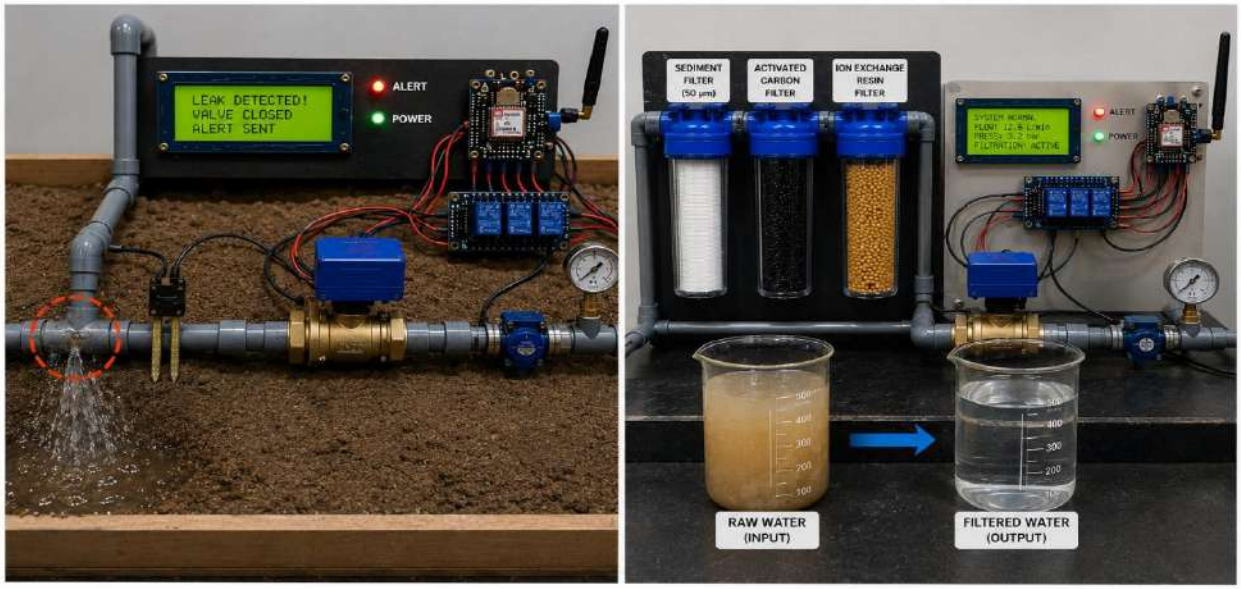
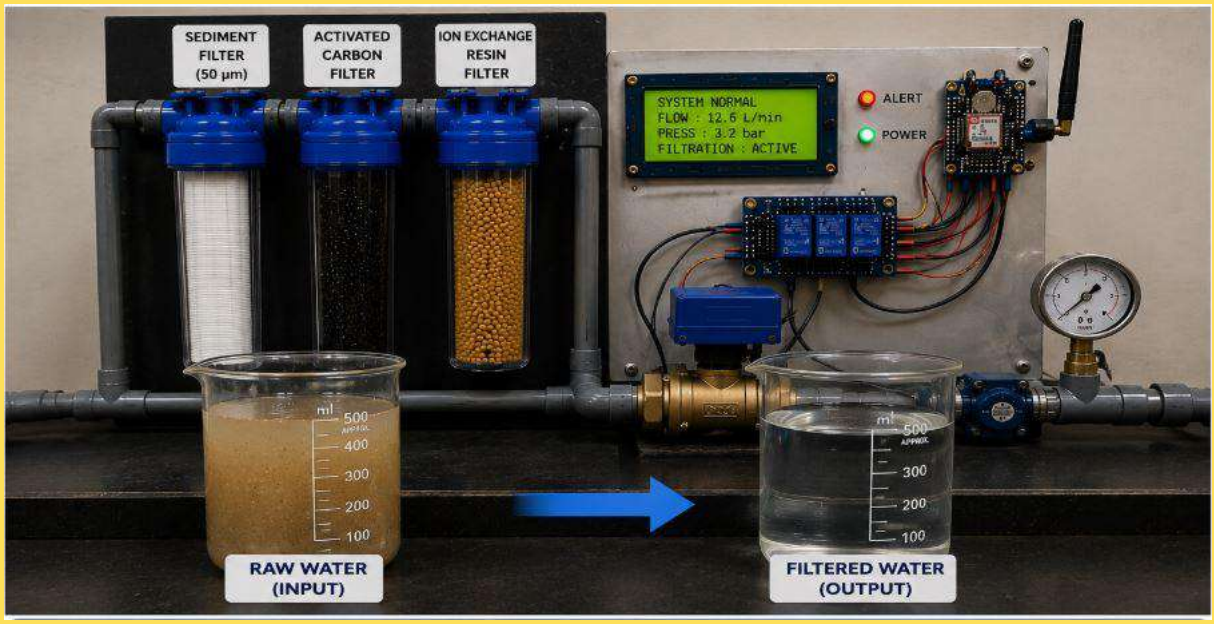


Figure5: Leak Detection and Automated Shut-Off during System Testing]

The performance tests further confirmed that normal water flow did not trigger unnecessary shut-off, while abnormal flow and pressure conditions generated leakage alerts and activated the automated valve. Leakage events were successfully stored in the system logs, and normal monitoring resumed after the system returned to normal conditions. These findings demonstrate the functional feasibility of automated leak detection and response for reducing prolonged water loss.

