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Influence of Financial Services Sector on Corporate Sustainability Development Support: Insights from Zimbabwe Stock Exchange Listed Firms

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Abstract: Objectives: This study examines the role of the financial service sector in promoting environmentally related sustainable development goals (SDGs). The primary purpose is to assess how listed financial institutions integrate sustainability into their operations, investment decisions, and corporate strategies. The study seeks to analyse the financial service sector's sustainability development support towards SDGs, evaluate the environmental sustainability practices adoption in achieving SDGs, and to identify barriers and enablers to sustainable development support by the financial service sector in Zimbabwe. **Prior Work:** Building on extant literature on achieving sustainability development goals, the paper positions sustainability reporting and the role played by the financial service sector in advancing sustainable development support in emerging economies. **Approach:** Content analysis of publicly available annual reports and sustainability reports of listed financial service firms was used to achieve the study objectives. Further, thematic analysis from interviews conducted with bank employees was done to get deep insights of research findings. **Results:** Findings indicate that sustainability development financing of SDGs is not fully supported, and significant gaps remain, particularly concerning SDG 14 and SDG 15, indicating a sustainability agenda that is not yet fully comprehensive. **Implications:** From a policy perspective, the study offers regulatory frameworks that incentivise green financing and sustainability reporting. The study also academically enriches the literature on sustainable finance in emerging markets, particularly in sub-Saharan Africa. **Value:** The study contributes significantly to practice by providing financial institutions and listed firms with evidence-based strategies to enhance sustainability integration. This study underscores the

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transformative potential of finance in fostering long-term economic, environmental, and social resilience in Zimbabwe.

Keywords: Sustainable Development Goals; Sustainability reporting; Green financing

1. Introduction

The growing recognition of the interconnectedness between economic prosperity, environmental stewardship, and social equity has propelled the concept of sustainable development to the forefront of global discourse (Ziai, 2025). At the heart of this paradigm lies the financial services sector, which plays a crucial role in channelling investments toward environmentally and socially responsible initiatives (Reddy et al., 2025). Financial institutions, through their lending, investment, and advisory activities, can significantly influence corporate behavior and drive the adoption of sustainable practices across various industries. However, despite the increasing awareness of the financial sector's potential to foster sustainability, the extent to which it effectively supports sustainable development, particularly in emerging economies, remains a subject of ongoing debate and empirical investigation (Sun et al., 2026; Alam & Paul, 2026.). The broader literature highlights a range of perspectives on the financial sector's role in promoting sustainability. Some literature argue that financial institutions are primarily driven by profit motives and short-term financial performance, leading to a limited focus on sustainability considerations (Atmeh et al., 2020). This perspective suggests that market failures, information asymmetries, and regulatory gaps hinder the integration of environmental, social, and governance (ESG) factors into financial decision-making (Parameswar et al., 2024). Others emphasise the growing investor demand for sustainable investment options and the increasing recognition of the financial risks associated with environmental degradation and social inequality. This view posits that financial institutions are increasingly incorporating sustainability considerations into their strategies and operations to enhance their long-term competitiveness and mitigate potential risks (Xie et al., 2025). Emerging economies face unique challenges and opportunities in leveraging the financial sector for sustainable development. While these economies often exhibit rapid economic growth and increasing investment needs, they may also face significant environmental and social challenges, such as resource depletion, pollution, and inequality (Xin et al., 2025). The financial sector in these contexts can play a critical role in mobilizing capital for sustainable infrastructure, renewable energy projects, and inclusive business models that address these challenges (Alam & Paul, 2025). However, the effectiveness of the financial sector in promoting sustainability in emerging economies is often constrained by factors such as weak regulatory frameworks, limited access to information, and a lack of awareness among financial institutions and investors (Ecer & Pamucar, 2022).

In the context of Zimbabwe, a developing economy striving for sustainable growth, the financial services sector's role in supporting corporate sustainability remains underexplored. Zimbabwe faces numerous socio-economic and environmental challenges, including climate change, resource scarcity, and poverty, which necessitate a concerted effort to promote sustainable development across all sectors of the economy. The Zimbabwe Stock Exchange (ZSE) and the Victoria Falls Exchange (VFEX) serve as platforms for listed firms to access capital and engage with investors, making them important conduits for promoting sustainable business practices. However, the extent to which financial institutions and listed firms in Zimbabwe integrate sustainability into their operations, investment decisions, and corporate strategies remains unexplored.

This study aims to address this gap in the literature by examining the influence of the financial services sector on corporate sustainability development support in Zimbabwe. Specifically, the study seeks to evaluate the sustainability practices adopted by ZSE-listed firms, analyse the financial sector's influence on these firms' sustainability commitments, and identify barriers and enablers to sustainable finance in Zimbabwe. By employing a mixed-methods approach that combines quantitative analysis of corporate sustainability disclosures with qualitative insights from interviews with financial sector executives, regulators, and sustainability officers, this study offers a comprehensive assessment of the current state of sustainable finance in Zimbabwe.

The findings of this study contribute to the existing body of knowledge on sustainable finance in several ways. First, the study provides empirical evidence on the sustainability practices of listed firms in Zimbabwe, shedding light on the extent to which they are integrating ESG factors into their operations and reporting. Second, the study identifies the key drivers and constraints that influence the financial sector's support for corporate sustainability in Zimbabwe, informing policy interventions and business strategies aimed at promoting sustainable finance. Finally, the study offers recommendations for regulatory frameworks that incentivise green financing and sustainability reporting, contributing to the development of a more sustainable and resilient financial system in Zimbabwe and other emerging economies. By bridging the gap between financial sector operations and sustainable development goals, this study underscores the transformative potential of finance in fostering long-term economic, environmental, and social resilience in Zimbabwe.

2. Literature Review

2.1. Theoretical Perspectives

The study is guided by three theories namely the stakeholder theory (Freeman & Reed, 1983), legitimacy theory (Dowling & Pfeffer, 1975) and institutional theory (DiMaggio & Powell, 1983).

Stakeholder theory suggest that a firm's success is dependent on its ability to manage its relationships with a wide range of stakeholders (not just shareholders), including employees, customers, suppliers, communities, government, and the environment (Freeman & Reed, 1983). Financial institutions such as banks and other financial service providers are therefore not isolated entities. Their lending and investment decisions in supporting the achievement of SDGs are influenced by pressures from various stakeholders such as regulators and the government to report on sustainability development issues, ESG reporting or green finance quotas (Muhammad & Ali, 2025). There is also growing demand from investors and shareholders for sustainable and responsible investment options by firms across all industry sectors (Initiative for Responsible Investment, 2015; Ndamba & Chisaira, 2016; Wagemans et al., 2025). Financial institutions such as banks listed on the ZSE/VFEX are therefore expected to adopt sustainability practices in response to stakeholder pressures such as offering better loan terms to a company that demonstrates strong environmental risk management, thereby influencing the company's behavior.

Legitimacy theory on the other hand is viewed as a subset of stakeholder theory and suggest that firms should constantly seek to ensure their operations are perceived as being within the bounds and norms of their society in which they seek a "social license to operate" (Dowling & Pfeffer, 1975). When a gap exists between societal expectations and the firm's actions (a "legitimacy gap"), the firm will engage in activities (like sustainability reporting and initiatives) to close that gap (Deegan, 2010; Herbert & Graham, 2022). In this context, financial institutions operating in developing countries such as Zimbabwe facing similar significant environmental challenges like climate change and environmental degradation are expected to engage in sustainability practices as a strategy to gain legitimacy in the eyes of the public, government, and international community.

Institutional theory explains how organisational structures and practices become standardised through external pressures, leading to homogeneity in practices within

an organizational field (DiMaggio & Powell, 1983). These pressures include coercive pressure, mimetic pressure and normative pressure (Latif et al., 2020). Coercive pressure is formal pressure exerted through regulations, by the government, and powerful stakeholders such as the central banks' mandates (Bhuiyan et al., 2023). Conversely, mimetic pressure is the pressure that arise by imitating successful competitors in times of uncertainty such as all financial institutions begin offering green loans just because the first mover was praised by various stakeholders in doing so, while normative pressure emanates from professionalisation needs, education and standardisation requirements such as adopting global reporting standards such as GRI standards or IFRS S1/S2 (Bhuiyan et al., 2023; De et al., 2025). Institutional theory is relevant in this study by identifying and analysing the barriers and enablers of sustainability financing by the financial service sector in Zimbabwe.

2.2. Sustainability Development Financing Practices

The financing of sustainable development represents a fundamental shift in how capital is allocated, moving from a singular focus on financial return to a paradigm that integrates environmental, social, and governance (ESG) considerations into the core of financial decision-making. This practice, often encapsulated under the umbrella term sustainable finance, which encompasses a wide array of instruments, actors, and methodologies aimed at supporting the Sustainable Development Goals (SDGs) (Sachs et al., 2019). The literature reveals a rapid evolution in these practices, driven by regulatory pressures, market demand, and a growing recognition of the materiality of ESG risks and opportunities (Dunfjäll, 2025; Oliver Yébenes, 2024; Sheehan et al., 2023).

A primary manifestation of sustainable financing practices is the proliferation of labelled financial instruments. The most prominent among these is the green bond, a fixed-income instrument specifically earmarked to raise capital for climate and environmental projects (Flammer, 2021). The green bond market has experienced exponential growth, evolving from a niche product to a mainstream asset class. Recent studies highlight that these instruments not only provide essential capital for renewable energy, energy efficiency, and pollution prevention projects but can also offer financial advantages for issuers, such as a "green premium" or lower cost of capital due to high investor demand (Baker et al., 2022). Beyond green bonds, the market has expanded to include social bonds (funding projects with positive social outcomes, e.g., affordable housing), sustainability bonds (combining both

environmental and social objectives), and most recently, sustainability-linked bonds (SLBs), whose financial characteristics are tied to the achievement of predefined sustainability performance targets (Chandrakant & Rajesh, 2023; Khatri & Kjærland, 2023; Papoutsi & Sodhi, 2023).

On the other hand, the practice of active ownership, which investors use their power to influence corporate behaviour through shareholder engagement and proxy voting on ESG issues, has also gained significant traction (Dyck et al., 2019). A critical enabler of these financing practices is sustainability reporting and disclosure. The ability to accurately measure, manage, and report on ESG performance is paramount for attracting sustainable capital. The landscape of reporting frameworks, such as the Task Force on Climate-related Financial Disclosures (TCFD) and the Sustainability Accounting Standards Board (SASB), has aimed to standardise and improve the quality of non-financial information (Kotsantonis & Serafeim, 2019). The recent consolidation into the International Sustainability Standards Board (ISSB) under the IFRS Foundation marks a significant step towards a global baseline of sustainability disclosure standards, which is expected to reduce greenwashing and enhance the credibility of sustainable finance markets (Christensen et al., 2022).

However, the literature also identifies significant challenges. Greenwashing, whereby institutions overstate or misrepresent their sustainability credentials remains a persistent threat that can undermine market confidence (de Freitas Netto et al., 2020). Furthermore, there is a pronounced financing gap for the SDGs, particularly in emerging and developing economies, where perceived risks and a lack of bankable projects hinder the flow of private capital (Dikau & Volz, 2021; Espagne & Aglietta, 2016). This has spurred the development of blended finance models, where public or philanthropic capital is used to de-risk investments and catalyse private sector funding for sustainable development in these regions (Rashed & Shah, 2021).

2.3. Corporate Sustainability Development Support

The financial services sector is widely recognised as a critical catalyst for sustainable development, wielding significant influence through its capital allocation, risk assessment, and advisory functions (Kaonga et al., 2026). Its role extends beyond mere financing to actively shaping corporate strategies and national economic trajectories towards sustainability goals (Barua, 2020). This influence is primarily

exercised through two interconnected channels which are capital provision and risk pricing. Through their lending and investment decisions, banks, asset managers, and institutional investors directly determine the availability of capital for sustainable projects. The integration of ESG criteria into credit risk analysis and investment frameworks has become a mainstream practice, enabling the channelling of funds towards green bonds, renewable energy initiatives, and socially responsible enterprises (Dikau & Volz, 2021). This allocative function is paramount, as a significant financing gap persists for achieving the Sustainable Development Goals (SDGs), particularly in emerging economies. By offering favourable loan terms or lower cost of capital to companies with strong sustainability performance, financial institutions create a powerful economic incentive for corporate clients to adopt greener practices (Bei & Wang, 2023). This is often operationalised through sustainability-linked loans, where interest rates are directly tied to the borrower's achievement of predefined ESG or SDGs targets (Auzepy et al., 2023; Pohl et al., 2023).

The financial service sector, furthermore, exerts influence through shareholder activism and engagement. Institutional investors, by virtue of their large equity holdings, are increasingly using their power to influence corporate behavior (García-Meca et al., 2017). This is achieved through direct dialogue with company management, filing shareholder resolutions on climate-related issues, and voting on ESG proposals at annual general meetings (Dyck et al., 2019). This active ownership pushes firms to enhance their sustainability disclosures, improve their environmental management, and align their long-term strategies with a low-carbon transition. The financial service sector's effectiveness is however contingent on robust regulatory frameworks and accurate information. The potential for greenwashing, where financial products are deceptively marketed as sustainable, remains a key challenge that can erode trust and hinder progress (de Freitas Netto et al., 2020). Therefore, the development of mandatory and standardized sustainability reporting standards, such as those being developed by the International Sustainability Standards Board (ISSB), is crucial for providing the reliable data needed for effective ESG risk assessment and capital allocation (Christensen et al., 2022). The financial service sector's influence on sustainability support is multifaceted and powerful. By acting as gatekeepers of capital and engaged stewards, financial institutions can incentivize and accelerate the adoption of sustainable practices across the economy. However, realising this potential fully requires continued regulatory evolution to ensure transparency and mitigate market imperfections.

3. Methodology

The study employs a multiple-case study design to achieve its objectives. This approach is deemed most appropriate as it facilitates an in-depth, holistic, and contextual exploration of a contemporary phenomenon (Yin, 2018), which is the integration of sustainability into operations and strategies within its real-world context, where the boundaries between the phenomenon (sustainability integration) and the context (the Zimbabwean banking sector) are not clearly evident. The seven listed banking firms constitute the seven cases for this study.

3.1. Research Philosophy and Design

The research is grounded in a pragmatism philosophy, which implores what currently works to understand the complex social phenomena (Saunders et al., 2019) of sustainability commitment from the perspectives of the participants within the financial sector). A multiple-case study design is adopted to allow for a comparative analysis across the different firms, enabling the identification of patterns and unique challenges specific to the Zimbabwean context.

3.2. Population and Sample Size

There is a total of 17 firms in the financial sector listed on both ZSE and VFEX as of 31 May 2025. However, a sample of six (6) firms were purposively selected since these are the ones in the banking category and are therefore expected to provide finance support for sustainable development in the country. The remaining 11 firms were excluded as they are non-banking financial service institutions and do not provide financial support in form of borrowings to the general communities. The following sample firms were thus included.

Table 1. Sample Size

	Listed Firm	**Exchange**
1	CBZ Holdings	ZSE
2	FBC Holdings	ZSE
3	First Capital Bank	VFEX
4	Nedbank Group Zimbabwe	VFEX
5	NMBZ Holdings	ZSE
6	ZB Financial Holdings	ZSE

Source: ZSE & VFEX Website:2025

3.3. Data Collection

To ensure data triangulation and enhance the validity and reliability of the findings, data was collected from two primary sources. Firstly, documentary analysis was carried out in the form a systematic content analysis of publicly available documents from the six banks for the most recent three-year period (2022-2024). The documents include annual and integrated reports inorder to evaluate disclosed sustainability practices (Objective 1) and identify mentions of the target SDGs (SDG 6, 7, 13, 14, 15). Sustainability/CSR reports were analysed to gain deeper insights into specific initiatives and their alignment with SDGs, while official websites were browsed to analyse marketing communications and public commitments to sustainability. This analysis is guided by a coding framework developed from existing sustainability reporting frameworks like the Global Reporting Initiative (GRI) and principles from the UN Principles for Responsible Banking (Davies & Green, 2020).

Secondly, semi-structured interviews were conducted to gather rich, experiential data and achieve objectives 2 and 3, and in-depth semi-structured interviews were conducted with key informants. A purposive sampling technique was used to identify participants who possess expert knowledge of their institution's sustainability and investment strategies. These participants include Heads of Sustainability or Corporate Social Responsibility, Sustainability Officers, Finance Managers. An interview guide was developed with open-ended questions exploring the motivation for SDG integration; the influence of the financial sector (e.g., through lending criteria) on client behaviour; and the perceived barriers and enablers to corporate sustainability development financing in Zimbabwe.

3.4. Data Analysis

The data was analysed using a combination of content analysis and thematic analysis. To achieve the first objective, content analysis was used to quantify the extent of environmental related SDGs support. The was achieved by means of identifying sustainability reporting related to the seven environmental related SDGs (SDG 6-clean water and sanitation; SDG 7- affordable and clean energy; SDG 11 - Sustainable cities; SDG-Responsible consumption; SDG 13-climate action; SDG14-life below water and SDG15-life on land). This was complemented by qualitative content analysis to interpret the nature and depth of the SDGs commitment support by the six listed financial institutions(banks). For qualitative data (Objectives 2 &

3), interviews were transcribed verbatim and analysed using thematic analysis following the steps outlined by (Braun & Clarke, 2006) which are familiarisation, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. Atlas.ti software was utilised to manage and code the data efficiently. The analysis sought to identify themes related to the financial sector's influence, as well as the salient barriers and enablers.

3.5. Ethical Considerations

Ethical approval was sought from the relevant participants. Prior to interviews, all participants electronically received a participant information sheet and sign an informed consent form. Anonymity and confidentiality were assured, allowing participants to speak freely. Given the seniority of the participants, the study's focus was on institutional practices rather than personal critique.

3.6. Limitations

The primary limitation of the study could be the potential for social desirability bias in interview responses, where participants may overstate their institution's sustainability commitments. Triangulation with documentary evidence was thus designed to mitigate this. Furthermore, the study was only limited to publicly listed banks and did not capture the practices of smaller, non-listed financial institutions in Zimbabwe.

4. Results and Discussion

4.1. Objective 1: Financial Service Sector's Sustainability Development Support Towards SDGs

This section presents a quantitative analysis of the Sustainable Development Goal (SDG) reporting practices of major financial institutions in Zimbabwe. The data, drawn from corporate sustainability disclosures for the 2024 reporting period, provides a clear overview of the sector's current priorities and gaps in supporting the global sustainability agenda.

4.1.1. Descriptive Statistics and Sector-Wide Adoption Trends

The dataset (Table 2) encompasses six leading financial institutions: CBZ Holdings, FBC Holdings, First Capital Bank, Nedbank Zimbabwe, NMBZ Holdings, and ZB Financial Holdings. Their reported adherence to seven environmental-focused SDGs (6, 7, 11, 12, 13, 14, 15) is binary-coded (1 = reporting evidence of support, 0 = no evidence reported).