4.5 Water Filtration Results

The filtration unit operated successfully during prototype testing. Water passed through sediment filtration, activated carbon, and ion exchange resin, and the resulting output showed improved clarity and reduced visible impurities compared with untreated water. The findings demonstrate that filtration could be incorporated alongside automated leak management to support water quality improvement.



Fire:6: Filtered Water Output after System Operation]

4.6 Real-Time Monitoring and System Evaluation

The developed web-based interfaces supported real-time monitoring, leakage detection, system logging, and automated shut-off status. During testing, leakage conditions were recorded together with sensor values and relay status, while system logs maintained historical information for monitoring and analysis.

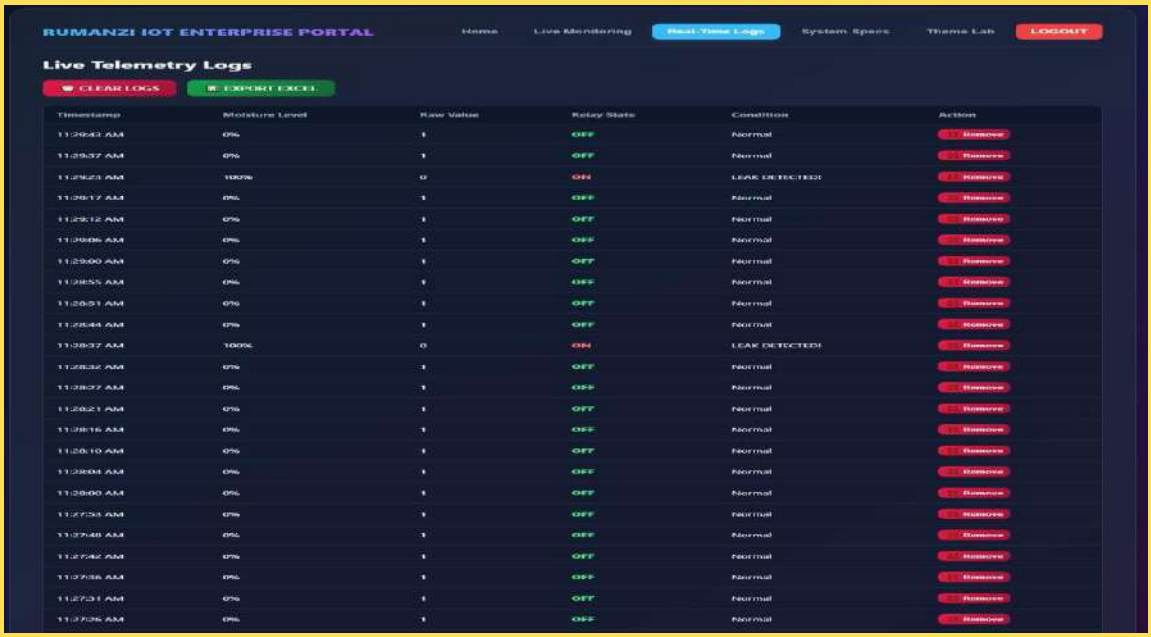


Figure7: Automated Shut-Off Valve Control and Status Interface

Overall, the functional evaluation showed that real-time monitoring, leak detection, automated shut-off, alert generation, data logging, web monitoring, and water filtration all passed the prototype tests. The findings therefore demonstrate the functional feasibility of integrating IoT monitoring, automated pipeline isolation, and water filtration within a single smart water management system.

5. Conclusion and Recommendations

5.1 Conclusion

The study concluded that the developed Smart Underground Water Filtration System provides a practical approach for reducing water loss and improving water quality at WASAC Remera Branch. By integrating IoT sensors, an ESP32 microcontroller, automated shut-off technology, GSM/Wi-Fi communication, and multi-stage water filtration, the system enabled real-time pipeline monitoring, leak detection, automatic isolation of damaged sections, and water filtration. Prototype testing confirmed that the system successfully performed its intended functions, demonstrating its potential to reduce Non-Revenue Water (NRW), improve operational efficiency, enhance water quality, and support reliable water distribution management.

5.2 Recommendations

WASAC should conduct pilot deployments of the developed system in selected high-leakage water distribution zones before considering large-scale implementation. The organization should progressively adopt IoT-based pipeline monitoring, automated shut-off mechanisms, and integrated filtration technologies to improve leak detection, reduce water loss, and protect water quality. WASAC technical personnel should also receive regular training in operating and maintaining these technologies, while government agencies and policymakers should support investment and policies that promote smart water infrastructure in Rwanda.

5.3 Suggestions for Future Research

Future studies should test the system on a larger scale under actual water distribution conditions and assess its long-term reliability, scalability, maintenance requirements, economic feasibility, and environmental impact. Further research could also integrate Artificial Intelligence and Machine Learning for predictive pipeline maintenance, investigate communication technologies such as LoRaWAN, NB-IoT, and 5G, and evaluate more advanced filtration technologies for removing chemical, metallic, and microbial contaminants.

REFERENCES

Adu-Manu, K. S., Tapparello, C., Heinzelman, W., Katsriku, F. A., & Abdulai, J. D. (2017). Water quality monitoring using wireless sensor networks: Current trends and future research directions. *ACM Transactions on Sensor Networks, 13*(1), Article 4.

Ahmed, U., Mumtaz, R., Anwar, H., Mumtaz, S., & Qamar, A. M. (2020). Water quality monitoring: From conventional to emerging technologies. *Water Supply, 20*(1), 28–45.

Akhter, F., Siddiquei, H. R., Alahi, M. E. E., & Mukhopadhyay, S. C. (2021). An IoT-enabled portable sensing system with MWCNTs/PDMS sensor for nitrate detection in water. *Measurement, 178*, 109424.

Gautam, J., Chakrabarti, A., Agarwal, S., Singh, A., Gupta, S., & Singh, J. (2020). Monitoring and forecasting water consumption and detecting leakage using an IoT system. *Water Supply, 20*(3), 1103–1113.

Geng, B., Fan, J., Shi, M., Zhang, S., & Li, J. (2022). Control of maximum water age based on total chlorine decay in secondary water supply system. *Chemosphere, 287*, 132198.

Khutsoane, O., Isong, B., Gasela, N., & Abu-Mahfouz, A. M. (2020). WaterGrid-Sense: A LoRa-based sensor node for industrial IoT applications. *IEEE Sensors Journal, 20*(5), 2722–2729.

Li, L., & Chen, H. (2023). Artificial intelligence and Internet of Things-based leak detection method for the water supply network. *International Transactions on Electrical Energy Systems, 2023*, 3443047.

Li, R., Yang, X., Lu, Z., & Chen, C. (2019). Research on water quality monitoring system based on IoT technology. In *2019 4th International Conference on Control, Robotics and Cybernetics (CRC)* (pp. 321–324). IEEE.

Narayana, C. L., Singh, R., & Gehlot, A. (2020). Design and development of a system to detect third-party damages of an oil pipeline using IoT. *International Journal of Advanced Science and Technology, 29*(5), 9676–9682.

Singh, M., & Ahmed, S. (2021). IoT based smart water management systems: A systematic review. *Materials Today: Proceedings, 46*(11), 5211–5218.

World Health Organization. (2022). *Guidelines for drinking-water quality: Fourth edition incorporating the first and second addenda*. World Health Organization.

World Bank. (2016). *The challenge of reducing non-revenue water (NRW) in developing countries: How the private sector can help*. World Bank Group.

Water and Sanitation Corporation. (2024). *Annual report 2023–2024*. WASAC.

Zhang, Y., Wang, J., Shi, W., Li, J., & Li, X. (2021). Design of water quality monitoring system based on LoRaWAN technology. In *2021 IEEE 3rd International Conference on Cloud and Big Data Computing (CBD)* (pp. 132–135). IEEE.

Zhang, X., Zhao, X., Li, R., Mao, G., Tillotson, M. R., Liao, X., Zhang, C., & Yi, Y. (2020). Evaluating the vulnerability of physical and virtual water resource networks in China's megacities. *Resources, Conservation and Recycling, 161*, 104972.

Journal of Financial and Management Sciences, 2 (3) 348 –365, (2026)

DOI: https://doi.org/10.70970/nwherf95

Public Relations, Communication Strategies and Mining Project Outcomes: Evidence from Nyakabingo Mine, Rulindo District, Rwanda

Safari Charles and Dr. Naomi Njoroge (PhD)

Received: May 11, 2026

Revised: July 8, 2026
Accepted: August 13, 2026
Published online: September 10, 2026

Abstract

Effective public relations (PR) communication is increasingly recognized as a pivotal driver of mining project outcomes, yet empirical evidence from Sub-Saharan Africa remains scarce. This study investigated the influence of public relations communication strategies on project outcomes at Nyakabingo Mine in Rulindo District, Northern Rwanda, one of Rwanda's flagship 3T (Tin, Tantalum, and Tungsten) mining operations. Anchored in Stakeholder Theory (Freeman, 1984), the Shannon-Weaver Communication Model (1949), and Benoit's Image Restoration Theory (1995), the study employed a mixed-methods descriptive survey and case study design. A sample of 346 respondents was drawn from a population of 1,800 stakeholders using stratified random sampling for mine workers (n=327), and census sampling for corporate management (n=9) and external stakeholders (n=10). Data were collected through pretested structured questionnaires, semi-structured interview guides, and document analysis. Quantitative data were analyzed using SPSS version 28 via descriptive and inferential statistics, while qualitative data were subjected to thematic analysis. Results revealed a strong, positive, and statistically significant effect of PR communication strategies on project outcomes (β=2.280; R^2=0.724; F=20.948; p=0.002). The regression model explained 72.4% of the variance in project outcomes, confirming PR as the strongest predictor among the communication variables examined. Key PR activities, including community engagement events, proactive crisis communication, and reputation management, were found to enhance stakeholder trust, collaboration, and social license to operate. The study recommends the institutionalization of strategic, proactive, and stakeholder-segmented PR frameworks in mining project management. These findings contribute original empirical evidence to the limited body of knowledge on communication-driven project success in Rwanda's extractive sector.