Table 2. SDGs Development Support among Zimbabwean Listed Financial Institutions (N=6)

SDG	Description	Firms Reporting (n)	Support rate (%)
6	Clean Water and Sanitation	6	100%
7	Affordable and Clean Energy	6	100%
11	Sustainable Cities	4	66.7%
12	Responsible Consumption and Production	5	83.3%
13	Climate Action	6	100%
14	Life Below Water	1	16.7%
15	Life on Land	3	50%

Source: Author's compilation from annual reports & sustainability reports for 2024

The analysis reveals a high degree of adoption for certain SDGs across the sector (Table 2). SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), and SDG 13 (Climate Action) demonstrate universal adoption, with all six firms (100%) reporting supportive initiatives. This is followed closely by SDG 12 (Responsible Consumption and Production), with five out of six firms (83.3%) reporting activities.

Higher disclosures of SDG 6 (Clean water), SDG 7 (Affordable clean energy), and SDG 13 (Climate Action) is possibly driven by the need for operational survival, national infrastructure deficits and direct supply-chain risks rather than abstract environmental goals as the economy faces recurrent water shortages particularly in urban areas, persistent electricity shortages and load shedding over the years, and droughts affecting agriculture. It is also noted that companies usually prioritise what is material to their business continuity, cost structure and investor expectations in the absence of mandatory disclosure requirements (Mazumder & Hossain, 2025). Conversely, significant gaps are evident. For instance, SDG 14 (Life Below Water), is notably the least addressed, with only a single firm (16.7%) reporting any initiatives. This is possibly due to the fact that Zimbabwe is a landlocked country

and therefore seen as not material to the listed companies' direct risk-impact. However, (Hummel & du Toit, 2026) notes that most African listed firms are generally associated with lower SDG disclosures due to institutional quality and lack of developmental assistance. SDG 15 (Life on Land) shows moderate engagement, with half of the institutions (50%) reporting activities such as tree-planting campaigns, indicating that the average bank is actively reporting on most of the environmental SDGs analysed. NMBZ Holdings is the only institution reporting support for all seven SDGs, demonstrating a comprehensive public sustainability profile probably due to its board committee diversity (Mazumder & Hossain, 2025).

4.1.2. Strategic Priorities and Omissions

The near-universal adoption of SDGs 6, 7, and 13 suggests that these goals align closely with both the core operations of financial institutions and the immediate environmental challenges facing Zimbabwe. The focus on SDG 7 is largely driven by economic rationality; investments in solar power for bank branches reduce operational costs associated with an unreliable national grid and diesel generators, while simultaneously yielding carbon emission reductions. Similarly, efforts towards SDG 6, such as installing water-efficient fixtures and boreholes, mitigate operational risk from water scarcity and present tangible Corporate Social Responsibility (CSR) opportunities for community engagement. The universal reporting on SDG 13 has likely become a baseline expectation for corporate legitimacy. However, a critical distinction must be made between operational climate action (e.g., reducing emissions from buildings and vehicles) and financed emissions. The former is increasingly common, while the latter, arguably where banks have their greatest impact, involves integrating climate risk into lending and investment portfolios and is less easily captured in a binary metric.

The high engagement with SDG 12 reflects a straightforward and cost-effective win for the sector, primarily through digitisation and paper-reduction strategies. This directly improves efficiency and cuts costs, making it a strategically logical priority. The lower adoption rates for SDG 11 and SDG 15 indicate that these are perceived as more peripheral to core banking activities. Support is often channeled through discrete CSR projects (e.g., community clean-ups, tree planting) rather than being integrated into core business strategy. The near-total neglect of SDG 14 (Life Below Water) is statistically the most significant finding. This suggests a fundamental disconnection between the banking sector's sustainability agenda and marine conservation. For a landlocked country like Zimbabwe, this may be perceived as less

directly relevant. However, this omission highlights a potential lack of consideration for indirect impacts, such as financing agricultural or industrial clients whose runoff or practices might affect transnational water systems that eventually impact marine life.

4.2. Objective 2: Environmental sustainability initiatives -Thematic Areas of Environmental Focus

This analysis synthesises the environmental sustainability initiatives reported by all the six financial institutions (banking sector) listed on both the ZSE and VFEX in Zimbabwe during the study period. The findings reveal a sector-wide engagement with the Sustainable Development Goals (SDGs), though the depth, strategic integration, and focus areas of these initiatives vary significantly across institutions. The banks' environmental practices can be categorised into three primary thematic areas: climate action and energy transition, resource management and circular economy, and sustainable finance and risk management.

4.2.1. Climate Action and Energy Transition

A dominant theme across all banks is the transition to renewable energy to mitigate climate change (SDG 13) and ensure affordable and clean energy (SDG 7). This is predominantly operationalised through investments in solar power infrastructure. For instance, NMB Bank has made a significant investment with a solar plant that meets approximately 25% of its daily electricity demand, generating 109.85 MW in 2024. Similarly, First Capital Bank reported two branches operating primarily on solar in 2022 and the construction of a new 5-Star Green-rated Head Office. Nedbank Zimbabwe and FBC Holdings also reported the installation of solar systems across their branches and donated solar systems to community projects. These initiatives directly reduce Scope 2 emissions (purchased electricity) and demonstrate a clear understanding of the link between operational efficiency and environmental responsibility. Furthermore, CBZ Holdings is extending this transition beyond its operations by issuing "solar loans" to customers and employees, thereby using its financial leverage to accelerate the broader adoption of clean energy.

4.2.2. Resource Management and Circular Economy

The study results indicate that financial institutions are actively pursuing strategies to minimize their environmental footprint through efficient resource use, aligning with SDG 12 (Responsible Consumption and Production) and SDG 6 (Clean Water

and Sanitation). Reduction of paper use is being widely adopted in all the banking institutions as a universal drive towards paperless banking. This is being achieved through digital banking platforms, mobile apps, and electronic internal processes. For instance, Nedbank Zimbabwe provided a quantifiable metric, noting a reduction in POS rolls from 190,700 in 2022 to 129,000 in 2023. ZB Bank and others are also emphasising this shift, linking it to reduced waste and operational efficiency. Many of the banks have implemented water conservation measures to ensure water management. For instance, CBZ Holdings demonstrates a sophisticated approach, committing to 100% water measurement, conducting regular water audits, and installing intelligent monitoring systems for real-time tracking and leak detection. FBC Holdings on the other hand reported installing automatic faucets at its head office, estimating a 60% reduction in water usage. However, efforts in waste and e-waste management are emerging but appear less developed. Notable progress is shown by CBZ Holdings which has set specific targets to reduce landfill waste by 10% by 2025 and implement waste separation. Conversely, FBC Holdings mentioned a transition towards partnering with certified recyclers for e-waste disposal, moving away from auctions, which is a crucial step for mitigating toxic pollution.

4.2.3. Biodiversity and Afforestation Initiatives

Direct environmental conservation efforts, particularly tree planting, are a popular and visible CSR activity aligned with SDG 13 (Climate action) and SDG 15 (Life on Land) among the banks. Nedbank Zimbabwe in particular reported extensive partnerships, planting 2,700 trees in 2022 and 843 in 2024. ZB Financial Holdings and FBC Holdings also documented tree-planting initiatives, often tied to anniversaries or national events. While positive for awareness and local ecosystem services, these activities are often symbolic in scale compared to the banks' operational impacts. A more strategic integration of biodiversity is evidenced by NMBZ Holdings, which explicitly states that it does not finance projects causing "massive destruction of ecologically sensitive ecosystems" and assesses biodiversity action plans of prospective borrowers.

4.3. Objective 3: Barriers and Enablers of Sustainable Development Support by Financial Institutions

This section presents and discusses the key findings derived from thematic analysis of semi-structured interviews with 25 senior professionals from the six listed banks in Zimbabwe. The analysis reveals a complex interplay of formidable barriers and critical enablers influencing the support for sustainable development projects in order to achieve SDGs.

4.3.1. Prevailing Barriers to Sustainable Finance

The interview data identified three primary, interconnected barriers constraining the flow of capital towards sustainable development. Firstly, macroeconomic volatility and regulatory uncertainty has been identified as one of the barriers to sustainable finance. Overwhelmingly, participants (n=23) cited the domestic macroeconomic environment as the most significant impediment. Hyperinflation, currency instability, and fluctuating interest rates were frequently mentioned. A Chief Risk Officer from one of the banks stated that.

> *"Our primary mandate is fiduciary responsibility and capital preservation. In this environment, the time horizon for any investment shrinks dramatically. A solar farm project with a 20-year payback period is simply unbankable when we cannot forecast the value of the currency next quarter." (Participant 7).*

This sentiment highlights a critical challenge whereby macroeconomic instability forces financial institutions to prioritise short-term survival over long-term sustainable investing. Furthermore, participants (n=18) expressed frustration with a fragmented and sometimes contradictory regulatory landscape. Frequent changes in monetary policy and a lack of clear, incentivising guidelines for green finance create a high degree of uncertainty, discouraging long-term commitments.

A second major barrier is the perceived high-risk profile of sustainable projects, particularly those led by SMEs and in nascent sectors like waste-to-energy. Participants (n=20) noted a severe shortage of "bankable" projects. A Head of Credit remarked that:

> *"Many proposals we receive are strong on passion but weak on financial fundamentals. They lack detailed feasibility studies, robust cash flow projections, and often have weak collateral. The technology*

> *might be unproven here, and the management capacity can be a concern." (Participant 12).*

This points to a fundamental market gap: a misalignment between project developers' aspirations and the stringent risk-assessment frameworks of financial institutions. The technical complexity of evaluating new green technologies further exacerbates this perception of risk.

Finally, there exist limited internal capacity and short-term performance metrics. Internally, financial institutions face their own constraints. Many participants (n=15) from traditional commercial banks admitted that their staff lack the specialised knowledge to accurately assess environmental, social, and governance risks and opportunities. Concurrently, performance incentives for loan officers are typically tied to short-term metrics like loan volume and immediate profitability, not long-term sustainability impact. This creates a disincentive to pursue more complex, longer-gestation sustainable projects.

4.3.2. Critical Enablers for Sustainable Finance

Despite the barriers, the analysis shows several potent enablers that are fostering a gradual shift towards sustainable finance. The most frequently cited enabler (n=21) was the role of strategic partnerships, particularly with international development agencies and multilateral development banks (MDBs). These partnerships facilitate blended finance structures, where public or philanthropic capital absorbs first-loss risk or provides concessional funding. An executive manager of one bank explained that:

> *"Our partnership with [an international agency] allows us to offer lower-interest loans for solar home systems and climate-smart agriculture. Their credit guarantee gives us the confidence to enter a market we would otherwise avoid." (Participant 3).*

This demonstrates how de-risking mechanisms can effectively bridge the gap between high-risk sustainable projects and risk-averse private capital, making projects commercially viable.

Growing regulatory push and international standards has also been cited as an enabler for sustainable finance. Participants (n=17) acknowledged the growing influence of both domestic regulatory nudges and global standards. While current

regulation was seen as a barrier, there was a strong consensus that a clear, supportive policy framework such as tax incentives for green bonds or mandatory ESG reporting would be a powerful catalyst. Furthermore, the adoption of international frameworks like IFRS S1 and IFRS S2, the Equator Principles and the TCFD (Task Force on Climate-related Financial Disclosures) was seen as providing a necessary structure for integrating sustainability into risk management. A Sustainability Officer noted that:

> *"Adopting the TCFD recommendations is not just about compliance; it's a risk management tool. It forces us to stress-test our portfolio against climate scenarios, and that analysis is revealing hidden risks—and opportunities—in carbon-intensive sectors." (Participant 19)*

This indicates a growing recognition that ESG integration is not merely a philanthropic exercise but a core component of prudent financial management in the 21st century.

Finally, a growing market demand for sustainable products and the associated reputational benefits were identified as key drivers (n=16). Corporates are seeking green financing to enhance their own sustainability credentials, and a segment of retail customers is increasingly interested in ethical banking. Participants reported that leading on sustainability issues enhances their brand image, attracts quality clients, and improves stakeholder relations.

> *"We are seeing more tender requirements from large corporate and government that require ESG compliance. Supporting our clients to meet these standards is becoming a new line of business for us." (Participant 22)*

This suggests that sustainable finance is increasingly being viewed as a competitive advantage and a driver of new business growth, moving beyond a purely risk-mitigation perspective.

5. Conclusion

The findings paint a picture of a sector caught between a challenging macroeconomic context and a strong, growing impetus to embrace sustainable finance. The analysis reveals a high level of engagement with certain SDGs, notably SDG 7 (Affordable and Clean Energy), SDG 13 (Climate Action), and SDG 6 (Clean Water and

Sanitation), primarily driven by operational cost-saving, risk mitigation, and corporate legitimacy. However, this engagement is often superficial, focusing on internal operational efficiencies rather than the more impactful integration of sustainability into core lending and investment decisions (financed emissions). Significant gaps remain, particularly concerning SDG 14 (Life Below Water) and SDG 15 (Life on Land), indicating a sustainability agenda that is not yet fully comprehensive or strategically embedded.

The study identifies a critical dichotomy influencing this progress. On one hand, formidable external barriers-primarily macroeconomic volatility and regulatory uncertainty-severely constrain long-term investment horizons and force a prioritisation of short-term survival. This is compounded by a shortage of bankable projects and an internal capacity gap within financial institutions regarding ESG risk assessment. On the other hand, powerful enablers are emerging. Strategic partnerships for blended finance are effectively de-risking sustainable investments, while international standards are providing a crucial framework for integrating sustainability into risk management. Conclusively, while the Zimbabwean financial sector demonstrates a clear and growing commitment to sustainability, its support remains promising and selectively focused. The sector is not a passive victim of its environment but is actively employing strategic enablers to advance its sustainability agenda. The transition from a compliance-based, operationally focused approach to a strategic, finance-led model is underway but incomplete. The transformative potential of the financial sector to catalyse sustainable development in Zimbabwe remains significant but is yet to be fully realised.

6. Recommendations and Areas for Further Studies

Based on the findings of this study, financial institutions should develop specialised capacity such as investing in training and hiring experts in ESG risk assessment and green finance. Building such internal competency is essential for accurately evaluating the risks and opportunities of sustainable projects, particularly in emerging sectors. Financial institutions are also encouraged to innovate financial products by moving beyond solar loans to develop a suite of green financial products, such as sustainability linked bonds, green mortgages, and insurance products tailored for climate-resilient agriculture. These products can tap into growing market demand and create new business lines.

Policymakers and regulators should play crucial roles in stabilising macroeconomic environment, which is the foundational enabler of sustainable finance. Thus, pursuing sound monetary and fiscal policies is critical in achieving currency stability and low inflation, which is the single most important action to unlock long-term investment, including in sustainable projects. Policymakers should also develop a clear and coherent incentivising green policy framework for sustainable finance. This could include tax incentives for green bonds, lower reserve requirements for green loans, and incorporating sustainability criteria into public procurement tenders. Regulators should also consider moving towards mandatory and standardised ESG reporting based on international frameworks like TCFD and ISSB. This will improve transparency, allow for comparability between institutions, and reduce greenwashing.

While this study documented widespread reporting on operational sustainability, further studies can focus on quantifying the impact of financed emissions and environmental impact of the loan portfolios and investment decisions of Zimbabwean banks. Other studies can also focus on comparative studies across SADC or Sub-Sahara Africa comparing the barriers, enablers and regulatory approaches to sustainable finance in Zimbabwe thereby offering valuable insights for regional policymakers. By pursuing these research avenues, scholars can significantly contribute to refining theory and practice, ultimately supporting the development of a more robust and effective sustainable finance ecosystem in Zimbabwe and similar emerging economies.

Disclosure Statement

- The author declares no potential conflict of interest.
- Gemini was used to identify the most appropriate research method to apply in this study.

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Agricultural Taxation and Fiscal Sustainability in Emerging Economies: Evidence from a Recursive Dynamic CGE Model for Morocco

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Abstract: This paper investigates the economic, distributive, and fiscal implications of extending taxation to Morocco's still-exempt agricultural segment within the post-2014 agricultural tax reform framework. Covering the period 2025–2035, the study employs a recursive dynamic computable general equilibrium (CGE) model calibrated on a Social Accounting Matrix constructed from High Commission for Planning (HCP) 2024 data. The model incorporates agricultural dualism, fiscal recycling through the Agricultural Development Fund (FDA), capital accumulation, and climate-related productivity shocks. The results show that abrupt agricultural taxation reduces GDP, agricultural value added, productive investment, and rural welfare. Conversely, progressive and differentiated taxation limits these adverse effects while preserving macroeconomic stability. The findings indicate that the remaining exempt agricultural segment offers limited short-term revenue potential, making fiscal equity and tax-base broadening the main objectives of reform. The study concludes that sustainable agricultural taxation requires gradual implementation, effective FDA recycling, and climate-resilient agricultural investment.

Keywords: Agricultural taxation; Computable general equilibrium; Fiscal sustainability; Climate vulnerability; Morocco

JEL Classification: C68, H21, O13, Q18, Q54

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1. Introduction

Tax mobilization remains a major challenge for developing economies facing growing public expenditure needs, fiscal sustainability constraints, and increasing demands for tax equity (Tanzi & Zee, 2000; Besley & Persson, 2014). In this context, improving fiscal performance does not solely depend on increasing tax rates but also on broadening the tax base, reducing sectoral exemptions, and improving the allocation of the tax burden across economic activities (Bird & Zolt, 2008). These challenges are particularly significant in countries where large segments of the economy remain partially integrated into the formal tax system.

In Morocco, the agricultural sector occupies a strategic position within the national economy. Depending on climatic conditions, agriculture contributes between 12% and 15% of gross domestic product and accounts for nearly 30% to 40% of total employment, while its indirect effects on agro-industrial activities and rural demand further increase its macroeconomic importance (HCP, various years). Beyond its economic contribution, agriculture plays a critical social role through rural employment generation, food security, poverty reduction, and territorial stability. However, the sector also remains highly vulnerable to climatic shocks, particularly recurrent droughts and increasing water scarcity (World Bank, 2022; FAO, 2023).

Historically, Moroccan agriculture benefited from a highly favorable tax treatment. Agricultural incomes were largely exempted from corporate and personal income taxation for several decades in order to support rural incomes, stimulate investment, and preserve social stability in rural areas. This preferential regime was justified by the structural fragility of small-scale farming, the dependence of agricultural production on rainfall variability, and the strategic importance of the sector for national development. Nevertheless, the persistence of generalized tax exemptions gradually generated growing concerns regarding fiscal equity, tax neutrality, and public revenue mobilization.

A major institutional turning point occurred with the progressive agricultural tax reform introduced under the 2014 Finance Law. Since then, large agricultural farms exceeding specific turnover thresholds have gradually entered the formal tax system. Since 2020, only farms generating annual turnover below MAD 5 million remain exempt from direct taxation. Consequently, the current debate no longer concerns the taxation of a fully exempt agricultural sector, but rather the potential extension of taxation to the remaining exempt segment, composed mainly of small and medium-sized farms.

This institutional evolution substantially changes the analytical framework of agricultural taxation in Morocco. Estimates frequently discussed during the National Tax Conferences suggest that only 1% to 2% of agricultural farms are currently subject to direct taxation, while nearly 98% remain outside the tax base due to their low turnover levels. Although these farms individually exhibit limited taxable capacity, they collectively represent a substantial share of rural employment, agricultural activity, and territorial economic equilibrium. Therefore, extending taxation to this remaining exempt segment may generate important macroeconomic, distributive, and social effects.

The literature on agricultural taxation highlights a complex trade-off between public revenue mobilization, economic efficiency, and social equity (Newbery, 1987; Burgess & Stern, 1993). While expanding agricultural taxation may improve fiscal fairness and reduce distortions associated with prolonged exemptions, excessive or poorly designed taxation may negatively affect rural incomes, agricultural investment, and food security, especially in economies characterized by strong structural heterogeneity and climatic vulnerability. These issues are particularly relevant in Morocco, where sharp disparities persist between irrigated commercial agriculture and rainfed smallholder farming systems.

Despite the growing policy relevance of agricultural taxation reforms in developing economies, the existing literature remains characterized by several important limitations.

First, most studies on agricultural taxation primarily rely on descriptive institutional analyses or partial equilibrium approaches, which do not adequately capture the economy-wide interactions between fiscal policy, sectoral production structures, household income distribution, and intersectoral linkages (Dervis et al., 1982; Shoven & Whalley, 1992). As a result, the broader macroeconomic and distributive effects of agricultural taxation reforms remain insufficiently explored.

Second, the empirical literature devoted to Morocco remains relatively scarce and largely predates the progressive agricultural tax reform introduced under the 2014 Finance Law. Earlier studies generally analyzed agricultural taxation within the context of a largely exempt agricultural sector and therefore do not account for the current institutional configuration in which large farms are already integrated into the tax system. Consequently, limited evidence exists regarding the taxation of the remaining exempt segment composed predominantly of small and medium-sized farms.

Third, previous studies rarely integrate climate vulnerability into the analysis of agricultural taxation reforms. This omission constitutes a major limitation in the Moroccan context, where agricultural production remains highly exposed to recurrent droughts, water scarcity, and climate-related productivity shocks (World Bank, 2022; FAO, 2023). Ignoring these structural vulnerabilities may lead to an underestimation of the distributive and macroeconomic consequences of fiscal reforms applied to agriculture.

Fourth, the role of fiscal recycling mechanisms and agricultural support policies remains insufficiently examined in the literature. Existing studies generally focus on the direct effects of taxation while paying limited attention to the potential stabilizing role of compensatory public investment mechanisms such as the Agricultural Development Fund (FDA). Yet, these mechanisms may significantly influence the magnitude and distribution of the adjustment costs associated with agricultural taxation reforms.

Accordingly, this paper contributes to the literature by developing a dynamic computable general equilibrium (CGE) model calibrated on a Moroccan social accounting matrix that explicitly incorporates sectoral heterogeneity, fiscal recycling mechanisms, capital accumulation dynamics, and climate-related productivity shocks. Unlike previous studies, the analysis focuses specifically on the macroeconomic and distributive implications of extending taxation to the still-exempt agricultural segment in post-reform Morocco.

More specifically, the paper makes three main contributions. First, it provides one of the first dynamic CGE analyses of agricultural taxation in Morocco under the post-2014 institutional framework. Second, it integrates fiscal policy, climate vulnerability, and agricultural heterogeneity within a unified macroeconomic modeling framework. Third, it evaluates the stabilizing role of fiscal recycling mechanisms and public agricultural investment in mitigating the adverse effects of taxation reforms on rural welfare, agricultural value added, and macroeconomic stability.

To address these issues, the study develops a recursive dynamic CGE model calibrated on a Moroccan social accounting matrix and simulates several agricultural taxation scenarios over the 2025–2035 period. The model explicitly incorporates sectoral heterogeneity between irrigated and non-irrigated agriculture, fiscal compensation mechanisms through the Agricultural Development Fund (FDA), capital accumulation dynamics, and climate-related productivity shocks. The

simulations evaluate progressive taxation schemes, differentiated taxation structures, and climate-sensitive fiscal reform scenarios.

The results suggest that abrupt agricultural taxation without compensatory mechanisms could generate significant negative effects on GDP, agricultural value added, and rural welfare. Conversely, gradual taxation combined with targeted fiscal recycling and climate adaptation investment appears to reduce macroeconomic distortions while improving fiscal sustainability and tax equity. The findings therefore highlight the importance of sequencing, targeting, and institutional design in agricultural tax reforms implemented in structurally vulnerable economies.

The remainder of the paper is organized as follows. Section 2 reviews the theoretical and empirical literature on agricultural taxation and fiscal reforms in developing economies. Section 3 presents the dynamic CGE model, calibration strategy, and simulation scenarios. Section 4 discusses the simulation results and analyzes the macroeconomic, sectoral, and distributive effects of agricultural taxation reforms. Section 5 discusses the main policy implications arising from the simulation results. Finally, Section 6 concludes by summarizing the main findings and highlighting their implications for sustainable agricultural taxation reform.

2. Literature Review

2.1. Agricultural Taxation and Fiscal Capacity in Developing Economies

The mobilization of domestic fiscal resources remains one of the central challenges facing developing economies. Increasing public expenditure needs, infrastructure financing requirements, rising social demands, and fiscal sustainability constraints have intensified the need to broaden tax bases and improve tax capacity (Tanzi & Zee, 2000; Besley & Persson, 2014). In many developing countries, however, tax systems remain characterized by narrow fiscal bases, widespread exemptions, high levels of informality, and unequal distribution of the tax burden across economic sectors (Bird & Zolt, 2008).

Within this broader context, agricultural taxation occupies a particularly sensitive and complex position. Agriculture simultaneously fulfills economic, social, territorial, and food-security functions while remaining highly exposed to climatic uncertainty and structural vulnerability. Historically, many developing countries adopted preferential fiscal regimes for agriculture in order to protect rural incomes,

preserve food security, and support structural transformation processes (Newbery, 1987). Agricultural tax exemptions were often justified by low productivity levels, fragmented land structures, weak administrative capacity, and the political sensitivity of taxing vulnerable rural populations.

However, prolonged tax exemptions may generate important distortions and fiscal inequities. Burgess and Stern (1993) argue that maintaining broad agricultural exemptions over extended periods may reduce fiscal neutrality, distort resource allocation, and weaken public revenue mobilization. Similarly, Bird and Zolt (2008) emphasize that unequal tax treatment between sectors may undermine both horizontal equity and fiscal legitimacy, particularly when highly profitable agricultural activities remain partially outside the formal tax system.

The theoretical foundations of agricultural taxation are closely linked to the broader literature on optimal taxation. Ramsey (1927), Mirrlees (1971), and Diamond and Mirrlees (1971) demonstrate that efficient tax systems should minimize distortions while ensuring sufficient revenue mobilization and preserving distributive equity. Applied to agriculture, these principles imply that fiscal reforms must account not only for revenue objectives but also for productive efficiency, income volatility, rural welfare, and heterogeneous productive capacities.

In developing economies, this trade-off becomes particularly complex because agriculture often combines modern export-oriented activities with low-productivity subsistence farming systems. Consequently, agricultural taxation cannot be analyzed solely from the perspective of fiscal yield; it must also incorporate issues related to social cohesion, rural poverty, structural transformation, and economic resilience.

2.2. Structural Heterogeneity and Agricultural Dualism

A major theme in the literature concerns the strong structural heterogeneity characterizing agricultural sectors in developing countries. Agricultural systems frequently exhibit a dual structure combining highly productive, market-integrated commercial farms alongside smallholder and subsistence-oriented agriculture with limited productive capacity (Johnston & Mellor, 1961; Timmer, 2009).

This dualism has important implications for tax policy design. Large commercial farms generally benefit from better access to irrigation, credit, technology, export markets, and institutional support, allowing them to sustain higher productivity and stronger taxable capacity. By contrast, smallholder farms often operate under severe

financial constraints, unstable incomes, weak market integration, and high exposure to climatic shocks.

The Moroccan agricultural sector illustrates this structural duality particularly clearly. Irrigated agriculture generally displays higher productivity levels, stronger market integration, and greater access to public support mechanisms. Rainfed agriculture, by contrast, remains heavily dependent on precipitation variability and exhibits lower productivity, weaker resilience capacity, and stronger vulnerability to drought episodes.

The persistence of this dual structure substantially complicates the implementation of uniform agricultural taxation policies. According to Atkinson and Stiglitz (1980), tax systems should account for heterogeneous welfare effects and differentiated productive capacities across economic agents. Similarly, Stiglitz (1982) emphasizes that optimal taxation requires consideration of both efficiency and distributive objectives, especially when income disparities are significant.

In this context, uniform agricultural taxation may generate asymmetric distributive effects by disproportionately affecting vulnerable rural households with limited savings capacity and high dependence on current agricultural income. Several studies suggest that excessive or poorly calibrated agricultural taxation may reduce investment incentives, constrain productive modernization, and increase rural inequality (Newbery, 1987; Bird & Zolt, 2008).

Consequently, progressive taxation schemes targeting highly productive and commercially integrated farms appear more consistent with the principles of tax equity and economic efficiency than generalized taxation approaches. This issue is particularly relevant in Morocco, where agricultural incomes and productive capacities remain highly unevenly distributed across farms and regions.

2.3. Agricultural Tax Reforms in Morocco: From Generalized Exemption to Selective Taxation

For several decades, Moroccan agriculture benefited from a quasi-generalized tax exemption regime. Agricultural revenues were exempt from both personal income tax and corporate income taxation as part of a broader development strategy aimed at supporting rural incomes, agricultural modernization, and social stability. This preferential treatment was justified by the structural fragility of small farms, the

dependence of agricultural activity on climatic conditions, and the strategic importance of agriculture for employment and food security.

However, the structural transformation of Moroccan agriculture progressively altered the terms of the fiscal debate. Since the early 2000s, the expansion of irrigated agriculture, export-oriented production, and high-value agricultural chains has increased productivity and income disparities within the agricultural sector. The emergence of large, modern, and highly capitalized agricultural enterprises raised increasing concerns regarding fiscal fairness and the unequal distribution of the tax burden across economic sectors.

A major institutional turning point occurred with the progressive agricultural tax reform introduced under the 2014 Finance Law. This reform established a gradual integration of agricultural activities into the formal tax system based on turnover thresholds. Since 2020, only farms generating annual turnover below MAD 5 million remain exempt from direct taxation.

This reform fundamentally transformed the nature of the agricultural taxation debate in Morocco. The issue no longer concerns the taxation of a fully exempt sector, but rather the potential extension of taxation to the remaining exempt agricultural segment composed primarily of small and medium-sized farms.

This institutional evolution creates a particularly important research context. Estimates frequently discussed during National Tax Conferences suggest that nearly 98% of agricultural farms remain outside direct taxation due to low turnover levels, despite their substantial aggregate role in rural employment and domestic agricultural production.

Despite the growing importance of these reforms, empirical evidence on their macroeconomic and distributive implications remains relatively limited. Existing studies on Moroccan agricultural taxation are generally descriptive or static in nature and largely predate the implementation of the post-2014 institutional framework.

2.4. Climate Vulnerability and Fiscal Sustainability

The interaction between climate vulnerability and agricultural taxation remains relatively underexplored in the literature despite its increasing importance in developing economies exposed to environmental stress. Agricultural production systems in many emerging economies remain highly dependent on rainfall conditions,

water availability, and climate-sensitive productivity dynamics (FAO, 2023; IPCC, 2023).

In Morocco, climate vulnerability constitutes one of the major structural constraints affecting agricultural productivity, rural welfare, and macroeconomic stability. Recurrent drought episodes continue to significantly affect GDP growth, agricultural value added, and rural incomes due to the central role of agriculture within the national economy. The World Bank (2022) identifies water scarcity and climate-related productivity shocks among the most important long-term risks facing Moroccan agriculture.

This climate dimension substantially complicates the design of agricultural taxation reforms. Taxation may reduce disposable income and productive investment precisely when agricultural producers face increasing climate adaptation costs and declining hydric availability. Consequently, the macroeconomic and distributive effects of agricultural taxation are likely to depend strongly on the interaction between fiscal reforms, productivity shocks, and climate resilience policies.

Nevertheless, most empirical studies on agricultural taxation continue to neglect climate-sensitive dynamics. Existing approaches frequently assume stable productivity conditions and therefore underestimate the amplification effects associated with droughts and hydric stress. This omission appears particularly problematic in the Moroccan context, where climate variability directly affects both agricultural output and fiscal sustainability.

2.5. Fiscal Recycling Mechanisms and Agricultural Support Policies

The literature on fiscal reforms increasingly emphasizes the importance of compensatory mechanisms and fiscal recycling policies in reducing the adjustment costs associated with taxation reforms. In CGE and Social Accounting Matrix (SAM)-based approaches, the macroeconomic effects of taxation depend not only on the initial fiscal burden but also on the allocation of the additional revenues generated by the reform (Dervis et al., 1982; Decaluwé et al., 2001).

Public investment programs targeting agricultural modernization, irrigation infrastructure, technological upgrading, and rural connectivity may partially offset the contractionary effects associated with agricultural taxation. Through multiplier effects, productivity gains, and capital accumulation dynamics, compensatory mechanisms can support agricultural output, rural incomes, and long-term growth trajectories.

In Morocco, the Agricultural Development Fund (FDA) constitutes one of the main public instruments supporting agricultural modernization and productive investment. Since the launch of the Green Morocco Plan and subsequently the Generation Green 2020–2030 strategy, the FDA has played a central role in financing irrigation systems, agricultural equipment, hydraulic infrastructure, and modernization projects.

These public investments generated important positive externalities through productivity improvements, market integration, export development, and technological diffusion. However, several studies also emphasize that public agricultural support may disproportionately benefit larger and more capitalized farms due to unequal access to finance, administrative capabilities, and institutional networks.

As a result, the effectiveness of fiscal recycling mechanisms depends strongly on governance quality, targeting efficiency, and distributive design. Poorly targeted support mechanisms may reinforce existing inequalities and generate long-term dependency effects, whereas well-designed compensatory policies may improve both economic efficiency and social sustainability.

2.6. Computable General Equilibrium Approaches and Agricultural Taxation

Computable general equilibrium (CGE) models have become one of the principal analytical tools used to evaluate fiscal, commercial, and sectoral reforms in developing economies. Unlike partial equilibrium approaches, CGE models explicitly incorporate intersectoral linkages, factor markets, institutional interactions, price adjustments, and macroeconomic constraints (Shoven & Whalley, 1984, 1992; Robinson, 1989).

Dynamic recursive CGE models are particularly appropriate for analyzing agricultural taxation reforms because they allow the integration of capital accumulation, investment dynamics, public expenditure effects, and intertemporal adjustment mechanisms. These models are therefore capable of capturing both direct and indirect effects transmitted through production structures, household income distribution, consumption patterns, and public finance channels.

In the Moroccan context, however, applications of CGE models to agricultural taxation remain relatively limited. Existing studies generally focused on generalized agricultural taxation before the implementation of the progressive post-2014 tax reform framework. Karim and Mansouri (2015), for example, show that agricultural

taxation may generate short-term contractionary effects on rural welfare while improving public revenues.

Nevertheless, previous empirical contributions present several limitations. First, most studies do not explicitly account for the current institutional configuration in which large farms are already integrated into the tax system and only the still-exempt agricultural segment remains outside the fiscal base. Second, existing approaches rarely integrate climate vulnerability, fiscal recycling mechanisms, and agricultural heterogeneity simultaneously within a unified macroeconomic framework. Third, many studies rely on static approaches that fail to capture dynamic adjustment mechanisms and long-term accumulation effects.

2.7. Research Gap and Analytical Contribution

The literature review highlights four major gaps.

First, most studies on agricultural taxation continue to rely either on descriptive institutional analyses or static approaches that inadequately capture economy-wide transmission mechanisms, intersectoral interactions, and dynamic adjustment processes.

Second, the empirical literature devoted to Morocco largely predates the post-2014 agricultural tax reform and therefore does not examine the taxation of the remaining exempt agricultural segment under the current institutional framework.

Third, climate vulnerability remains insufficiently integrated into the analysis of agricultural fiscal reforms despite its central role in shaping agricultural productivity, rural welfare, and macroeconomic stability in Morocco.

Fourth, the interaction between taxation reforms and fiscal recycling mechanisms through agricultural public investment remains largely underexplored.

This paper addresses these limitations by developing a recursive dynamic CGE model calibrated on a Moroccan social accounting matrix and explicitly incorporating sectoral heterogeneity, fiscal recycling mechanisms, climate-related productivity shocks, and capital accumulation dynamics. Unlike previous studies, the analysis specifically focuses on the macroeconomic and distributive implications of extending taxation to the still-exempt agricultural segment in post-reform Morocco.

The study therefore contributes to the literature in three main ways. First, it provides one of the first climate-sensitive dynamic CGE analyses of agricultural taxation under the post-2014 Moroccan institutional framework. Second, it integrates fiscal policy, climate vulnerability, and agricultural heterogeneity within a unified macroeconomic modeling approach. Third, it evaluates the stabilizing role of fiscal recycling mechanisms and agricultural public investment in mitigating the adverse effects of agricultural taxation reforms on growth, rural welfare, and fiscal sustainability.

3. Data and Methodology

3.1. Methodological Framework

This study develops a recursive dynamic computable general equilibrium (CGE) model to evaluate the macroeconomic, sectoral, and distributive effects of extending taxation to the still-exempt agricultural segment in Morocco. The methodological framework follows the tradition of multisectoral dynamic CGE models initially developed by Shoven and Whalley (1984, 1992) and subsequently adapted to developing economies by Dervis et al. (1982), Robinson (1989), and Decaluwé et al. (2001).

CGE models constitute one of the principal analytical tools used for the ex ante evaluation of fiscal, sectoral, and structural reforms because they explicitly capture interactions between productive sectors, factor markets, institutions, public finance, and external trade. Unlike partial equilibrium approaches, CGE frameworks allow the simultaneous analysis of direct, indirect, and induced effects generated by policy shocks throughout the entire economic system.

The recursive dynamic specification adopted in this study introduces intertemporal adjustment mechanisms linking each simulation period to the next through capital accumulation, labor force growth, investment dynamics, and public infrastructure development. This structure makes it possible to evaluate not only the immediate effects of agricultural taxation reforms but also their cumulative implications for sectoral productivity, rural welfare, macroeconomic stability, and long-term growth trajectories.

The model is specifically designed to capture the institutional and structural characteristics of the Moroccan economy following the progressive agricultural tax reform introduced under the 2014 Finance Law. Unlike previous studies focusing on

the taxation of a largely exempt agricultural sector, the present analysis examines the potential extension of taxation to the remaining exempt agricultural segment composed mainly of small and medium-sized farms with annual turnover below MAD 5 million.

3.2. Data Sources and Social Accounting Matrix

The empirical implementation of the model relies on a Social Accounting Matrix (SAM) constructed using the most recent national accounts and Input–Output data published by the Moroccan High Commission for Planning (HCP Stat 2024). The database combines information from national Input–Output Tables, sectoral production accounts, institutional accounts, external trade statistics, household consumption structures, and public finance data.

The SAM was specifically reconstructed, balanced, and aggregated for the purpose of this study in order to ensure accounting consistency between productive sectors, institutional agents, fiscal accounts, and external transactions. The calibration process integrates macroeconomic aggregates related to production, intermediate consumption, value added, household income, public revenues, savings-investment balances, and trade flows observed in the Moroccan economy.