Keywords: Public relations strategies, mining project outcomes, stakeholder communication, social license to operate

ndutanjoroge600@gmail.com
Mount Kigali University, Kigali, Rwanda
© The Author(s) 2026. Published by Journal of Financial and Management Sciences. This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at http://creativecommons.org/licences/by/4.0/legalcode

1. Introduction

Mining operations worldwide are characterized by intricate stakeholder networks, significant environmental and social impacts, and intense regulatory scrutiny. Within this complexity, the ability of mining companies to communicate effectively is not merely to disseminate information, but to manage perceptions, build trust, and foster collaborative relationships, has emerged as a critical determinant of project success. Public relations (PR) communication, in particular, occupies a strategic position in this communication ecosystem, serving as the primary mechanism through which mining entities engage diverse stakeholders, manage their corporate image, and navigate the social and political terrain of resource extraction.

Rwanda's mining sector has experienced significant formalization and expansion over the past decade, contributing over 2.5% to national GDP and serving as one of the country's largest sources of foreign exchange (Rwanda Mines, Petroleum and Gas Board [RMB], 2023). The Government of Rwanda, through the Rwanda Mining Policy (2021) and the National Strategy for Transformation (NST1) 2017–2024, has emphasized inclusive governance, transparency, and stakeholder collaboration as foundational pillars of sustainable mining. These policy imperatives directly implicate the quality and design of communication strategies employed by mining operators. Despite this policy momentum, empirical research examining how specific communication strategies, especially PR influence actual project outcomes in Rwandan mining contexts remains sparse.

Nyakabingo Mine, located in Rulindo District of Northern Rwanda and operated by Trinity Metals Ltd, presents a particularly instructive case study. As a flagship 3T (Tin, Tantalum, and Tungsten) operation, the mine operates within a web of stakeholders including government regulatory agencies, local communities across multiple cells, civil society, and international buyers. Preliminary observations prior to this study indicated that while the mine has generated employment and contributed to local infrastructure, persistent tensions related to environmental impacts, community consultation, and information asymmetry suggest potential gaps in communication strategy implementation. These dynamics make Nyakabingo Mine an ideal site for examining the relationship between PR communication and project outcomes.

The purpose of this study is therefore to investigate the influence of public relations communication strategies on project outcomes at Nyakabingo Mine. Specifically, the study examines how community engagement events, responsiveness to stakeholder concerns, and reputation management; the core dimensions of PR in this context shape measurable project outcomes, including stakeholder satisfaction, conflict resolution, attainment of social license to operate, environmental sustainability, and economic benefits. By providing empirical evidence from a context where such research is notably absent, this paper contributes original insights that are relevant to mining practitioners, policymakers, and academics interested in stakeholder-communication-outcome nexuses in Sub-Saharan Africa's extractive sector.

2. Literature Review

2.1 Theoretical Framework

This study draws upon three complementary theoretical frameworks. Stakeholder Theory, advanced by Freeman (1984), posits that organizational success is contingent upon the effective management of relationships with all relevant parties who can affect or are affected by organizational decisions. In the mining context, stakeholders range from government regulators and local communities to employees and international partners. The theory underpins the premise that PR strategies must engage this diversity of stakeholders meaningfully and equitably, not merely as a formality, but as a strategic imperative for legitimacy and project continuity.

The Shannon and Weaver (1949) Communication Model provides a structural lens for examining information flow between mining entities and their publics. The model's components; sender, message, channel, receiver, and feedback, illuminate the mechanics of effective PR communication, particularly regarding channel selection, message clarity, and the critical role of feedback loops in two-way engagement. While critics note the model's linear limitations (Lorena, 2019), its systematic framework remains useful for diagnosing communication failures and evaluating the technical adequacy of information dissemination.
Benoit's Image Restoration Theory (1995) is particularly germane to PR strategy in the mining industry, where organizations frequently face public scrutiny, environmental concerns, and community grievances. The theory outlines strategies ranging from denial and evasion to corrective action and mortification that organizations employ to manage their public image during periods of reputational threat. Critically, the theory also underlines the importance of proactive PR that prevents reputational damage from escalating, making it directly applicable to mining contexts where community relations can shift rapidly.

2.2 Public Relations and Project Outcomes in Mining Contexts

Public relation in institutional and project contexts has evolved considerably beyond promotional communication to encompass strategic relationship management, crisis communication, and community development facilitation (Chartered Institute of Public Relations [CIPR], 2019). In the extractive sector, the International Finance Corporation (IFC, 2015) explicitly recommends that PR strategies be integrated into broader stakeholder engagement frameworks to minimize social risks and sustain the social license to operate (SLO), a concept that captures the ongoing approval of host communities for mining operations.

Empirical research affirms the centrality of PR to mining project outcomes. Blesia (2021) demonstrated in a Papua New Guinea case study that proactive, community-inclusive PR strategies significantly reduced project conflicts and enhanced operational continuity. Pratama et al. (2022) found that PR campaigns centered on environmental stewardship improved community trust and reduced opposition to mining activities in Indonesian contexts. Wambugu and Murithi (2022) in Kenya established that dialogue-based PR strategies led to smoother project operations and sustained local community support, attributing this success to the early and genuine integration of community voices into project decision-making.