The benchmark structure reflects the most recent available configuration of the Moroccan economy and explicitly incorporates the post-2014 agricultural tax reform environment in which large agricultural farms are already integrated into the formal tax system while smaller farms generating annual turnover below MAD 5 million remain exempt from direct taxation.

The database construction process also incorporates recent macroeconomic and sectoral information concerning agricultural production, irrigation structures, public agricultural investment, and fiscal aggregates derived from official HCP statistical publications as well as complementary reports issued by the Ministry of Economy and Finance and the Directorate of Financial Studies and Forecasts (DEPF).

The use of recent HCP Stat 2024 data constitutes an important empirical contribution of the study, as most previous Moroccan CGE applications relied on older benchmark matrices and pre-reform agricultural structures. This updated database allows a more accurate representation of the current institutional and productive configuration of the Moroccan agricultural sector.

To capture the structural heterogeneity of Moroccan agriculture, the SAM distinguishes between irrigated agricultural activities and non-irrigated agricultural activities. This distinction is particularly important given the significant differences in productivity, market integration, climate vulnerability, and taxable capacity between the two agricultural systems.

The final SAM structure distinguishes six productive sectors:

- irrigated agriculture,
- non-irrigated agriculture,
- agro-industrial activities,
- non-agro-industrial manufacturing,
- market services,
- and public administration.

The institutional accounts distinguish households, firms, government, investment-savings accounts, and the rest of the world. Agricultural households are further disaggregated into small farms, medium farms, and large agricultural producers in order to evaluate the distributive implications of taxation reforms across heterogeneous rural groups.

The benchmark year calibration reflects the most recent macroeconomic structure available in HCP Stat 2024 and constitutes the reference equilibrium for all simulations performed over the 2025–2035 simulation horizon.

3.3. Model Structure

The model adopts a recursive dynamic multisectoral CGE structure in which markets are solved sequentially period by period while state variables evolve dynamically over time. The economy is represented through interconnected productive activities, commodities, production factors, institutions, government accounts, investment-savings balances, and external trade accounts.

The productive structure combines a Leontief specification linking intermediate consumption and value added with a Cobb–Douglas value-added function integrating labor, capital, and land. Sectoral production is defined as:

$$Y_i = min\left[\frac{CI_i}{oi_i}, \frac{V_i}{v_i}\right] \quad (1)$$

where CI_i represents intermediate consumption and V_i sectoral value added. Sectoral value added is generated according to a Cobb–Douglas technology:

$$V_i = A_i T_i^{\eta} K_i^{\beta_i} L_i^{\alpha_i} \quad (2)$$

where T_i, and L_i denote land, capital, and labor inputs, respectively. A_i captures sectoral productivity, while α_i, β_i, and η_i represent factor elasticities.

The explicit introduction of land as a production factor is particularly important in the Moroccan context due to strong differences in productivity between irrigated and non-irrigated agriculture as well as the importance of hydric constraints and land fragmentation.

Productivity incorporates positive externalities associated with public capital accumulation:

$$A_i = A_0 \left(\frac{K^G}{\sum_i K^i}\right)^{\varphi} \quad (3)$$

where K^G represents public capital stock. This specification captures the effects of irrigation infrastructure, hydraulic investment, rural roads, and agricultural modernization programs financed through public support mechanisms such as the Agricultural Development Fund (FDA).

3.4. Household Behavior and Welfare

Household behavior is represented using an Extended Linear Expenditure System (ELES) derived from Stone–Geary preferences. This specification distinguishes subsistence consumption, discretionary consumption, and savings behavior. The ELES structure appears particularly appropriate in the Moroccan context because rural households allocate a large share of income to food consumption and essential goods.

The representative household utility function is defined as:

$$\ln(U_h) = \sum_{i=1}^{n} \mu_{i,h} \ln\left(CM_{i,h} - \theta_{i,h}\right) + \mu s_h \ln(SM_h) \quad (4)$$

where $CM_{i,h}$ denotes household consumption of commodity i, $\theta_{i,h}$ the subsistence consumption level, and SM_h household savings.

Agricultural taxation reforms directly affect household disposable income through new fiscal liabilities applied to previously exempt agricultural revenues:

$$RDM_h^1 = RDM_h^0 - T_h^{agri} + TR_h^{FDA} \quad (5)$$

Where T_h^{agri} denotes agricultural taxation and TR_h^{FDA} transfers received through compensatory fiscal recycling mechanisms financed by the Agricultural Development Fund.

Household welfare effects are evaluated using equivalent variation measures aggregated into a synthetic social welfare indicator, allowing the assessment of distributive impacts across different categories of agricultural households.

3.5. External Trade and Price Formation

The model incorporates imperfect substitution between domestic and imported goods following the Armington (1969) specification. Composite demand for commodity iii is represented through a Constant Elasticity of Substitution (CES) function:

$$Q_i = \left[\delta_i M_i^{-\rho i} + (1-\delta_i) D_i^{-\rho i}\right]^{-1/\rho i} \quad (6)$$

where M_i denotes imports and D_i domestically produced goods supplied to the domestic market.

Domestic prices depend on world prices, exchange rates, tariffs, indirect taxation, and subsidy mechanisms:

$$P_i = Pw_i e\left(1+\tau_i^{dd}\right)\left(1+\tau_i^{ind}\right)(1+\tau_i^{s}) \quad (7)$$

This specification allows the model to capture the effects of agricultural taxation reforms on production costs, food prices, competitiveness, and external trade structures.

The explicit incorporation of VAT mechanisms is particularly important in the Moroccan agricultural context because indirect taxation may influence both agricultural input costs and food prices, thereby affecting rural welfare and sectoral competitiveness.

3.6. Government Behavior and Fiscal Recycling Mechanisms

The government is modeled as a central institutional agent collecting taxes, redistributing income, financing public expenditure, and supporting productive investment. Public revenues originate from indirect taxes, customs duties, direct household taxation, and corporate taxation.

Agricultural taxation reforms introduce an additional fiscal component targeting previously exempt agricultural revenues:

$$RDD^{agri} = \sum_i \tau_h \, Y_h^{\text{exempt}} \quad (8)$$

where Y_h^{exempt} represents previously exempt agricultural income and τ_h the effective tax rate applied to household category h.

A share of additional agricultural tax revenues is recycled toward the agricultural sector through compensatory public investment mechanisms financed by the Agricultural Development Fund:

$$TRFDA = \alpha \, RTD^{agri} \quad (9)$$

where α represents the share of additional tax revenues reinjected into agricultural support programs.

This fiscal recycling mechanism constitutes a central feature of the model because it allows the evaluation of the stabilizing role of compensatory public investment in mitigating the contractionary effects associated with agricultural taxation reforms.

Public investment influences productivity through irrigation infrastructure, hydraulic systems, modernization policies, climate adaptation programs, and rural connectivity. These mechanisms are particularly important in the Moroccan context where agricultural productivity remains strongly dependent on water infrastructure and climate resilience capacity.

3.7. Dynamic Specification

The recursive dynamic structure links simulation periods through capital accumulation, labor force growth, investment dynamics, and public infrastructure development. Labor supply evolves according to demographic growth:

$$L_{t+1}^s = L_t^s \cdot (1 + n) \quad (10)$$

Public capital evolves according to:

$$K_{t+1}^{G} = K_{t}^{G} \cdot (1 - \theta) + \delta^{i} IG_{t}^{v0} \quad (11)$$

while private sectoral capital accumulation follows:

$$K_{t+1}^{i} = K_{t}^{i} \cdot (1 - \theta) + \delta^{i} IP_{t}^{i} \quad (12)$$

where IG_t and IP_t^i denote public and private investment, respectively.

Private investment dynamics depend on previous investment levels, economic growth, and public investment effects:

$$\frac{I_t^p}{GDP_t} = b \frac{I_{t-1}^p}{GDP_{t-1}} + c \ln\left(\frac{GDP_t}{GDP_{t-1}}\right) + d \frac{IG_t}{GDP_t} \quad (13)$$

This recursive specification allows the model to capture medium-term accumulation effects and intertemporal transmission mechanisms associated with agricultural fiscal reforms.

The dynamic structure is particularly relevant for the Moroccan economy because the effects of irrigation investment, agricultural modernization, public infrastructure, and climate adaptation policies materialize progressively over time rather than instantaneously.

The model is calibrated on the benchmark equilibrium derived from the Moroccan Social Accounting Matrix constructed using HCP Stat 2024 data. Calibration ensures that the benchmark equilibrium reproduces the observed structure of production, consumption, factor remuneration, fiscal accounts, and external trade flows of the Moroccan economy.

The model adopts a standard neoclassical closure commonly used in recursive dynamic CGE applications for developing economies (Dervis et al., 1982; Decaluwé et al., 2001).

The following closure assumptions are retained:

- factor markets clear through relative price adjustments;
- labor supply evolves exogenously according to demographic growth;
- total investment is savings-driven;
- public savings adjust endogenously to maintain fiscal equilibrium;

- the current account balance is fixed as a share of GDP;
- the exchange rate acts as the external adjustment variable;
- capital accumulation follows recursive investment mechanisms.

The consumer price index (CPI) is selected as the model numéraire:

$$PCPI = 1$$

This normalization ensures the consistent determination of relative prices within the general equilibrium framework.

Labor mobility is assumed to be imperfect between agricultural and non-agricultural sectors, reflecting structural rigidities and labor segmentation within the Moroccan economy. Capital is sector-specific in the short run but becomes partially mobile over time through investment accumulation mechanisms.

The model distinguishes three production factors:

- labor;
- private capital;
- agricultural land.

Land is assumed to be sector-specific and imperfectly substitutable across agricultural activities, particularly between irrigated and non-irrigated production systems.

Elasticity parameters are calibrated using a combination of Moroccan Input–Output structures, previous CGE studies applied to developing economies, GTAP-based elasticities, and parameter values commonly retained in agricultural CGE applications. Armington elasticities govern substitution between imported and domestically produced goods, while CET elasticities determine export-domestic transformation behavior.

The depreciation rate of private capital is fixed at 5%, while labor force growth is assumed at 1.2% annually based on recent demographic projections. Public investment productivity effects are calibrated using the elasticity parameter ϕ, reflecting infrastructure externalities associated with irrigation systems, agricultural modernization, and rural investment policies.

The Agricultural Development Fund (FDA) recycling parameter (α) determines the share of additional agricultural tax revenues reinvested into agricultural support

programs. Climate shocks are introduced through exogenous productivity reductions affecting primarily non-irrigated agricultural activities.

It is important to distinguish between the share of taxable agricultural producers and the fiscal recycling parameter. Analyses of the Moroccan agricultural structure and discussions held during the National Tax Conferences suggest that only a very small proportion of agricultural holdings—often estimated at around 1% to 2% of farms—exceed the turnover thresholds required for direct taxation, while the vast majority remain effectively outside the scope of agricultural income taxation (Akesbi, 2012; Kingdom of Morocco, 2019). This reflects the narrowness of the taxable agricultural base and helps explain the limited short-term revenue potential associated with extending taxation to the remaining exempt agricultural segment. By contrast, the FDA recycling parameter (α) is a policy assumption representing the proportion of additional agricultural tax revenues reinvested into the sector through public support mechanisms. In this study, α is set at 40% to represent a moderate fiscal recycling scenario, whereby part of the additional revenues finances irrigation infrastructure, agricultural modernization, and climate adaptation programs, while the remaining share contributes to the general government budget.

Similarly, the public capital productivity elasticity (ϕ) is set at 0.08 to capture the positive but moderate productivity effects associated with public investment in irrigation systems, rural infrastructure, and agricultural modernization. This value is consistent with the range commonly adopted in CGE applications for developing economies and reflects a conservative assumption regarding the contribution of public capital to agricultural productivity growth.

Table 1 summarizes the principal calibration parameters retained in the simulations.

Table 1. Main Calibration Parameters

Parameter	Description	Value	Source
ρ_A	Armington elasticity	2.0	GTAP / CGE literature
ρ_T	CET elasticity	1.5	CGE literature
θ	Capital depreciation rate	5%	Standard CGE calibration
n	Labor force growth	1.2%	HCP demographic projections
ϕ	Public capital productivity elasticity	0.08	Calibrated
α	FDA recycling share	40%	Simulation assumption

Climate shock	Agricultural productivity shock	-15% to -30%	FAO / World Bank
s	Household savings rate	18%	HCP national accounts

This calibration framework ensures consistency between the observed structure of the Moroccan economy, the post-2014 agricultural tax regime, and the policy scenarios evaluated over the 2025–2035 simulation horizon.

To further assess the consistency of the calibration procedure, the benchmark equilibrium generated by the model was compared with the principal macroeconomic aggregates of the Social Accounting Matrix used for calibration. The benchmark replication exercise confirms that the calibrated model accurately reproduces the benchmark structure of the Moroccan economy, including production, value added, and fiscal revenues. As expected from the calibration procedure, the benchmark equilibrium replicates the Social Accounting Matrix exactly, resulting in zero replication errors. This confirms the internal consistency of the calibration and provides a reliable starting point for the policy simulations.

Table 2. Benchmark Replication of Key Macroeconomic Aggregates

Variable	SAM	Model	Error (%)
GDP	1,420,068	1,420,068	<0.001
Fiscal Revenues	320,503	320,503	<0.001
Agricultural Value Added	226,771	226,771	<0.001

Source: Authors' calculations based on the calibrated Moroccan Social Accounting Matrix (HCP Stat 2024)

The near-perfect replication of the benchmark aggregates confirms the internal consistency of the calibration procedure and validates the benchmark equilibrium used as the starting point for all simulations. The negligible replication errors indicate that the model accurately reproduces the structural characteristics of the Moroccan economy prior to the introduction of fiscal and climate policy shocks.

3.8. Simulation Scenarios

The analysis evaluates seven policy scenarios designed to assess the macroeconomic, sectoral, fiscal, and distributive implications of extending taxation to the still-exempt agricultural segment.

Scenario	Description
S0	Baseline scenario without additional agricultural taxation reform
S1	Introduction of VAT, personal income tax, and corporate tax on still-exempt agricultural activities with partial fiscal recycling through the FDA
S2	Taxation applied only to irrigated agricultural activities combined with FDA compensatory mechanisms
S3	Introduction of personal and corporate income taxation without VAT
S4	Direct agricultural taxation without compensatory mechanisms
S5	Agricultural taxation combined with climate shocks simulating drought conditions
S6	Progressive agricultural taxation over the 2025–2035 period
S7	Progressive taxation combined with reinforced FDA investment and climate adaptation policies

The integration of climate shocks allows the model to evaluate the vulnerability of agricultural growth trajectories under recurrent drought conditions and increasing hydric stress.

All simulations were implemented in R (version 4.6.0) using a recursive dynamic CGE framework calibrated on the Moroccan Social Accounting Matrix constructed from HCP Stat 2024 data.

The simulations evaluate the effects of agricultural taxation reforms on:

- sectoral production;
- agricultural value added;
- household income;
- fiscal revenues;
- productive investment;
- capital accumulation;
- rural welfare;
- and macroeconomic equilibrium.

The adopted framework therefore provides an integrated assessment of the trade-offs between fiscal mobilization, economic growth, distributive equity, agricultural resilience, and macroeconomic sustainability within the context of agricultural taxation reforms in Morocco.

4. Simulation Results and Policy Analysis

4.1. Macroeconomic Effects of Agricultural Taxation Scenarios

The simulations performed using the recursive dynamic computable general equilibrium (CGE) model reveal differentiated macroeconomic effects depending on the intensity of agricultural taxation, the existence of compensatory fiscal mechanisms, and the integration of climate-related constraints. Overall, the results indicate that the macroeconomic impact of agricultural tax reforms depends strongly on the degree of fiscal progressivity and on the capacity of public policies to recycle additional tax revenues toward productive agricultural support.

The baseline scenario (S0) corresponds to a trajectory without additional agricultural tax reform. Under this configuration, real GDP increases from MAD 1,420,068 million in 2025 to MAD 2,003,146 million in 2035, reflecting a relatively stable long-term growth trajectory.

By contrast, scenarios involving more intensive agricultural taxation generate stronger contractionary effects. Scenario S4, characterized by agricultural taxation without compensatory FDA mechanisms, appears to be the most restrictive configuration for the Moroccan economy. GDP reaches only MAD 1,871,717 million in 2035, corresponding to a contraction of 6.56% relative to the baseline scenario. This result suggests that abrupt fiscal integration of the agricultural sector could generate negative effects on productive investment, rural incomes, and domestic demand.

Conversely, Scenario S6, based on progressive agricultural taxation, appears to be the most macroeconomically sustainable configuration among the simulated reform scenarios. GDP declines remain limited to −0.96%, while fiscal revenues remain broadly stable (+0.02%). Although the direct fiscal gains are modest, this outcome reflects the limited taxable capacity of the remaining exempt agricultural segment, which is composed predominantly of small and medium-sized farms. Consequently, the primary rationale for progressive agricultural taxation is not short-term revenue maximization but rather the gradual broadening of the tax base, the enhancement of fiscal equity across sectors, and the progressive integration of agricultural producers into the formal fiscal system. The results suggest that a gradual approach can improve tax neutrality while minimizing adverse effects on economic activity and rural welfare.

The simulations also indicate that compensatory mechanisms play a crucial stabilizing role. Scenario S1 (VAT + PIT + CIT + FDA recycling) generates smaller output losses than Scenario S4 without FDA support, highlighting the importance of partially

recycling fiscal revenues toward agricultural investment and productive support mechanisms. These findings suggest that agricultural taxation should not be assessed solely on the basis of its immediate fiscal yield. A significant share of the reform's effectiveness derives from the capacity of the Agricultural Development Fund (FDA) to transform fiscal revenues into productivity-enhancing investments, including irrigation infrastructure, agricultural modernization, climate adaptation measures, and rural development projects. In this perspective, the FDA operates as a key transmission mechanism linking fiscal policy to long-term agricultural competitiveness and resilience.

Finally, scenarios incorporating climate shocks (S5 and S7) reveal the strong structural vulnerability of Moroccan agriculture. The combination of drought and agricultural taxation produces a sharp contraction in agricultural value added, emphasizing the importance of integrating climate adaptation policies into fiscal reform strategies.

Table 3. Macroeconomic Results of Agricultural Taxation Scenarios in 2035

(MAD million)

Scenario	GDP	GDP Var (%)	Fiscal Revenues	Revenue Var (%)	Agricultural VA	Agri VA Var (%)	FDA Transfers
S0 Baseline	2,003,146	0.00	320,503	0.00	226,771	0.00	0
S1 VAT + PIT + CIT + FDA	1,890,005	-5.65	310,957	-2.98	213,902	-5.67	8,556
S2 Irrigated agriculture taxation + FDA	1,945,835	-2.86	317,941	-0.80	220,252	-2.87	4,405
S3 PIT + CIT without VAT	1,927,062	-3.80	319,236	-0.40	218,117	-3.82	0
S4 Taxation without FDA	1,871,717	-6.56	316,421	-1.27	211,822	-6.59	0
S5 Taxation + drought shock	1,891,218	-5.59	307,093	-4.18	149,927	-33.89	2,999

S6 Progressive taxation	1,983,876	-0.96	320,564	+0.02	224,579	-0.97	1,347
S7 FDA + climate adaptation	1,934,487	-3.43	311,813	-2.71	152,998	-32.53	5,355

Source: Authors' calculations based on the recursive dynamic CGE model calibrated on the Moroccan SAM (HCP Stat 2024) under R 4.6.0

Table 3 clearly indicates that the economic effects of agricultural taxation depend not only on the level of taxation but also on the presence of compensatory investment mechanisms. Scenarios incorporating FDA-supported recycling generally perform better than equivalent scenarios without support measures, highlighting the importance of linking fiscal reform to productive agricultural investment.

4.2. Sectoral Effects and Productive Dynamics

The sectoral simulations reveal pronounced heterogeneity in the economic effects of agricultural taxation reforms across productive activities. While all sectors are indirectly affected through intersectoral linkages, agriculture emerges as the most vulnerable component of the productive system, particularly under scenarios combining fiscal reforms with adverse climatic conditions. This outcome reflects both the strategic importance of agriculture within the Moroccan economy and its continued dependence on climate-sensitive production systems.

Under the baseline scenario (S0), agricultural value added reaches MAD 226,771 million by 2035, reflecting a stable expansion of productive capacity consistent with the long-run growth trajectory of the economy. However, the introduction of taxation in conjunction with drought-induced productivity shocks substantially alters this trajectory. In Scenario S5, agricultural value added declines to MAD 149,927 million, corresponding to a reduction of approximately 34 percent relative to the baseline. Such a contraction underscores the structural fragility of Moroccan agriculture, particularly in rainfed areas where production remains highly dependent on rainfall variability and where adaptive capacity is comparatively limited.

The results further indicate that the economic impact of taxation depends critically on the design of the reform. Scenario S2, which limits taxation to irrigated agricultural

activities while maintaining support through the Agricultural Development Fund, generates considerably smaller distortions. Agricultural value added declines by less than 3 percent, suggesting that a targeted fiscal approach focused on the most capitalized and productive segments of agriculture can broaden the tax base while preserving sectoral performance. This finding supports the argument that differentiated taxation may reduce adjustment costs and improve the political feasibility of agricultural fiscal reforms.

Beyond the agricultural sector itself, the simulations reveal significant economy-wide transmission mechanisms. Agriculture constitutes both a major supplier of intermediate inputs to agro-industrial activities and an important source of income for rural households. Consequently, reductions in agricultural output generate cascading effects throughout the production system. Agro-industrial industries experience lower input availability and higher production costs, while market services are affected through declining household consumption and weaker investment demand. These multiplier effects confirm the strong production and income linkages embedded in the Social Accounting Matrix and illustrate how sector-specific fiscal reforms can generate broader macroeconomic repercussions.

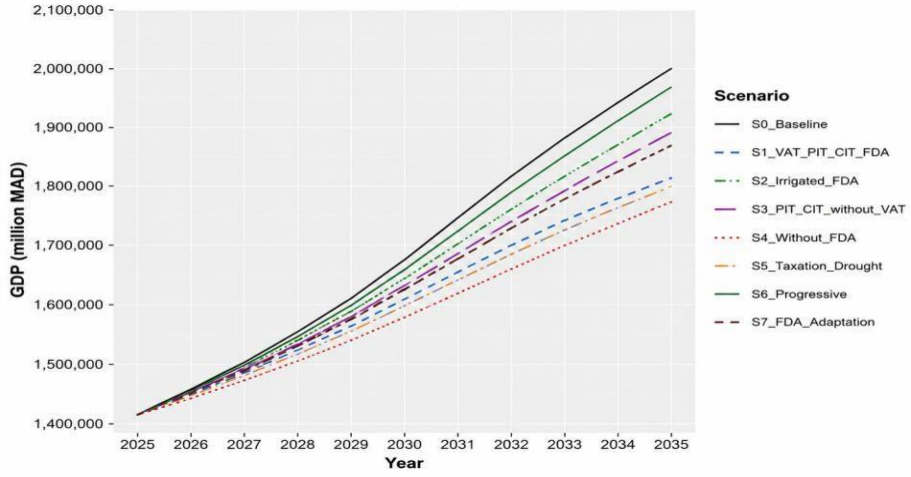

Figure 1. Real GDP Trajectories Across Simulation Scenarios

Source: Authors' calculations based on the recursive dynamic CGE model under R 4.6.0

Figure 1 illustrates the progressive divergence of economic growth trajectories under alternative fiscal regimes. Scenarios S1 and S4 display the weakest long-term performance, reflecting the contractionary consequences of broad-based agricultural taxation and the absence of effective compensatory mechanisms. By contrast,

Scenario S6 remains relatively close to the baseline trajectory throughout the simulation horizon, indicating that gradual fiscal integration substantially reduces adjustment costs and preserves growth dynamics.

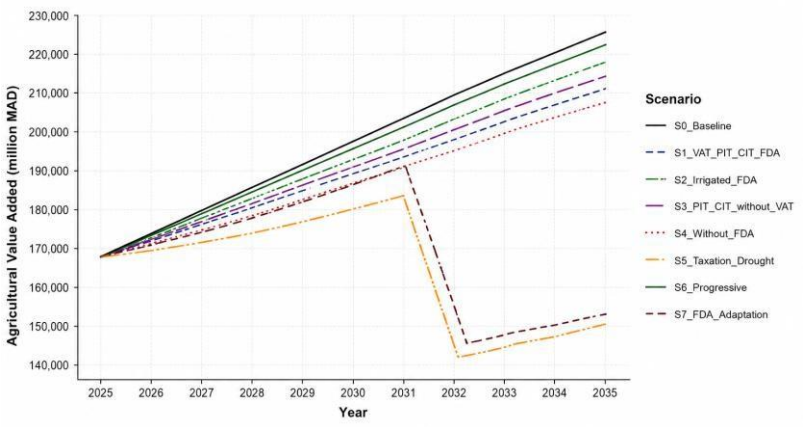

Figure 2. Agricultural Value Added Across Scenarios

Source: Authors' calculations based on the recursive dynamic CGE model under R 4.6.0

Figure 2 highlights the pronounced decline in agricultural value added under climate-sensitive scenarios. The sharp structural break observed in Scenarios S5 and S7 following the introduction of drought shocks illustrates the interaction between fiscal policy and climate vulnerability. More importantly, the magnitude of the decline suggests that climate-induced productivity losses may exceed the direct effects of taxation itself. This finding reinforces the view that the effectiveness of agricultural tax reforms depends not only on fiscal design but also on the capacity of public policies to strengthen climate resilience and reduce exposure to recurrent drought risks.

Table 4. Ranking of Scenarios According to Macroeconomic Sustainability

Scenario	GDP Variation (%)	Revenue Variation (%)	Agricultural VA Variation (%)	Sustainability
S0 Baseline	0.00	0.00	0.00	High
S6 Progressive taxation	-0.96	+0.02	-0.97	High
S2 Irrigated taxation + FDA	-2.86	-0.80	-2.87	Moderate

S3 PIT + CIT without VAT	-3.80	-0.40	-3.82	Moderate
S7 FDA + climate adaptation	-3.43	-2.71	-32.53	Moderate
S1 VAT + PIT + CIT + FDA	-5.65	-2.98	-5.67	Low
S5 Taxation + drought shock	-5.59	-4.18	-33.89	Low
S4 Taxation without FDA	-6.56	-1.27	-6.59	Low

Source: Authors' calculations based on the recursive dynamic CGE model calibrated on the Moroccan SAM (HCP Stat 2024)

The ranking presented in Table 4 confirms that the long-term sustainability of agricultural tax reform depends on achieving an appropriate balance between fiscal equity, productive efficiency, and social stability. Scenario S6 emerges as the most sustainable reform option, not because it generates substantial additional revenues, but because it broadens the agricultural tax base while preserving economic activity and rural welfare. The results indicate that the remaining exempt agricultural segment offers limited short-term revenue potential; therefore, the economic justification for progressive taxation lies primarily in improving horizontal equity between sectors and strengthening the long-term formalization of agricultural activities. Furthermore, scenarios incorporating FDA-supported investment consistently outperform equivalent scenarios without compensatory mechanisms, underscoring the central role of fiscal recycling in enhancing the effectiveness and acceptability of agricultural tax reforms. Conversely, Scenarios S4 and S5 produce the least favorable outcomes owing to the absence of compensatory support mechanisms and the amplification effects of climate shocks. Overall, the results suggest that gradual taxation, accompanied by targeted fiscal recycling and climate adaptation measures, represents the most effective strategy for reconciling fiscal sustainability, agricultural competitiveness, and rural welfare in Morocco. Such an integrated approach is essential to ensure that agricultural taxation contributes not only to revenue generation but also to long-term structural transformation and economic resilience.

4.3. Distributive Effects and Fiscal Redistribution Through the FDA

The distributive analysis indicates that the effects of agricultural tax reforms differ significantly across categories of agricultural producers. Small farms benefit relatively more from FDA compensatory mechanisms, whereas large commercial farms bear the largest share of the fiscal burden.

Beyond its redistributive role, the FDA also functions as a productive investment instrument. By financing irrigation systems, agricultural equipment, climate adaptation projects, and rural infrastructure, FDA transfers contribute to strengthening agricultural productivity and mitigating the adjustment costs associated with fiscal reform. Consequently, the effectiveness of agricultural taxation depends not only on the amount of revenue collected but also on the efficiency with which these revenues are recycled into productive agricultural investments.

The simulations suggest that redistributive mechanisms partially mitigate income losses for the most vulnerable agricultural households. However, the magnitude of compensation remains insufficient under aggressive fiscalization scenarios without gradual implementation.

In Scenario S6, the progressive nature of the reform helps limit distributive losses while maintaining relatively stable public finance dynamics. These results suggest that gradual fiscal integration combined with targeted redistribution mechanisms may improve the social acceptability of agricultural tax reforms.

Table 5. Simplified Distributive Effects by Farm Category

Group	Share of Agricultural Production (%)	Tax Rate	FDA Share (%)	Net Effect
Small farms	55	0.00	70	Positive
Medium farms	30	3%	25	Moderately negative
Large farms	15	10%	5	Negative

Source: Authors' calculations based on the recursive dynamic CGE model calibrated on the Moroccan SAM (HCP Stat 2024)

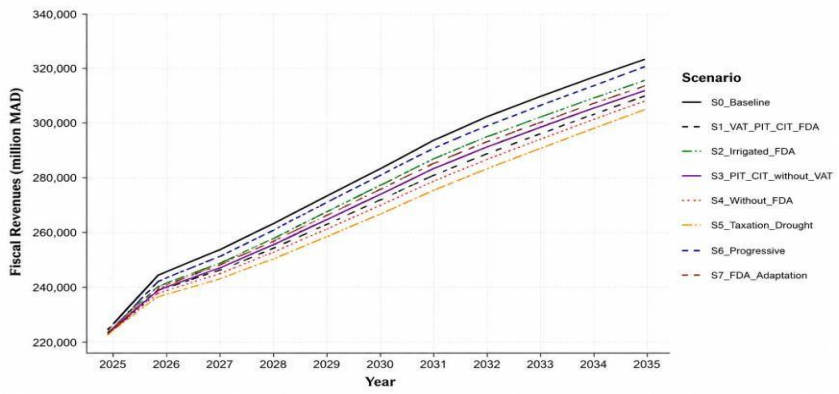

Figure 3. Fiscal Revenues Across Scenarios

Source: Authors' calculations based on the recursive dynamic CGE model under R 4.6.0

Fiscal revenues increase progressively across most reform scenarios, although long-term differences remain relatively limited. Highly aggressive taxation strategies do not necessarily generate the strongest fiscal performance because recessionary effects partially offset additional tax collection.

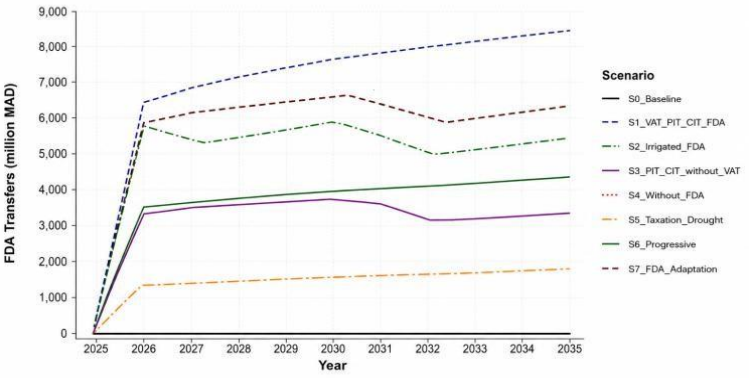

Figure 4. FDA Transfers Across Scenarios

Source: Authors' calculations based on the recursive dynamic CGE model under R 4.6.0

FDA transfers vary substantially across scenarios and emerge as a key determinant of reform sustainability. Higher levels of fiscal recycling are associated with smaller losses in GDP and agricultural value added, highlighting the role of the FDA as a productive investment mechanism rather than a simple redistribution tool. The results suggest that the effectiveness of agricultural taxation depends critically on the capacity

of public authorities to channel fiscal resources toward irrigation infrastructure, agricultural modernization, and climate adaptation programs.

4.4. Agricultural Taxation and Climate Vulnerability

The climate-sensitive simulations indicate that the structural vulnerability of Moroccan agriculture constitutes a major constraint for any agricultural taxation strategy. Simulated drought episodes generate substantial contractions in agricultural value added, which subsequently propagate throughout the economy through sectoral multiplier effects.

Under Scenario S5, agricultural losses simultaneously reduce rural incomes, fiscal revenues, and demand addressed to agro-industrial and service sectors. These results suggest that the effectiveness of agricultural tax reforms depends strongly on the capacity of public policies to integrate climate and hydric dimensions into fiscal reform strategies.

Scenario S7 further indicates that strengthened FDA mechanisms and climate adaptation policies may partially mitigate economic losses, although they do not entirely eliminate the adverse effects associated with drought shocks. The results therefore suggest that climate vulnerability constitutes a more significant constraint on agricultural performance than taxation itself. Consequently, the long-term success of agricultural fiscal reform depends not only on tax design but also on the capacity of public policies to enhance water security, irrigation efficiency, and climate resilience.

Table 6. Impact of Climate Shocks on Agricultural Value Added

(current MAD million)

Year	Baseline	Climate Shock	Loss
2028	184,386	157,533	26,852
2029	189,917	162,259	27,658
2030	195,615	167,127	28,488
2031	201,483	172,141	29,342
2032	207,528	142,877	64,651
2033	213,754	147,163	66,590
2034	220,166	151,578	68,588
2035	226,771	156,126	70,646

Source: Authors' calculations based on the recursive dynamic CGE model calibrated on the Moroccan SAM (HCP Stat 2024)

5. Discussion and Policy Implications

The results provide several important insights into the economic, distributive, and fiscal implications of extending taxation to the still-exempt agricultural segment in Morocco. Unlike earlier analyses focusing on the hypothetical taxation of the entire agricultural sector, the present study is situated within the current post-2014 institutional framework in which large agricultural farms have already been progressively integrated into the formal tax system. Consequently, the issue examined in this research no longer concerns the fiscalization of a fully exempt agricultural sector, but rather the potential extension of taxation to the remaining exempt segment composed mainly of small and medium-sized farms with annual turnover below MAD 5 million.

This institutional specificity is particularly important because small and medium-sized farms still represent the overwhelming majority of the Moroccan agricultural structure. Although these farms exhibit relatively limited individual taxable capacity, the simulations indicate that they collectively maintain a substantial economic and social role within rural Morocco. The contraction of rural disposable income generated by taxation reforms propagates through domestic demand mechanisms captured by the dynamic CGE model and the Social Accounting Matrix. Reduced rural consumption progressively affects agro-industrial activities, services, and productive investment through strong intersectoral linkages embedded within the Moroccan economy.

The results therefore suggest that small and medium-sized agricultural producers play a more important macroeconomic role than their relatively low individual productivity levels would initially imply. Their demographic weight gives rural income an important multiplier effect on domestic demand and related productive activities. In this perspective, agricultural taxation appears not only as an instrument of public revenue mobilization but also as a potential lever of structural transformation affecting productive accumulation, territorial equilibrium, rural resilience, and the progressive integration of agricultural activities into the formal economy.

One of the central findings of the dynamic CGE model concerns the existence of a fundamental trade-off between fiscal integration and economic growth. The simulations indicate that aggressive agricultural taxation generates contractionary effects on economic activity while producing only limited additional fiscal revenues. This result reflects the structural characteristics of the remaining exempt agricultural

segment, which is largely composed of small and medium-sized farms with relatively low taxable capacity. Consequently, the economic rationale for agricultural taxation extends beyond short-term revenue mobilization and relates more closely to fiscal equity, formalization, and the gradual integration of agricultural activities into the national tax system.

The contractionary effects are not confined to agriculture alone. The simulations reveal important intersectoral transmission mechanisms operating through intermediate consumption, household income distribution, and demand multiplier effects. Agro-industrial activities and market services appear especially sensitive to the slowdown of agricultural activity. Moreover, the dynamic structure of the model shows that fiscal shocks progressively affect capital accumulation mechanisms. Reduced agricultural income limits savings and productive investment capacities, thereby weakening long-term growth trajectories and future productive potential.

By contrast, the simulations suggest that progressive taxation significantly reduces the macroeconomic adjustment costs associated with reform. Scenario S6 emerges as the most sustainable compromise between fiscal integration and growth preservation. Although the increase in fiscal revenues remains modest, GDP losses are limited and agricultural value added remains close to the baseline trajectory. These results suggest that the objective of progressive taxation should not be interpreted primarily as revenue maximization but rather as a mechanism for broadening the tax base, improving horizontal fiscal equity, and strengthening the long-term formalization of agricultural activities while preserving rural economic stability.

The analysis highlights the central stabilizing role of the Agricultural Development Fund (FDA), which emerges as one of the key determinants of reform sustainability. Scenarios incorporating fiscal recycling mechanisms systematically outperform equivalent scenarios without compensatory support. When part of the additional tax revenues is reinvested through the FDA, the negative effects of taxation on household income, investment, and productive activity are significantly reduced.

The results therefore suggest that agricultural taxation should not be evaluated solely through its direct fiscal yield. The effectiveness of reform depends equally on the allocation of the revenues collected. In the Moroccan context, the FDA acts as a transmission mechanism through which fiscal resources are transformed into productivity-enhancing investments. By financing irrigation infrastructure, water-saving technologies, agricultural modernization programs, rural connectivity, and

climate adaptation projects, the FDA contributes to strengthening agricultural competitiveness and resilience. Consequently, the long-term benefits of agricultural taxation arise less from immediate revenue generation than from the capacity of fiscal recycling mechanisms to support productive transformation and climate adaptation within the agricultural sector.

The integration of climate shocks constitutes one of the principal contributions of the model developed in this study. The simulations indicate that the structural vulnerability of Moroccan agriculture represents a major constraint for any agricultural taxation strategy. Scenarios incorporating drought episodes generate sharp contractions in agricultural value added and progressive deterioration of macroeconomic trajectories. These climate-related losses simultaneously reduce rural income, fiscal revenues, productive investment, and demand addressed to agro-industrial and service sectors.