Conversely, reactive PR characterized by communication efforts triggered primarily by crises rather than proactive planning, has consistently demonstrated limited effectiveness in sustaining positive stakeholder relationships (Wambu & Paul, 2023). The Project Management Institute (PMI, 2013) corroborated this, reporting that organizations with robust, proactive communication strategies experienced significantly fewer project failures and achieved better alignment with project goals, timelines, and budgets. In the African context, the African Development Bank (AfDB, 2020) emphasized that effective PR is particularly critical in regions where information asymmetry and weak institutional trust can rapidly erode community support for extractive projects.

In Rwanda specifically, prior studies have highlighted the importance of communication intermediaries such as local leaders and community forums in shaping perceptions of mining projects (Uwizeyimana & Mutangana, 2022; Musoni, 2021). However, these studies did not systematically examine the structural PR practices of mining companies or quantitatively assess their influence on measurable project outcomes. This study addresses that gap directly.

2.3 Research Gap

Despite the growing body of literature on stakeholder communication in mining, significant contextual and methodological gaps persist. Most empirical studies originate from Australia, Europe, or West Africa, with limited attention to East African and Rwandan contexts. Furthermore, existing studies tend to examine PR and community relations qualitatively, without deploying regression-based analyses to quantify the strength of the PR-outcome relationship. This study addresses both gaps by providing original quantitative evidence from a Rwandan mining context, while integrating qualitative narratives to enrich interpretation.

3. Methodology

3.1 Research Design

The study employed a convergent parallel mixed-methods design, integrating descriptive survey and case study approaches (Creswell & Creswell, 2018). This design enabled simultaneous collection of quantitative data (structured questionnaires) and qualitative data (semi-structured interviews and document analysis), which were subsequently triangulated to yield comprehensive insights. The case study approach facilitated contextually rich analysis of communication dynamics unique to Nyakabingo Mine, while the descriptive survey enabled statistical generalization within the studied population.

3.2 Study Site and Population

The study was conducted at Nyakabingo Mine in Rulindo District, Northern Province, Rwanda, a strategically significant 3T mining operation managed by Trinity Metals Ltd under the oversight of the Rwanda Mines, Petroleum and Gas Board (RMB). The total target population comprised 1,800 stakeholders, distributed as follows: 1,781 mine workers (permanent and casual), 9 corporate management team members, and 10 external stakeholders including school principals, health center administrators, district RMB representatives, community leaders, and representatives from public security and labor organizations.

3.3 Sampling

A multi-stage sampling procedure was adopted to ensure both statistical representativeness and qualitative depth. For the mine workers, Yamane's (1967) formula was applied to determine an appropriate sample size from the population of 1,781 workers at a 95% confidence level and 5% margin of error, yielding a sample of 327 respondents. Simple random sampling was then used for selection within this stratum. Corporate management (n=9) and external stakeholders (n=10) were included in their entirety using a census approach, given their small numbers and the critical qualitative insights they possess (Etikan et al., 2016). The total study sample therefore comprised 346 respondents.

3.4 Data Collection and Instruments

Three instruments were employed. First, structured questionnaires using a five-point Likert scale (1=Strongly Disagree to 5=Strongly Agree) were administered to mine workers. The PR communication scale comprised six items measuring community engagement events, responsiveness to concerns, and reputation management. The project outcomes scale comprised six items assessing timely completion, stakeholder satisfaction, conflict resolution, social license to operate, environmental sustainability, and economic benefits. Second, semi-structured interview guides were used with the 19 key informants (9 management and 10 external stakeholders).

Third, document analysis was conducted on project reports, communication logs, and policy documents. Prior to the main data collection, a pilot study was conducted with 33 respondents (approximately 10% of the main sample), following recommendations by In (2017). Validity was assessed through expert review (content validity), pilot testing (construct validity), and peer appraisal (face validity). Reliability was assessed using Cronbach's alpha. The PR Communication Strategies scale attained $\alpha=0.811$, and the Project Outcomes scale attained $\alpha=0.744$, both exceeding the accepted threshold of 0.70 (Nunnally & Bernstein, 1994), confirming sufficient internal consistency.

3.5 Data Analysis

Quantitative data were analyzed using SPSS version 28. Descriptive statistics (means, frequencies, standard deviations) characterized the distribution of responses. Pearson correlation and linear regression analysis were employed to assess the strength, direction, and significance of the relationship between PR communication strategies (independent variable) and project outcomes (dependent variable). The regression model controlled for one predictor at a time, consistent with the study's objective-based analysis design. Qualitative data were analyzed thematically following Braun and Clarke's (2006) six-phase framework, generating themes that were triangulated with quantitative results to enhance validity.

4. Results and Discussion

4.1 Socio-Demographic Profile of Respondents

Table 1 presents the socio-demographic characteristics of the 327 questionnaire respondents. The majority were male (73.7%), reflecting the gender composition typical of Rwanda's mining sector, though the notable female representation (26.3%) aligns with Rwanda's National Gender Policy's emphasis on women's inclusion in the labor force. The dominant age cohorts were 25–34 years (36.7%) and 35–44 years (31.5%), indicating a relatively young and productive workforce. A significant proportion held primary school education (63.0%), underscoring the importance of accessible and culturally appropriate communication strategies. The majority of respondents occupied operational positions (mine staff: 89.6%), with smaller proportions in management, administration, and community liaison roles.