The results also show that non-irrigated agricultural activities are considerably more vulnerable to climate shocks. Their strong dependence on rainfall variability amplifies the negative effects associated with taxation and weakens their taxable capacity. Conversely, taxation scenarios focused on irrigated agriculture generate more moderate recessionary effects. Irrigated farms generally display higher productivity levels, stronger market integration, and greater taxable capacity, making them more suitable candidates for gradual fiscal integration.

These findings suggest that a sustainable agricultural tax reform must necessarily be coordinated with climate adaptation policies, water management strategies, and investment in hydraulic infrastructure. In a context characterized by recurrent droughts and increasing water scarcity, climate resilience becomes a central condition for the sustainability of agricultural fiscal reforms.

The distributive analysis further reveals significant asymmetry in the welfare effects of reform across categories of agricultural producers. Small farms appear to be the most vulnerable despite bearing a lower absolute tax burden. Equivalent variation measures derived from the ELES demand system show that relative welfare losses decline progressively with farm size.

This result reflects several structural characteristics of Moroccan agriculture. Small farms generally exhibit limited savings capacity, weak access to credit, low productive diversification, and consumption levels close to subsistence thresholds. Consequently, even relatively moderate reductions in disposable income may

generate significant welfare losses. These farms also face restricted access to irrigation, financing, and modern productive technologies, limiting their ability to absorb fiscal shocks.

At the same time, the simulations indicate that well-targeted FDA transfers can partially offset these vulnerabilities. Beyond its redistributive role, the FDA functions as a productive investment instrument that supports agricultural modernization and adaptation. By directing a significant share of compensatory resources toward smaller agricultural producers, fiscal recycling mechanisms contribute to improving the social acceptability of reform while preserving productive capacities in rural areas.

In this context, a uniform agricultural taxation strategy would risk exacerbating rural inequality and further weakening the most vulnerable agricultural producers. The results therefore support the implementation of a progressive and differentiated fiscal reform strategy based on productive capacity, market integration, and climate resilience.

These findings contribute directly to ongoing debates on fiscal equity in Morocco. The continued exemption of a large proportion of agricultural producers raises legitimate concerns regarding the distribution of the tax burden between agriculture, salaried workers, and non-agricultural enterprises. However, the simulations indicate that extending taxation to the remaining exempt segment cannot be justified solely on revenue grounds because the associated fiscal gains remain limited. Instead, the principal justification for reform lies in improving tax neutrality across sectors, strengthening fiscal legitimacy, and progressively integrating agricultural producers into a more equitable and transparent fiscal framework.

The sustainability of future reforms will therefore depend strongly on the capacity of public authorities to design coherent mechanisms of redistribution, productive support, and agricultural modernization. The results suggest several important policy implications. First, agricultural taxation should be implemented progressively in order to limit recessionary effects on economic activity and rural income. Second, large commercial farms and irrigated agricultural zones appear to be the most appropriate segments for initial fiscal integration due to their higher productivity and stronger taxable capacity. Third, compensatory mechanisms and fiscal recycling through the FDA appear essential for improving both the economic and social acceptability of reform. Fourth, public investment in irrigation, hydraulic infrastructure, productive modernization, and climate adaptation remains crucial for sustaining agricultural

productivity and resilience. Finally, fiscal policy should be integrated within a broader framework of rural development and agricultural transformation rather than being viewed solely as a revenue-raising instrument.

Overall, the simulations suggest that the success of future agricultural tax reforms in Morocco will depend less on the immediate magnitude of fiscal revenues generated than on the capacity of public authorities to combine fiscal equity, productive investment, climate resilience, and rural inclusion within a coherent long-term development strategy. The findings indicate that the remaining exempt agricultural segment offers limited short-term revenue potential. Consequently, the sustainability of reform depends fundamentally on progressive implementation, differentiated taxation according to productive capacity, and the effective recycling of fiscal resources through the FDA. Under such conditions, agricultural taxation may contribute not only to a fairer distribution of the tax burden but also to the modernization, resilience, and long-term sustainability of Moroccan agriculture.

6. Conclusion

The study therefore highlights the existence of a fundamental trade-off between fiscal integration, social equity, and macroeconomic sustainability. Extending taxation to the still-exempt agricultural segment may contribute to broadening the tax base and improving fiscal neutrality across sectors. However, the simulations indicate that the direct fiscal gains associated with such reforms remain relatively limited because the remaining exempt segment is composed predominantly of small and medium-sized farms with modest taxable capacity. Consequently, the economic rationale for agricultural taxation cannot be reduced to short-term revenue mobilization alone.

Instead, the results suggest that agricultural taxation should be viewed as part of a broader strategy of fiscal modernization, economic formalization, and structural transformation. By progressively integrating agricultural producers into the tax system, reform may strengthen fiscal legitimacy, improve transparency, and contribute to a more balanced distribution of the tax burden between agriculture, salaried workers, and non-agricultural enterprises.

A central finding of the analysis concerns the decisive role played by the Agricultural Development Fund (FDA). The simulations demonstrate that the effectiveness of agricultural taxation depends not only on the amount of revenue collected but also on the way these revenues are allocated. Fiscal recycling through the FDA substantially

reduces the contractionary effects of taxation by supporting productive investment, irrigation infrastructure, agricultural modernization, climate adaptation, and rural development. In this perspective, the FDA emerges as a key institutional mechanism linking fiscal policy to productivity growth, agricultural competitiveness, and long-term economic resilience.

The analysis also highlights the critical importance of climate vulnerability in shaping the outcomes of agricultural tax reforms. Drought shocks generate considerably larger losses in agricultural value added than taxation itself, particularly in rainfed agricultural systems. These results indicate that climate resilience, water management, and irrigation investment constitute essential complements to any sustainable agricultural taxation strategy. Fiscal reforms implemented without adequate climate adaptation measures may amplify existing vulnerabilities and reduce the long-term effectiveness of public intervention.

The distributive results further emphasize the need for differentiated taxation. Small farms remain particularly vulnerable because of limited savings capacity, weak market integration, and strong dependence on current agricultural income. Conversely, irrigated and commercially oriented farms display greater productive capacity and stronger resilience to fiscal adjustment. These findings support the implementation of a progressive and targeted taxation strategy that preserves exemption mechanisms for vulnerable producers while gradually integrating farms with higher taxable capacity.

An effective reform strategy should therefore rely on several complementary principles:

- gradual implementation of taxation;
- priority targeting of commercially oriented and highly productive farms;
- preservation of exemption thresholds protecting vulnerable agricultural households;
- systematic fiscal recycling through the Agricultural Development Fund;
- sustained investment in irrigation infrastructure and climate adaptation;
- support for agricultural modernization and technological upgrading;
- improved access to agricultural finance, insurance, and social protection mechanisms;
- and institutional support facilitating the fiscal transition of agricultural producers.

The sustainability of agricultural taxation reforms ultimately depends on their economic and social acceptability. Reforms perceived as purely extractive are likely to encounter resistance and generate significant adjustment costs. By contrast, a gradual, redistributive, and investment-oriented approach appears more capable of reconciling fiscal equity, rural inclusion, agricultural modernization, and long-term economic sustainability.

Some limitations should nevertheless be acknowledged. Although the model incorporates recursive dynamic mechanisms, several dimensions remain partially aggregated. Intertemporal expectations, regional disparities, water-resource dynamics, and micro-level heterogeneity among agricultural households are only imperfectly captured within the current framework. Future research could therefore extend the analysis through regionalized CGE specifications, explicit hydrological modules, agricultural insurance mechanisms, and richer household disaggregation in order to better evaluate resilience and distributive outcomes under alternative fiscal and climate scenarios.

Overall, this study contributes to the literature on agricultural taxation, fiscal reform, and structural transformation in emerging economies. The results indicate that the remaining exempt agricultural segment offers limited short-term revenue potential, but that its gradual fiscal integration may nevertheless contribute to improving fiscal equity and strengthening the institutional coherence of the tax system. Most importantly, the findings demonstrate that the long-term success of agricultural taxation depends less on immediate revenue generation than on the capacity of public authorities to transform fiscal resources into productive investment through effective recycling mechanisms such as the FDA. Under these conditions, agricultural taxation can become not only a fiscal instrument, but also a lever for modernization, climate resilience, and sustainable rural development in Morocco.

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ŒCONOMICA

Business Leadership and Gender Equality: Engaging Women from Developing Countries in Digital Entrepreneurship

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Abstract: Women in business leadership play a crucial role in improving organizational performance, innovation, and collaboration and driving economic growth and development. However, numerous challenges such as cultures, traditions, education and gender limit the women's opportunity to participate in civilian entrepreneurship. In addition, developing countries are facing serious challenges in this digital economic arena. **Objective:** this article analyzes business leadership, gender equality, and women's engagement in digital entrepreneurship. It focuses on how digital technology was used to grow their business. **Methodology/Approach:** a questionnaire was designed to collect data from 50 female entrepreneurs in the urban area of Durban, South Africa, in August 2023. The methodology used in this study was exploratory research and thematic analysis. A non-probability convenience sampling technique was used to ascertain digital technology usage among women entrepreneurs. The study is also based on secondary data from various documents, like a systematic analysis of scholarly articles, financial reports, and case studies retrieved from government sources and academic platforms. **Results:** the analysis draws from NVivo for qualitative synthesis, and the study uses descriptive statistical analysis to evaluate digital women's entrepreneurship. The key findings of the study reveal that there are low levels of representation of women in entrepreneurship. The study found that 72.1% of respondents do not have the skills needed to use current technology, which will lead to low levels of adoption rates of digital technology. Subsequently, 74.5% of participants reported that they do not

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possess the requisite skills to operate the most recent technologies. Indeed, women cannot fully benefit from this expanding industry, which would be closed by increasing the proportion of women working in ICT. Based on the obtained results, this study further investigates the strategies for women business leaders in the context of women entrepreneurs in South Africa. **Implications:** it recommends that there are tremendous opportunities for business leaders among women entrepreneurs, and **Value:** therefore, the government of South Africa should encourage and support the women entrepreneurs with the necessary financial support to develop its digital economy.

Keywords: Digital entrepreneurship; digital technologies; emerging economies; ICT infrastructure; innovation

JEL Classification: J16, L26, O1, O33

1. Introduction

Entrepreneurship, in its broadest sense, is an essential pillar of economic growth and social development. It acts as a catalyst for innovation, the development of new jobs, and overall economic growth (Rena, 2009; Hamdan et al., 2022). For women, engaging in entrepreneurial activity is a path to economic autonomy and a strategy for combating gender inequality. Women entrepreneurs not only contribute to economic growth and job creation but also challenge conventional notions of women's business leadership and stereotypes (Byrne et al., 2019).

The low participation of women in the digital economy, a significant driver of growth in the twenty-first century, is put at risk by the discrepancy between the demand for ICT employees and the supply of job seekers with the required technical abilities. The challenges that women entrepreneurs must overcome include a lack of access to the most advanced technology and sophisticated telecommunications infrastructure, limited computer literacy, and various cultural and socioeconomic variables.

In emerging and market economies, women have historically been subjected to a variety of socio-cultural barriers that have limited their participation in traditional business enterprises (Rena & Nettem, 2007; Kushwah & Sharma, 2020; Bentancor, 2022). These limits have hindered the economic independence of women and their business leadership. Their journey to economic independence and business leadership roles was frequently hampered by the expectations of society, biases based on gender, and a lack of access to resources (Kushwah & Sharma, 2020; Rena & Mbukanma, 2023).

However, the digital revolution is rewriting this narrative, presenting a new horizon where women may harness the power of technology to redefine their economic possibilities, and this will eventually foster business leadership for women in South Africa (Rena, 2008; Rosca et al., 2020; Ajani et al., 2021).

This new horizon offers women the opportunity to harness the power of technology to reshape their economic prospects. Despite the significant beneficial impact that women company entrepreneurs have on economies worldwide, they continue to face a wide array of barriers in their daily lives as business owners. Regarding the challenges they face, women entrepreneurs in emerging nations are confronted with issues that are much more severe than those their counterparts experience in industrialized economies (Rena & Nettem, 2007; Ughetto et al., 2020). These issues consist of cultural prejudices and discrimination, limited access to networks and markets, limited access to educational and training opportunities, limited access to financial resources, and limited access to networks (Rena, 2009; Haase et al., 2011; Goyal & Yadav, 2014; Rosca et al., 2020).

Digital entrepreneurship offers a transformative pathway for women to overcome many of the traditional barriers. It involves identifying and pursuing entrepreneurial opportunities based on creating digital artifacts, platforms, and infrastructures that provide services through technology (Schmidt, 2011; Giones & Brem, 2017).

Digital artifacts consist of applications or any media component that offers a specific function to users (Ekbia, 2009; Kallinikos et al., 2013). A digital platform is the collection of a common and shared set of digital artifacts that provide entrepreneurs with a venue for production, marketing, and distribution processes (Ratzinger et al., 2018; Rahayu & Ellyanawati, 2023).

In the last two decades, digital entrepreneurship has opened new venues for entrepreneurial activities and has transformed the nature of uncertainty inherent to entrepreneurial processes and outcomes (Nambisan, 2017; Al-Qahtani et al., 2022). Therefore, the aim of this study is to examine how digital entrepreneurship can serve as a strategic vehicle for women's economic empowerment in emerging economies.

2. Literature Review

The participation of women as business owners is essential to the continued expansion and growth of economies in developing countries (Rena, 2008).

According to a survey published by the International Finance Corporation, women-owned firms make up around 31% of the total number of small and medium-sized enterprises (SMEs) in emerging countries. These small and medium-sized businesses (SMEs) help fuel innovation, generate employment opportunities, and contribute to the general economic prosperity of their respective nations. The Global Entrepreneurship Monitor (GEM) found that the rates of female entrepreneurship varied around the world, with the highest in sub-Saharan Africa and Latin America and the lowest in the Middle East and North Africa.

According to the Global Entrepreneurship Monitor, Sub-Saharan Africa has the world's highest rates of female entrepreneurship, with 25.9% of women participating in early-stage entrepreneurship. On the other hand, in Latin America, women constitute only 17% of the total entrepreneurial activity. Nevertheless, women-owned firms continue to face substantial challenges in emerging economies. Only 46% of female entrepreneurs report having access to finance, in comparison to 61% of male entrepreneurs. Women entrepreneurship plays a crucial role in emerging economies for various reasons. It brings about positive social, economic, and developmental impacts that contribute to the overall growth and sustainability of these nations:

Economic Growth and Job Creation. Women-owned businesses contribute significantly to economic growth by creating jobs, stimulating innovation, and fostering competition. In emerging economies, where unemployment and underemployment can be issues, women entrepreneurs play a vital role in generating new employment opportunities.

Diversification of Industries. Women entrepreneurs often venture into sectors that might be underrepresented or overlooked, leading to the diversification of industries. This diversification can lead to a more balanced and resilient economy, reducing the dependence on a single sector.

Poverty Alleviation. Women's business leadership through entrepreneurship can help lift families and communities out of poverty. When women are empowered to start and run their businesses, they can generate income and improve the living standards of their families. This, in turn, contributes to poverty reduction.

Empowerment and Gender Equality. Women's entrepreneurship promotes gender equality by allowing women to participate actively in economic activities and

decision-making processes. As women gain economic independence, their social status and bargaining power within households and communities also improve.

Social Change and Cultural Shifts. Women's entrepreneurship challenges traditional gender roles and norms, leading to positive shifts in societal attitudes and perceptions. Stereotypes about women's roles and capabilities can be dismantled as more women become business leaders.

Access to Finance and Resources. Enhancing access to financial resources, training, mentorship, and networking opportunities can result from supporting female entrepreneurs (Rena & Nettem, 2007). This assistance can aid in closing the gender disparity in resource access that is frequently present in developing nations.

In developing countries, digital technology can significantly change the environment for female entrepreneurship (Dy et al., 2017; Aly, 2020; Al-Qahtani et al., 2022). Thanks to the developments in mobile technologies and internet usage, women interested in launching their own enterprises now have access to a multitude of information, resources, and networks that were previously unattainable.

Digital technology has facilitated women's establishment of new ventures and broadened their prospective customer base beyond their local area. E-commerce platforms, for example, have eliminated the need for traditional storefront locations and allowed female entrepreneurs to market their goods and services globally. Digital technology has completely changed many facets of contemporary life, and it has greatly influenced women who want to start their businesses (Paul & Rena, 2024). Women may now launch and grow their enterprises in previously unheard-of ways thanks to the new opportunities, lowered barriers, and tools that have been made available to them.

Access to Markets. The advent of digital platforms, e-commerce websites, and online marketplaces has allowed women entrepreneurs to reach a wider audience and access both domestic and foreign markets.

Lower Entry Barriers. Starting a digital firm typically takes less upfront money than traditional brick-and-mortar enterprises. Women entrepreneurs can lower entry barriers by using digital technology to produce and market goods and services without requiring a physical storefront.

Access to Information and Learning. The expertise, skills, and information that female entrepreneurs need to operate successful enterprises can be acquired through

webinars, online tools, and educational platforms. By providing women with necessary skills, this access to learning opportunities helps level the playing field.

Networking and Collaboration. Digital technology makes it easier to network and work with investors, consumers, mentors, and other business owners worldwide. Networking can result in collaborations, partnerships, and mentorship opportunities that support the expansion of businesses. Many digital tools and services are available to women entrepreneurs, helping them to overcome the challenges they have in running their enterprises.

Mobile Banking. Mobile banking is a helpful tool for female entrepreneurs since it allows them to manage their finances and access financial services from their mobile devices (Paul & Rena, 2024). This is very useful for women since they cannot access traditional financial services or live in remote areas.

E-commerce Platforms. Women entrepreneurs can reach a wider audience of potential customers outside of their local area by offering their products and services online, thanks to e-commerce platforms like Amazon, Etsy, and Shopify.

Online Marketplaces. Online marketplaces such as eBay and Alibaba have provided women entrepreneurs with a global market and a platform to sell their products and services.

Education and Training in the Digital Age. By engaging in virtual courses and training courses, prospective female entrepreneurs can obtain the skills and knowledge required to establish and grow their businesses.

Social Media. Social media websites and apps like Facebook and Instagram allow female entrepreneurs to market their products and services and establish connections with prospective customers.

2.1. The Challenges of Female Entrepreneurs in Digital Technology

Despite the many advantages of digital technology, female business leaders continue to encounter major challenges. Among these are a lack of access to financial resources, cultural biases and discrimination, and restricted access to networks and marketplaces (Dy et al., 2017; Paul & Rena, 2024). The use of digital technology can assist women business owners in overcoming some of these obstacles by giving them access to a wider range of financial services, markets, and networking opportunities.

For instance, mobile banking and online marketplaces can assist female entrepreneurs in gaining access to financial resources and expanding their consumer base beyond their geographical location. The use of social media platforms can be of assistance to women entrepreneurs in the process of building networks and establishing connections with other business owners, mentors, and prospective clients.

3. Methodology

This paper aims to investigate the impact of digital entrepreneurship among female entrepreneurs and highlight the challenges and opportunities females face in the digital landscape. This was completed and presented through the framework as outlined in Figure 1.