Table 1: Socio-Demographic Profile of Respondents (n=327)

Characteristic / Category	**Frequency (n)**	**Percentage (%)**
Gender		
Male	241	73.7%
Female	86	26.3%
Total	327	100%
Age Group		
18–24	53	16.2%
25–34	120	36.7%
35–44	103	31.5%
45–54	34	10.4%
55+	17	5.2%
Total	327	100%
Education Level		
Primary School	206	63.0%
Secondary School	102	31.2%
Diploma/Certificate	15	4.6%
Bachelor's Degree	2	0.6%
Master's Degree	2	0.6%
Total	327	100%
Position		

Characteristic / Category	Frequency (n)	Percentage (%)
Mine Staff (Miners & Technicians)	293	89.6%
Management	8	2.4%
Administrative Staff	9	2.8%
Community Liaison	4	1.2%
Other	13	4.0%
Total	327	100%

Source: Primary Data (2025)

4.2 Descriptive Statistics: PR Communication Strategies

Table 2 presents the descriptive statistics for the six items measuring public relations communication strategies at Nyakabingo Mine. Overall, respondents expressed strong agreement across all PR indicators, with item means ranging from 4.1543 to 4.3531 and an aggregate mean of 4.2408 (SD=0.8590), falling within the 'Strongly Agree' range on the Likert scale.

The highest level of agreement was recorded for the item concerning improved stakeholder collaboration through PR strategies (M=4.3531, SD=0.7657), suggesting that respondents perceive PR activities as having a tangible positive effect on inter-stakeholder relationships. Community trust-building received slightly lower agreement (M=4.1543, SD=1.0465), which, coupled with the higher standard deviation, indicates some variability in perceptions, notably among community members who may experience PR activities inconsistently. These findings are consistent with qualitative interview responses, where participants affirmed the existence of multiple PR channels at the mine including community forums, awareness campaigns, and CSR activities, but noted that engagement quality could be made more proactive and systematically targeted.

Table 2: Descriptive Statistics: PR Communication Strategies (n=327)

Statements	N	Min	Max	Mean	Std. Dev.
PR efforts at Nyakabingo Mine focus on building trust with surrounding communities.	327	1.00	5.00	4.1543	1.0465
PR initiatives effectively address local community concerns related to the mining project.	327	1.00	5.00	4.2315	0.8237
Stakeholder feedback is actively integrated into PR strategies.	327	1.00	5.00	4.2226	0.7721
The mine has a dedicated PR team that works to improve relations with all stakeholders.	327	1.00	5.00	4.2404	0.8009
PR activities contribute significantly to maintaining a positive image of the mine.	327	1.00	5.00	4.2433	0.9450
PR strategies employed have led to improved collaboration between stakeholders.	327	1.00	5.00	4.3531	0.7657
Overall / Valid N (listwise)	327	1.00	5.00	4.2408	0.8590

Source: Primary Data (2025)

4.3 Regression Analysis: PR Communication Strategies and Project Outcomes

To test the null hypothesis that 'Public relations strategies have no significant influence on project outcomes at Nyakabingo Mine,' simple linear regression was performed with PR communication strategies as the predictor and project outcomes as the dependent variable.

Table 3: Model Summary — PR Communication Strategies and Project Outcomes

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.851a	.724	.689	.09019
a. Predictors: (Constant), Public Relations Communication Strategies				

Source: Primary Data (2025)

Table 3 reveals a strong correlation between PR communication strategies and project outcomes (R=.851). The coefficient of determination (R^2=0.724) indicates that PR communication strategies explain 72.4% of the variance in project outcomes at Nyakabingo Mine. The adjusted R^2 of 0.689 confirms that this explanatory power holds when accounting for the number of predictors, indicating a robust model fit.

Table 4: ANOVA — PR Communication Strategies and Project Outcomes

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	.170	1	.170	20.948	.002b
Residual	.065	8	.008		
Total	.235	9			
a. Dependent Variable: Project Outcomes b. Predictors: (Constant), Public Relations Communication Strategies					

Source: Primary Data (2025)

The ANOVA results in Table 4 confirm the overall statistical significance of the regression model ($F=20.948$; $p=0.002 < 0.05$). This demonstrates that the relationship between PR communication strategies and project outcomes is not attributable to chance, and that PR communication explains a meaningful proportion of the systematic variation in project outcomes.

Table 5: Regression Coefficients — PR Communication Strategies and Project Outcomes

Model	B (Unstandardized)	Std. Error	Beta (Standardized)	t	Sig.
(Constant)	5.414	2.121	—	-2.552	.034
PR Communication Strategies	2.280	.498	.851	4.577	.002
a. Dependent Variable: Project Outcomes					

Source: Primary Data (2025)

Table 5 presents the regression coefficients. The unstandardized regression coefficient ($B=2.280$) indicates that for every one-unit improvement in the effectiveness of PR communication strategies, project outcomes increase by 2.280 units, holding other factors constant. The standardized coefficient ($\beta=0.851$) confirms a very strong positive relationship. The t-value of 4.577 ($p=0.002 < 0.05$) confirms that this relationship is highly statistically significant, leading to the rejection of the null hypothesis. Accordingly, the alternative hypothesis, that PR communication strategies significantly influence project outcomes at Nyakabingo Mine is accepted.

Notably, among the three communication strategy dimensions examined in the broader study (purposeful communication: β=1.041; adequate reporting: β=1.291; PR strategies: β=2.280), PR communication strategies emerged as the strongest predictor of project outcomes. This finding underscores the outsized role of external-facing, relationship-oriented communication in determining the success trajectory of mining projects.

4.4 Qualitative Insights

Interview responses from both internal and external stakeholders richly contextualised the quantitative findings. Management respondents highlighted multiple PR channels deployed at the mine, including monthly community meetings, safety awareness campaigns, local event sponsorships, and media engagements. A community health center director noted that the mine's provision of mattresses to Shorongi Health Center, construction of a kitchen, and support for a girls' dormitory at GS Shyorongi were concrete manifestations of PR-embedded CSR that had significantly improved community trust and reduced tensions between residents and mine operations.

Several external stakeholders, however, flagged an important limitation: PR activities were perceived as sometimes reactive rather than proactively designed. A community leader respondent indicated that communication from the mine typically intensified during periods of concern or protest, with less consistent engagement during routine operational phases. This observation is consistent with Wambu and Paul (2023), who cautioned that reactive PR is insufficient for sustaining long-term community confidence. Other interviewees suggested that a more deliberate stakeholder segmentation approach tailoring messages and engagement modalities to different community groups such as women, youth, and elderly residents would substantially enhance the effectiveness of PR efforts.

These qualitative insights reveal that while the structural conditions for effective PR exist at Nyakabingo Mine, their full potential remains constrained by insufficient proactivity, limited stakeholder segmentation, and inconsistent engagement cycles. Addressing these gaps would likely amplify the already substantial positive effect of PR communication on project outcomes.

5. Discussion

The findings of this study establish, with statistical strength, that PR communication strategies are a powerful determinant of mining project outcomes in the Rwandan context. The regression coefficient of β=2.280 and the model's explanatory power of 72.4% (R^2=0.724) are findings of considerable practical significance: they demonstrate that strategic improvements in how a mining company communicates with, engages, and manages the perceptions of its stakeholders translate directly into improved project performance outcomes including stakeholder satisfaction, conflict reduction, and social license to operate.

These results align with and extend the international literature. Blotnicky and Thurlow (2021) demonstrated that integrating PR functions into strategic decision-making positively affects organizational success, innovation, and reputation. Al Hadeed (2024) found that effective PR practices, including two-way communication and new media adoption, significantly boost audience engagement and project performance. The PMI (2013) similarly reported that organizations with robust communication strategies experience fewer project failures. The current study adds a crucial African and specifically Rwandan dimension to this body of evidence, confirming that these dynamics operate with particular force in contexts characterized by significant information asymmetry, diverse literacy levels, and complex community-company relationships.

A theoretically significant finding is the magnitude of PR's effect relative to other communication strategies. The fact that PR (β=2.280) exerts a stronger effect than purposeful communication (β=1.041) and adequate reporting (β=1.291) suggests that the relational and image management dimensions of communication, which directly shape stakeholder perceptions and trust, carry greater weight in determining project outcomes than internal information quality alone. This insight challenges the tendency in project management practice to prioritize reporting and internal communication over external relationship-building, and argues for a rebalancing toward strategic PR as a core project management competency.

The study's theoretical framework further illuminates these results. From a Stakeholder Theory perspective (Freeman, 1984), the findings affirm that proactive engagement of diverse stakeholder interests, operationalized through strategic PR, generates the trust and cooperation necessary for project success. Image Restoration Theory (Benoit, 1995) contributes an additional lens: the data suggest that Nyakabingo Mine's PR strategies, while functioning reactively in some instances, have nevertheless been sufficient to maintain a positive operational image and prevent trust deficits from escalating into project-disrupting conflicts. Transitioning from reactive to proactive PR, as the qualitative data recommend, would represent a move from image restoration to image maintenance, a more sustainable and less costly communication posture.

6. Conclusions and Recommendations

6.1 Conclusions

This study provides robust empirical evidence that PR communication strategies exert a strong, positive, and statistically significant influence on project outcomes at Nyakabingo Mine in Rwanda ($\beta=2.280$; $R^2=0.724$; $p<0.05$). PR communication explains nearly three-quarters of the variation in project outcomes, making it the strongest communication predictor identified in this study. Both quantitative data and qualitative insights converge on the conclusion that well-executed PR activities, encompassing community engagement, stakeholder responsiveness, and reputation management, enhance trust, collaboration, conflict resolution, and social license to operate, ultimately contributing to successful project delivery.

These findings have implications that extend beyond Nyakabingo Mine. They establish a precedent for conceptualizing PR not merely as a peripheral corporate activity but as a central project management function in Rwanda's mining sector. The social license to operate, upon which mining projects fundamentally depend, is a product of sustained, strategic, and authentic communication; and PR is its primary vehicle.

6.2 Recommendations

Based on the study's findings, the following recommendations are advanced:

1. Institutionalize proactive PR frameworks: Mining companies should develop structured, proactive PR communication plans with clear timelines, defined stakeholder segments, and multi-channel engagement strategies. PR activities should precede, not merely respond to, community concerns.
2. Invest in stakeholder segmentation: PR messages and engagement modalities should be tailored to distinct stakeholder groups, accounting for differences in literacy, gender, age, and proximity to mining operations. Generic communication fails to address the specific concerns and expectations of diverse community segments.
3. Build PR capacity within project teams: Continuous training in public relations, community engagement, and stakeholder management should be incorporated into professional development programs for mining project staff, ensuring that PR principles are embedded across organizational levels.
4. Policy integration: Regulatory bodies such as the RMB should incorporate mandatory PR strategy requirements into mining licensing frameworks, ensuring that communication quality is assessed alongside technical and environmental compliance.