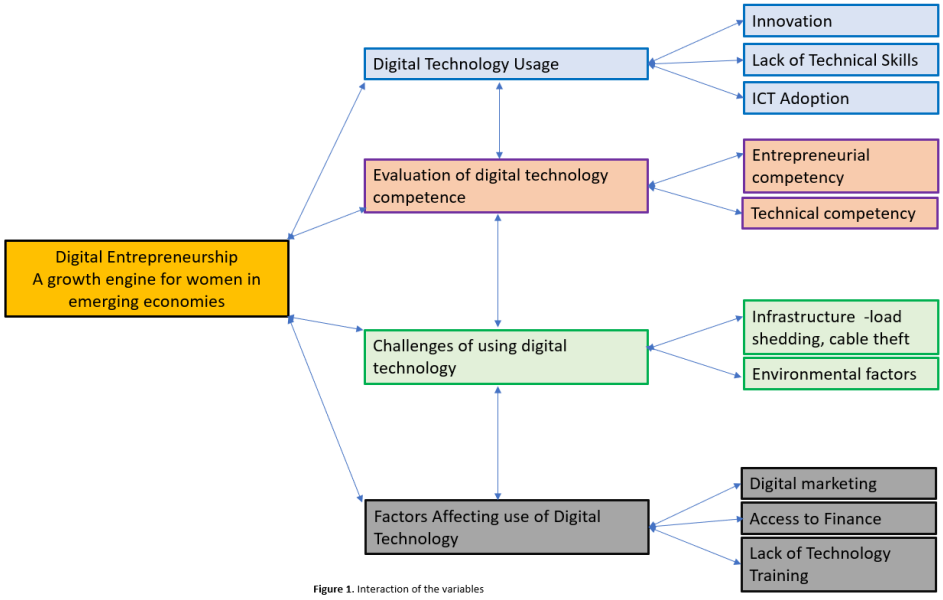

Figure 1. Digital Technologies Framework

Source: compiled by the authors

Figure 1 explains the digital technologies framework and highlights that this serves as a catalyst for women's empowerment. It further provides a positive relationship that exists between digital entrepreneurship, innovation and entrepreneurial and technical competencies. It deals also with various challenges and factors affecting

digital technology. The study's results demonstrate a strong ICT competency and technical expertise among digital women who develop an entrepreneurial mindset. The researchers' conclusion from this study is that females' entrepreneurial attitudes shape their intentions to be entrepreneurial. The primary constraint of this study is that it focuses on female entrepreneurs in urban areas; future studies should focus on rural entrepreneurship for female entrepreneurs, as digital transformation can enable and grow rural businesses.

This study aimed to comprehend how women entrepreneurs in emerging economies like South Africa deal with digitalization by integrating theoretical ideas in researching entrepreneurship, gender, and ICT. Female entrepreneurs with a common business leadership level in their business organizations were interviewed to share their experiences in digital business transformation. The female entrepreneurs also act as change agents and observers of any challenges to business operations. As a result, they are knowledgeable of the challenges encountered in implementing digital entrepreneurship in their business leadership. Regarding women's entrepreneurial activity and the rise of digital technology, a qualitative research method was adopted, and a questionnaire was distributed to 50 female entrepreneurs in Durban areas of South Africa. A non-probability, convenience sampling technique was used with a questionnaire as the primary data collection tool.

Data was gathered from the selected fifty female entrepreneurs who were chosen from Durban, South Africa. The researchers identified potential participants for the qualitative study by identifying SMME enterprises on the SEDA database to ensure appropriate representation.

4. Results

Table 1 illustrates the relationship between the research objectives, research questions and the subsequent findings and identified themes.

Table 1. Relationship Between Research Objectives, Research Questions, and Findings

Research Objectives	Research Questions	Findings/Themes
Implication of digital technology use in female entrepreneurship	How is digital technology used by female entrepreneurs to grow the business?	Innovation Lack of technical skills ICT adoption

Evaluate the factors contributing to the use of digital technology	What are the factors that impact the use of digital technologies?	Access to finance Lack of technology training
Evaluate the awareness and knowledge of female entrepreneurs in using digital technology	What are the characteristics of the female entrepreneur when embracing digital technology?	Entrepreneurial competency Technical competency
Examine the challenges experienced in using digital technology	What are the challenges experienced when using digital technology?	Infrastructure issues such as load shedding and cable theft External environmental factors Digital marketing

Source: compiled by the authors

As indicated in Table 1, the research objectives and research questions with findings were self-explanatory. Table 2 reflects the data collected from the respondents and displayed as percentages as per each identified theme.

Table 2. Response Rate

Respondents	Findings	Frequency	Percentage
50	Innovation	20.74	45.1
50	Lack of technical skills	36.05	72.1
50	ICT adoption	36.05	72.1
50	Entrepreneurial competency	31.9	63.8
50	Technical competency	37.25	74.5
50	Infrastructure - load shedding, cable theft	43.45	86.9
50	Digital marketing	31.25	62.5
50	Access to finance	37.65	75.3
50	Lack of technology training	37.25	74.5

Source: compiled by the authors based on primary data

As shown in Table 2, the results indicate that while 73.45% of the participants possessed a mobile device and a laptop, just a small proportion utilized technical instruments to advertise their business to leverage growth. Introducing new technological capabilities primarily drives innovation, and as such, successful innovation is necessary to achieve long-term corporate growth. The expanded skill sets of educated people were found to be critical for successful entrepreneurship, innovation, and business growth (OECD, 2018, p. 20). The results of this study show that 45.1% of respondents believe that businesses promote and encourage innovation. According to the results of this study, 72.1% of respondents thought that people do not have the skills needed to use current digital technology, which will lead to a low adoption rate of ICT in business. Subsequently, 74.5% of participants

reported that they do not possess the requisite skills to operate the business with the latest technologies. The results of this study demonstrate that 75.3% of all respondents agree that one of the elements influencing female entrepreneurs' adoption of digital technology is their ability to obtain financing. This study shows that a sizable portion of participants (72.1%) think that staff members lack the necessary skills to use digital technology. This can be attributed to a lack of training, which can impact on the effectiveness of ICT adoption. According to the empirical results, 86.9% of people think the local municipality does not offer enough digital technology infrastructure. This is one of the elements that encourages businesses to use digital technologies.

The findings further demonstrated that 63.8% of participants thought an entrepreneur's leadership abilities were crucial to the smooth operation of the business. The literature review cited by Robles and Zarraga-Rodrigues (2015, p. 828) supports this conclusion. They contend that three core competencies –motivation and attributes, social roles, and self-concepts – are the foundation for modeling the endogenous elements of an entrepreneur. Robles and Zarraga-Rodrigues (2015, p. 828), Msamula et al. (2016, p. 253) assert that people are inspired to act in a particular way by the dominating values and aspects of their character. The fact that a sizable portion of respondents (63.8%) agreed that having entrepreneurial traits is essential for ICT adoption serves as evidence of this. The study states that 62.5% of South African business owners have adopted online selling and digital marketing techniques, such as social media marketing, company websites, and online retailing.

4.1. Availability and Accessibility of Digital Infrastructure

Access to digital infrastructure is a factor that positively influences female entrepreneurs' capacity to participate in digital entrepreneurship and achieve success in the sector. A more developed digital infrastructure enables female business leaders as entrepreneurs to access a bigger audience, not only in their own country but also around the world. They can access potential clients, suppliers, and partners online, eliminating the need to be physically present in such relationships. The availability of digital infrastructure makes it easier to network and collaborate with other business owners, mentors, and potential investors, which in turn opens the door to meaningful relationships and assistance.

H1. Female entrepreneurs' access to digital infrastructure positively influences their participation and success in digital entrepreneurship.

It can be concluded that there is a connection between adopting digital technology and learning technical skills through education, which affects how women business leaders use digital technology. The more training there is on digital technology, the more online markets are promoted and the opportunity to embrace digital entrepreneurship is fostered.

4.2. Gender and Female Entrepreneurship – Entrepreneurial Intention

The inclination of female entrepreneurs in South Africa to participate in digital entrepreneurship is hindered, to a certain extent, by cultural conventions and gender roles. Conventions of the local culture and expectations regarding women's and men's roles in society act as a barrier to some degree for female business owners in developing countries who are interested in participating in digital entrepreneurship. To some extent, female entrepreneurs in developing countries interested in participating in digital entrepreneurship face an obstacle in the form of the cultural norms and expectations that prevail in their societies regarding the respective roles of women and men in the workplace and society. Women can encounter rejection or stigma from their communities or families if they want to pursue entrepreneurial endeavors, particularly in technology-related industries, which are frequently perceived as male-dominated fields.

H2. Cultural norms and gender roles negatively affect female entrepreneurs' willingness to engage in digital entrepreneurship in South Africa.

ICT makes it possible for women micro-entrepreneurs to maintain community ties swiftly and affordably by lowering barriers to connection. ICT affordances (e.g., WhatsApp, email, text messaging, Facebook) allow women micro-entrepreneurs to contact strangers, something they might not have done otherwise.

4.3. Digital Skills and Education

The growth and long-term financial success of digital firms run by women can be positively impacted by the ability to read and produce digital content and specific training in business management. The success of female entrepreneurs can be

positively impacted by higher levels of digital literacy and training explicitly tailored to entrepreneurship in the following ways:

Utilization of Digital Tools Efficiently. Digital literacy enables female entrepreneurs to use digital tools and platforms for a range of business activities, including online marketing, e-commerce, and data analysis, with effectiveness.

Innovation and Adaptability. Entrepreneurship-focused training equips women with the ability to identify market opportunities and create and modify their business models to meet the always-evolving needs of clients and market trends.

Digital Marketing Competence. Female entrepreneurs may create effective online marketing strategies to reach their target audience, raise their brand's visibility, and boost sales with the right digital literacy and training.

H3. Higher degrees of digital literacy and training tailored to entrepreneurship increase the likelihood that female entrepreneurs will launch and grow profitable digital enterprises.

Qualifications did matter a lot regarding the respondents' ability to operate a smartphone or other technological devices to access the internet. It has been observed that a respondent's proficiency with digital technology is closely associated with their educational attainment. Enhancing the financial resources and support available to female entrepreneurs can increase the development and success of their digital enterprises. The expansion and scalability of female-led digital firms can also be significantly impacted by their access to other critical resources, including technology infrastructure, business networks, mentorship, market intelligence, and skilled labor. Other resources besides capital can have an effect like this. More agencies can be granted to female entrepreneurs by having greater access to resources, which can boost their confidence and willingness to take calculated risks in the pursuit of business growth.

H4. Improved access to capital and resources positively impacts the growth and scalability of female-led digital startups in emerging economies.

It can be concluded that infrastructure availability and access to finance have a strong influence on how respondents use digital technologies to promote their business.

5. Conclusion

The study concludes that 45.3% of respondents generally concur that environmental issues affect a business's ability to operate and remain competitive. In addition to the challenges posed by a lack of broadband facilities and load shedding, small and medium-sized enterprises (SMMEs) located in urban areas must contend with other obstacles, including a deficient infrastructure for telecommunications, an absence of management and marketing expertise, insufficient understanding about entrepreneurship, and incompetent management. While there has been some progress over the last 3 decades, South African women in business leadership still face numerous challenges. The legacy of apartheid on one side and societal norms on the other continue to present hurdles for women. It is, therefore, imperative to address these challenges through government support for women business leaders and promoting gender diversity in businesses and the economy.

Education is a crucial component of the human capital that contributes to the success of the entrepreneurial process. Education is also commonly associated with the long-term growth and development of an individual's profession. However, most of the research on digital entrepreneurship has focused on businesses rather than individual entrepreneurs.

Future research must investigate the processes and effects of long-term, persistent, and serial entrepreneurship in the digital setting to add complexity and contemporary relevance to understanding education's role in this developing field. The online environment reflects racial and class divides, resulting in unequal resource access. They contend that the potential for digital entrepreneurship to emancipate marginalized women in wealthy nations may be exaggerated. The findings presented provide fresh insights into how technological affordances interact with social and cultural environments to make it possible to identify and carry out digital entrepreneurship. Many women entrepreneurs in South Africa, especially in rural areas, face challenges in financing, education, and business skills. However, there are tremendous opportunities for women to engage in business leadership roles, which ultimately enhance efficiency, adopt innovation, develop collaboration, and thus contribute to a more inclusive and equitable business landscape in the country.

Authors' Declaration

Funding: This research did not receive any funds from any university or organization.

Ethical Approval: This research does involve human participants, human subjects, or personal data collection. A stratified random sampling method has been used to recruit participants from diverse demographic backgrounds. It's research that we did on our personal interest and hence it's not required any approval from an ethics committee or institutional review board.

The study maintains strict data privacy and confidentiality, adhering to ethical guidelines for responsible research conduct.

Informed consent: This study applies the principle of informed consent' is used. Data does involve human participants, human subjects, or personal data collection. The age group was 18-50 years; the informed consent was obtained via online platform.

Conflict of interest: The author declares no conflict of interest.

Data availability statement: The study has used questionnaires/ surveys for data collection for privacy issues and maintaining the confidentiality information is not shared.

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The Relationship Between Corporate Environmental Disclosure Volume and the Equity Capital Growth of Manufacturing Companies Listed in the FTSE/JSE RI Index

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Abstract: Corporate environmental disclosure (CED) has a lot of implications for companies. This is because investors value companies that take Corporate Environmental Disclosure (CED) seriously. Furthermore, companies that invest in corporate environmental disclosure enjoy long lasting relationship with their stakeholders. Therefore, this article is based on research conducted on selected Johannesburg Listed manufacturing Companies. The aim of the study was to examine the effect of the quantity of corporate environmental disclosure on South African Johannesburg Stock Exchange FTSE/JSE RI Index-listed manufacturing companies' equity capital growth. The study used the quantitative research method. The multiple linear regression analysis, which utilised the panel data, was applied to analyse the integrated annual reports of 10 Johannesburg Stock Exchange listed manufacturing organisations for the period 2014 to 2023. The researcher discovered a positive impact of CED on equity capital growth, which suggests that corporate environmental investment benefits the economy and facilitates the relief of environmental harms, thereby develop the SA economy and enhance the competitiveness of local companies. These results will encourage listed companies to

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enhance and improve their environmental information disclosure policies, which would help them to improve their return on equity for shareholders. The researcher recommends that future researchers should use all Johannesburg Stock Exchange socially responsible investment Index listed organisations to assess the influence of corporate environmental disclosure on organisations' financial performance. Moreover, the researchers recommend that societies in which companies operate ought to get involved in such companies to advance the socio-economic chances that they propose. This would assist in strengthening community security as they would receive support from the corporate environmental challenges faced by the surrounding societies.

Keywords: Corporate environmental disclosure; Return on equity; Equity capital growth; sustainability reports and stakeholders; integrated annual report

JEL Classification: M14

1. Introduction

According to Losse, Cui, Ding, Yang and Yu (2024), a business rarely increases its shareholders' worth when it oversees the significance of all their stakeholders. They must not only focus on investors, but also on customers and host communities. As customers become aware of the appropriate implications of a company's behaviour, they develop trust in the certainty that it can maintain its exceptional standards to improve its reputation for producing quality products (Muneer, Singh, Choudhary, Alshammari & Butt, 2025). The latter help companies to increase its financial performance, which results in higher returns for shareholders. However, once investors are faced with a variety of financial investments, and act with intellect and emotions, but their treasure remains the primary influence on their choices (Losse et al., 2024).

It is expedient for companies to maintain a good commercial standing to sustain the confidence of customers in their products, which would improve financial performance, resulting in shareholders receiving higher returns. Such a firm's return on equity would increase, and more shareholders would invest in the company (equity capital growth).

Companies have various stakeholders with diverse interests and needs. Therefore, it is to be expected that companies fulfil the desires of their stakeholders. Despite their different views and expectations regarding environmental matters, companies must operate their businesses in a sustainable manner (Zang, Zhang & Li, 2023). As such, directors of businesses ought to consider not only investors' benefits, but also those of all stakeholders as well, even when making investment choices (Zang et al., 2023).

Therefore, this article is based on the study that investigated whether adequate investment in community social activities influences organisations' financial performance, which is return on assets and its profitability. The study sought to close the knowledge gap around the relevance and importance attached to financial performance and the profitability of those organisations that invest in communities' social activities. The study was conducted on selected companies listed on the Johannesburg Security Exchange Index (JSE SRI Index, 2023).

1.1. Problem Statement

According to Muneer et al. (2025), directors of companies are obligated to use funds presented to them to create large profits for their investors, while guaranteeing obedience with environmentally associated principles. Nevertheless, the question is, can directors succeed in fulfilling their duties and still realise significant proceeds for their investors and progress compliance with environmental performance? Furthermore, it is not certain whether directors achieve investors' hopes of significant proceeds with stakeholders' hopes of enhanced compliance with environmental performance (Widuhung & Machmud, 2024).

Validation about whether directors achieve their duties can be done through information released in companies integrated annual reports regarding their environmental (water, waste, energy and carbon emissions indexes) involvement and how these corporate environmental disclosures quantity influence equity capital growth. Given the above uncertainty, it is expedient to inspect how the quantity of corporate environmental disclosures influences the South African FTSE/JSE RI Index listed manufacturing companies' equity capital growth.

1.2. Aim of the Research

According to Tolsgaard, Nayahangan, Cook, Madsen, Brydges, van Schalkwyk, de Carvalho Filho, You and Cleland (2025), the aim of a study helps the researchers to detail what the research study must achieve. Therefore, the research aim can be stated as follows:

This study examines how corporate environmental disclosure influences organisations' financial performance, which is equity capital growth. The

researcher chose to use equity capital growth as an element of financial performance since it measures how much an investment's value or ownership stake increases over time.

1.3. Research Hypotheses

The study will test the following research hypotheses:

H_o: Corporate environmental disclosure quantity does not influence the growth in equity capital of Manufacturing Companies Listed in the FTSE/JSE RI Index.

H_a: Corporate environmental disclosure quantity does influence the growth in equity capital of Manufacturing Companies Listed in the FTSE/JSE RI Index.

1.4. Research Objectives

Tolsgaard et al. (2025) state that research objectives help the researchers with what must be reviewed and revised. Therefore, the objectives of the study were formulated as follows:

To investigate the extent to which corporate environmental disclosure quantity influences the equity capital growth of Manufacturing Companies Listed in the FTSE/JSE RI Index.

2. Literature Review

2.1. Conceptual Review

According to Amelia et al. (2024), the disclosure of ecological data by many companies can help prevent most environmental challenges and companies with equity capital growth for shareholders and increase profitability. As a result, most listed companies are working to prevent pollution. In so doing, they discover innovative prospects that promote new environmental solutions that enhance profitability and increase return on equity (Tolsgaard et al., 2024).

2.1.1. Evolution of Corporate Regulations in South Africa and Contribution to ECI Practices

The SA corporate law, the Companies Amendment Act 16 of 2024 applies to organisations seeking to issue shares or other securities listed in a regulated market (JSE) (Adam, 2024). The law has evolved over the years. Among other provisions, the corporate law of SA distinguishes between the executive, non-executive and independent directors, albeit with a rather confusing description of their duties and tasks. The board of directors' exercises management and control of the company registered under the SA corporate law. The executive members of the Board of Directors (hereafter 'BoD') are deemed to be those shouldering daily governance issues of the corporate entity (Adam, 2024). The BoD reports to the shareholders and other stakeholders to fulfil their corporate governance responsibilities. Corporate governance in SA considers both King IV and the Companies Amendment Act 16 of 2024 requirements. Corporate governance can be looked at as a system by which limited liability companies are directed and controlled. According to Adam (2024), corporate governance arrangements require looking at the various stakeholders in the company, such as shareholders, directors, debtors, creditors and customers. Matters of ESG are included in the reports of the board.