6.3 Limitations and Future Research

This study is delimited to Nyakabingo Mine and its immediate stakeholder community. While the findings provide strong within-case insights, their generalizability to other mining operations should be approached with caution and tested through comparative research. Future studies should explore the differential effectiveness of specific PR modalities (e.g., digital platforms, traditional media, face-to-face engagement) in mining contexts; the longitudinal trajectory of PR effects on project outcomes; and comparative analyses across different African mining jurisdictions to build a broader evidence base. Mixed-methods and longitudinal designs are particularly recommended to capture the evolving nature of stakeholder relationships across project lifecycle phases.

REFERENCES

African Development Bank (AfDB). (2020). Stakeholder engagement and communication strategy toolkit. Abidjan: AfDB.

Al Hadeed, L. (2024). Effective PR practices, two-way communication and new media adoption in audience engagement. International Journal of Public Relations Research, 58(2), 88–101.

Angelakoglou, O., & Gaidajis, G. (2020). Social license to operate in mining: Present views and future trends. Sustainability, 12(9), 3822.

Benoit, W. L. (1995). Accounts, excuses, and apologies: A theory of image restoration strategies. State University of New York Press.

Blesia, L. (2021). Public relations strategies and stakeholder engagement in the mining industry: A case study of local community involvement in Papua New Guinea. Public Relations Review, 47(2), 145–156.

Blotnicky, K., & Thurlow, G. (2021). Integrating PR into strategic decision-making and organizational success. Journal of Applied Communication, 45(1), 33–48.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101.

Chartered Institute of Public Relations (CIPR). (2019). CIPR's definition and principles of public relations. London: CIPR.

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.

Dike, H. W. (2025). Public relations strategies and reputation management: Mastering stakeholder engagement and community building. International Journal of Latest Technology in Engineering, Management & Applied Science, 14(3), 52–60.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. American Journal of Theoretical and Applied Statistics, 5(1), 1–4.

Extractive Industries Transparency Initiative (EITI). (2021). EITI Standard 2021. Retrieved from https://eiti.org

Freeman, R. E. (1984). Strategic management: A stakeholder approach. Boston: Pitman.

International Finance Corporation (IFC). (2015). Stakeholder engagement: A good practice handbook for companies doing business in emerging markets. Washington, DC: IFC.

In, J. (2017). Introduction of a pilot study. Korean Journal of Anesthesiology, 70(6), 601–605.

Lorena, B. (2019). Moving away from the Shannon and Weaver model. Retrieved from https://insetia.com

Musoni, A. (2021). The role of local government in extractive industry governance in Rwanda. Rwanda Journal of Social Sciences, 8(1), 55–72.

Nunnally, J. C., & Bernstein, I. H. (1994). Psychometric theory (3rd ed.). McGraw-Hill.

Onyango, P., Akoth, F., & Odhiambo, J. (2023). Proactive public relations and stakeholder engagement in Uganda's mining sector. International Journal of Public Relations, 44(3), 100–115.

Pratama, E., Lestari, I., & Sari, A. (2022). Environmental PR campaigns in the mining

industry: Effects on stakeholder perceptions. Journal of Public Relations Research, 56(4), 210–225.
Project Management Institute (PMI). (2013). The high cost of low performance: The essential role of communications. Pulse of the Profession. PMI.
Rwanda Mines, Petroleum and Gas Board (RMB). (2023). Annual mining sector report 2022. Kigali: RMB.
Rwanda Ministry of Trade and Industry. (2021). Rwanda mining policy. Kigali: MINICOM.
Shannon, C. E., & Weaver, W. (1949). The mathematical theory of communication. University of Illinois Press.
Stronge, D. C., Kannemeyer, R. L., & Edwards, P. (2025). Understanding stakeholder values in post-mining economies: A literature review. Resources Policy, 90, 104720.
Uwizeyimana, J., & Mutangana, S. (2022). Community engagement in mining projects: The case of Northern Rwanda. East African Journal of Policy Studies, 11(3), 45–59.
Wambugu, M., & Murithi, M. (2022). Stakeholder engagement and public relations strategies in Kenya's mining sector. International Journal of Stakeholder Engagement, 28(3), 178–192.
Wambu, K., & Paul, T. (2023). Reactive versus proactive PR in the mining industry: A comparative analysis. Journal of African Business Communication, 12(1), 55–70.
World Bank. (2017). Environmental and social framework. Washington, DC: World Bank.
Woźniak, J., & Jurczyk, W. (2022). Stakeholder engagement in the mining industry: A systematic literature review. Resources Policy, 79, 103046.
Yamane, T. (1967). Statistics: An introductory analysis (2nd ed.). Harper & Row.

Acknowledgements
The authors gratefully acknowledge the financial support provided by the Rwanda Ministry of Defense. Sincere appreciation is extended to the management of Trinity Metals Ltd and Nyakabingo Mine for facilitating the data collection process. The authors also wish to thank all study participants for their valuable time, cooperation, and insightful contributions to the research.