The provisions of the Companies Act are consistent with King IV, and consistent with Seligson and Blumberg's (2024) conclusion. Seligson and Blumberg (2024) contend that the corporate law of any country provides a company Act that controls businesses. A company is a business whose main aim or intention is to make a profit by producing goods or providing services to the public. This admittance also shelters guidelines by which organisations and trusts are controlled in South Africa, together with enterprises and sole proprietorships (Seligson & Blumberg, 2024).

2.1.2. National Environmental Management Act

The National Environmental Management Act was established for decision-making related to the environment to foster and implement processes for coordinating environmental functions (Umar, 2026). Only the National Environmental Management Act, which addresses environmental conservation by offering guidance on sustainable environmental decision-making while effectively addressing global warming, has an important influence on the study (Umar, 2026). The objectives of the Act are to promote sustainable development and to prohibit pollution. For companies, this would be done through environmental sustainability investments.

2.2. Empirical Review

With economic growth, due to inferior production circumstances and extreme power utilisation, the decline in ecological contamination in China has triggered the devotion of scholars and legislators (Aly, Hasan, Obioru & Nakpodia, 2024). Correspondingly, numerous eco-friendly regulatory instruments have been introduced to address the phenomena in question. For example, Bilal, Gerged, Arslan, Abbas, Chen and Manzoor (2024) examined the efficacy of China's eco-friendly data disclosure at the commercial level and how it influenced the return on equity. The study revealed a constructive and substantial relationship between ecological data disclosure and return on equity. Moreover, the authors showed that the disclosure of ecological data by many companies can help prevent most environmental challenges, support equity capital growth for shareholders and increase profitability. As a result, most listed firms are working to avoid pollution, thereby exploring new opportunities to develop environmental solutions that enhance profitability and increase return on equity. A study by Bilal et al. (2024) encouraged listed companies to improve their environmental information disclosure policies, thereby helping in improving their return on equity for shareholders.

Similarly, Amelia, Khakim and Astuti (2025), Phrophayak, Techarungruengsakul, Khotdee, Thuangchon, Ngamsert, Prasanchum, Sivanpheng and Kangrang (2024), Ramadana and Ilham (2025) and Zang et al. (2023) found that environmental disclosure mechanisms from a corporate perspective affect a company's return on equity. Amelia et al. (2025) revealed that almost 40% of the tested companies disclosed no significant ecological information disclosure to the community, as may well be observed from the content assessment of the released data from these companies. Moreover, Amelia et al. (2025) discovered that companies operating wherever the marketplace had been located and moderately advanced are more likely to release emission-related data and improve companies' financial performance. The more data on ecological investment and contamination regulation the more cost is released.

This is supported by Ramadana and Ilham (2025), who discovered a constructive and substantial connection between ecological data disclosure and return on equity, and that municipalities whose city managers had lengthier occupations and were Ph.D. graduates were expected to issue extra ecological data disclosures. Moreover, the more the cyberspace operators and income per capita, and the smaller a town's joblessness percentage, the better the degree of ecological disclosure (Ramadana &

Ilham, 2025). Conversely, Phrophayak et al. (2024) found a negative and insignificant connection between environmental information disclosure and return on equity.

Bilal et al. (2024) employed the Difference-in-Differences (DID) model, along with the analogous inclination hypothesis test, placebo testing, and the PSM-DID methods to identify the influence of Chinese eco-friendly data disclosure (EID) on return on equity at the commercial level. The emphasis of the study was on the NKME designed for independent oversight and ID distributed in 2019 as a self-styled accepted test. Amelia et al. (2025) used a trial of the uppermost 500 Indian companies for the period 2008 to 2018, and rigorous arithmetic approaches to assess the bidirectional interconnection and concentration of the environmental information disclosure and return on equity association using the Granger interconnection assessment and numerous reversions for panel information. Phrophayak et al. (2024) used a sample of 35 listed non-profit companies from India and Japan for the period 2015 to 2020. A binary coding system was used to estimate environmental information disclosure scores grounded on the Global Reporting Initiative (GRI) agenda. Growth in equity capital was selected to assess the financial performance, and panel regression models built on the Cobb-Douglas construction purpose were used to explore the data.

The researchers varied on the direction (positive or negative) of the influence of environmental information disclosure on equity capital growth; however, they concur that corporate environmental disclosure influences equity capital growth. Evidently, variances in population scope, statistical tests and study exploration methods might have contributed to differences in the directional relationship of CED on ECG. Although previous studies have yielded differing perspectives regarding the impact of CED on ECG, there might be a necessity for considerable CED policy/framework creativities that encourage equity capital growth.

The literature review thus far reveals that there is prior interrelated research on the singularity under investigation. Nevertheless, prior research has not fixated precisely on the joint effect of corporate environmental disclosure quantity on equity capital growth. Consequently, this study seeks to bridge this gap in knowledge by contributing to the existing body of knowledge through an investigation that explicates the relationship between CED quantity and shareholder value.

3. Material and Methods

3.1. Research Paradigm and Design

The study used the positivist paradigm and descriptive correlational design to test the hypothesis of the study regarding quantitative variables. The quantitative method was appropriate because the coefficients of the variables were estimated numerically. Amelia et al. (2024) used quantitative research within a positivist paradigm to investigate the effect of disclosure of environmental aspects (Environmental Disclosure) on company value.

3.2. Research Population and Sampling Procedure

A total of 52 manufacturing corporations listed in the FTSE/JSE RI Index constituted the population of this study (JSE, 2023). The sample comprised 10 manufacturing companies listed on the FSTSE/JSE through the RI index (JSE, 2023). Manufacturing companies were chosen because they were more involved in corporate environmental matters (air pollution, water pollution, increased energy usage, carbon emissions, etc.).

The justification for choosing the FTSE/JSE RI Index was that the integrated annual reports are audited by certified chartered accountants and approved, documented, and published on the JSE website and the IRESS Database.

3.3. Data Collection

This study collected quantitative data from the selected manufacturing companies' corporate integrated annual reports. The quantity of corporate environmental disclosure and equity capital growth data was sourced from the JSE SRI Website and the IRESS database for a period of ten (10) years (2014–2023). This was organised as a balanced panel dataset comprising 100 observations derived from 10 companies over a 10-year period (10 × 10 = 100). The quantity of corporate environmental disclosure was gathered using the JSE sustainability disclosure metrices.

Quantitative information gathered in the study encompassed variables aligned with the research objective, namely, quantity of water disclosure (in cubic kilometres); quantity of waste disclosure (in tonnage); quantity of energy disclosure (in kilowatt hour); and quantity of carbon emissions disclosure (in tonnes). Moreover, the

variables incorporate equity capital growth (in Rand amount) and market capitalisation (in Rand amount) as a control variable.

3.4. The Analytical Framework

Multiple linear regression analyses (Panel Auto-Regressive Distributive Lag) based on the empirical literature were applied to determine the correlation between the quantity of corporate environmental disclosure and the company's equity capital growth. The study had one independent variable, corporate environmental disclosure quantity, proxied by waste, water, energy, and carbon emissions. It also had one dependent variable as the company's equity capital growth.

The panel data analysis was chosen because, in this study, the data structure is quite complicated and is characterised by multiple observations and a period extending up to ten years. The multiple linear regression analysis was chosen for the researchers to know the effects of the correlation between corporate environmental disclosure and organisations' equity capital growth.

3.5. Data Management and Analysis

Both individual variables and models were subjected to several econometric tests. The variables were tested for stationarity to establish the integration order and to guide the appropriate examination for cointegration analysis. From there, a selection of suitable lag length structures was used to determine the best lag length in the dataset. This was followed by cointegration analysis using the panel auto-regressive distributive lag (PARDL) method to obtain long- and short-run estimates. A PARDL model was used to examine the impact of debt on growth (Epo, Tapche Ndam & Abiala, 2024). As this research study investigated the influence of the quantity of CED (spending) on equity capital growth (revenue), the PARDL model was suitable. Lastly, analytic and constancy examinations were performed to guarantee the legitimacy and robustness of the model.

This study collected information from 20 FTSE/JSE-listed manufacturing companies during the specified period spanning 2014 to 2023. In the preliminary PARDL analysis, data from 20 manufacturing companies were tested, resulting in erroneous outcomes. In econometrics terms, this implies that the dataset was dominating cross-

sectionally (Large N and small t). This means that the study encompassed a greater number of companies (20) compared to the period (10 years).

According to Rajabov (2025), the PARDL requires a time-series dataset (N =/< t) to yield positive outcomes. So, during the preliminary testing of data through the PARDL system, it was recommended that the sample of the study be 10 companies out of 20 manufacturing companies to accommodate the PARDL system (10 companies and 10 years – time-series based (N=t)). The study initially intended to use 20 companies but based on the preliminary PARDL analysis outcomes, only 10 were accommodated over 10 years, resulting in 100 observations (10 x 10). Therefore, the study sampled 10 manufacturing companies to accommodate the PARDL software.

The model designed to achieve the objective is presented as follows,

$$ECG_{(\text{Equity capital growth})it} = a + \beta_1 CEDQ_{(Water)it} + \beta_2 CEDQ_{(Waste)it} + \beta_3 CEDQ_{(Energy)it} + \beta_4 CEDQ_{(C\ Emissions)it} + \beta_5 MC_{it} + \varepsilon_{it}$$

Where:

Where ECG is Equity Capital Growth, CEDQ is the Corporate environmental disclosure quantity, and MC is Market Capitalisation. Furthermore, a is the constant, β_1 to β_5 are the coefficients of each descriptive variable, and ε_{it} is the error term.

3.6. Theoretical Review

3.6.1. Stakeholders Theory

One of the primary goals of the stakeholder theory is to inspire firms to focus on maintainable development and report on their sustainability involvement (Stoelhorst & Vishwanathan, 2024). According to Abubakr, Sahal, Mohammed, Yousif, Mohammed and Roustom (2024), businesses are encouraged to report evidence regarding their Environmental, Social and Governance performance. This is a technique to internalise and advance companies' pledges to supportable growth in a way that can be demonstrated to both internal and external stakeholders (Abubakr et al., 2024).

Awareness of a maintainable business has remained around for several years and is frequently denoted as maintainable commercial development or corporate social

responsibility (Widuhung & Machmud, 2024). A company may be considered sustainable if it meets extant desires without constraining its aptitude to encounter future necessities and strategies (Widuhung & Machmud, 2024). According to Esposito, Marrone, Pontrelli and Rella (2025), a corporation would hence be liked by society and stakeholders to be economically profitable, legitimate, publicly acknowledged, ethical and produce environmental-friendly products.

As described, information by an organisation is vital to every stakeholder of the organisation. It is every stakeholder's right to expect a more comprehensive corporate environmental disclosure of an organisation (Esposito et al., 2025). In the past, organisations have encountered increasing stress not only to perform well financially but are also expected to demonstrate environmental and social consciousness. Stakeholders and other investors expect a more comprehensive reporting about how organisations satisfy their financial, environmental, social and governance duties.

4. Presentation of Results

4.1. Empirical Results

One issue encountered in the study is that some variables were threads, which were converted into numeric values (Epo et al., 2024). Like several other panel studies, absent values or information facts were a problem requiring careful treatment.

The empirical analysis began with descriptive statistics, followed by Cross-sectional dependence (CSD) assessments, unit root assessment, and an assessment of cointegration among the variables.

4.2. Unit Root Tests

Table 1. First-generation unit root test results

Variable	**Test method**	**Test equation** II – Individual intercept II&T – Individual intercept & Trend N – None	**Probability value**		**Decision**
			LEVEL	**1ST DIFF**	
	LLC	***II***	0.9653	0.0090	

EQUITY CAPITAL GROWTH		***II&T***	0.0964	0.0000	I(1)
		N	0.0854	0.0000	
	IPS	***II***	0.0834	0.0000	
		II&T	0.9850	0.0000	
		II&T	0.0564	0.0021	
Water disclosure	***LLC***	***II***	0.9531	0.0084	I(1)
		II&T	0.1064	0.0000	
		N	0.3469	0.0000	
	IPS	***II***	0.9853	0.0019	
		II&T	0.9631	0.0000	
		II&T	0.7632	0.0000	
Waste disclosure	***LLC***	***II***	0.9520	0.0000	I(1)
		II&T	0.2965	0.0000	
		N	0.7943	0.0000	
	IPS	***II***	0.3596	0.0008	
		II&T	0.8409	0.0000	
		II&T	0.3028	0.0050	
Energy disclosure	***LLC***	***II***	0.0656	0.0970	I(1)
		II&T	0.8599	0.0000	
		N	0.7305	0.0065	
	IPS	***II***	0.9554	0.0000	
		II&T	0.9960	0.0000	
		II&T	0.0510	0.0000	
Carbon emission disclosure	***LLC***	***II***	0.1850	0.0000	I(1)
		II&T	0.0653	0.0000	
		None	0.1649	0.0000	
	IPS	***II***	0.6043	0.0000	
		II&T	0.0649	0.0041	
		II&T	0.9543	0.0000	
Market capitalisation	***LLC***	***II***	0.3051	0.0017	I(1)
		II&T	0.1865	0.0060	
		N	0.1965	0.0000	
	IPS	***II***	0.9856	0.0000	
		II&T	0.9853	0.0000	

Source: Authors' computation

This section provides formal unit assessments from the initial-generation unit root assessments of Lavin, Lin and Chu (LLC), as well as the Im, Pesaran and Shin tests. First-generation unit root tests were employed because they are CSD assessments. The findings showed no CSD across all four models. Table 1 describes the initial-generation unit root assessment findings for all the variables of the four estimated models.

The findings in Table 1 indicate that after first differencing, the probability values for all variables were less than the critical value of 0.05. Thus, it is concluded that they become stationary after first differencing. This implies that the model integrates at order I(1), which warrants the adoption of panel PARDL as the estimating technique for the model.

Apart from the unit root tests, the model was subjected to a battery of empirical tests presented below.

4.3. Equity Capital Growth Model Empirical Test Results

This subsection presents the results of the research objective (Equity capital growth model), which investigated the effects of CED quantity on the equity capital growth of Manufacturing Companies Listed in the FTSE/JSE RI Index.

4.3.1. Descriptive Statistics

Table 2. Descriptive statistics test results

	bs	CG	D	ASD	D	ED	C
Mean	0	19.606	37.495	64.677	25.092	16.864	43.618
Median	0	16.243	33.150	19.956	79.200	22.900	14.940
Maximum	0	80.104	18.300	78.000	14.100	15.531	38.453
Minimum	0	16.240	4.3000	15.600	2.518	9.100	6.800
Std. Dev.	0	17.094	19.437	10.338	41.746	32.688	95.529

Note: All variables are log (logarithm)

Source: Authors' computation

The results of the descriptive statistics analysis in Table 2 present the equity capital growth model variables for the number of observations, mean, median, standard deviation, smallest and biggest values.

As indicated in the table, the study had a well-balanced panel where the observations are 80, and all the variables were continuous. Equity capital growth had an average of 19.61, the smallest of 16.24, and the biggest of 80.10. The water disclosure had an average of 37.50, the least value being 4.30 and the highest of 18.30. The mean

waste disclosure was 64.68, the least of 15.60 and an utmost value of 78.00. Energy disclosure had an average value of 25.09, with the lowest of 2.52 and the highest of 14.10; and Carbon emission disclosure had a mean value of 16.86, with the smallest of 9.10, and the biggest of 15.53. Finally, the market capitalisation (control variable) was 43.62, with the lowest of 6.80, and the highest of 38.45.

4.3.2. Correlation Analysis

Table 3. Equity capital growth model Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Equity capital growth	1.000					
(2) Water disclosure	-0.206	1.000				
(3) Waste disclosure	-0.166	-0.347	1.000			
(4) Energy disclosure	-0.052	0.045	0.017	1.000		
(5) Carbon emission disclosure	-0.068	0.376	-0.556	0.033	1.000	
(6) Market capitalisation	0.205	-0.007	-0.028	-0.164	-0.006	1.000

Source: Authors' computation

The correlation test results in Table 3 suggest that equity capital growth and corporate environmental disclosures (water, waste, energy and carbon emissions) (r = -0.21; -0.17; -0.05; -0.07) were negatively correlated. At the same time, equity capital growth and market capitalisation were positively correlated (r = 0.21). This revelation implies that equity capital growth was most likely to decrease as corporate environmental disclosure level increased.

4.3.3. Multicollinearity Test

Table 4. Variance inflation factor results

Variables	**VIF**	**1/VIF**
Equity capital growth	2.750	0.920
Water disclosure	2.630	0.892
Waste disclosure	2.610	0.870
Energy disclosure	2.420	0.820
Carbon emission disclosure	1.950	0.790
Market capitalisation	2.120	0.670
Mean VIF	**2.413**	

Source: Authors' computation

Table 4 presents the VIF analysis. Given that the mean VIF is 2.413, which is less than 10, multicollinearity is not from the data.

4.3.4. Cross-Sectional Dependence Test Results

Table 5. Equity capital growth model cross-sectional dependence test results

Test description	Test	Statistic	P-value	Conclusion
CSD- SUR:	Breusch-Pagan LM	13.17171	0.4145	Null Accepted
	Pesaran scaled LM	2.070295	0.0384	Null Rejected
	Pesaran CD	-0.126651	0.8992	Null Accepted

Source: Authors' computation

Table 5 provides findings of the CSD assessment for the equity capital growth model. The calculated probability values for the Breusch-Pagan LM, Pesaran LM, and Pesaran CD analyses were 0.4145, 0.0384 and 0.8992, respectively. The decision in this case was to reject the null hypothesis, given that two of the three test statistics were insignificant; and to dismiss the null hypothesis of the absence of CSD, given that two test statistics out of three were statistically significant. The conclusion is that there was no existence of CSD in the estimated model.

4.3.5. Cointegration Estimation Results

Table 6. Equity capital growth mode Kao panel cointegration test results

Variable	**t-statistics**	**Probability**
ADF	-0.591303	0.0022
Residual variance	3.749411	-
HAC variance	7.330211	-

Source: Authors' computation

Table 6 presents the Kao (1999) panel cointegration test outcomes for the equity capital growth model. The computed probability value is 0.0022. As such, it is concluded that there was long-run co-movement among the variables.

4.4. Panel PARDL Results

The study tested the stability of the estimated models. All were stable and reliable for economic inference. The findings of the PARDL test for equity capital growth are presented in Table 7 below:

Table 7. Equity capital growth model panel PARDL test results

Variables	LONG RUN		SHORT RUN	
	Coefficients	Probability	Coefficients	Probability value
WASTE_DISCLOSURE	0.240512	0.0501	0.861111	0.4491
WATER_DISCLOSURE	0.414711	0.0452	0.478710	0.7917
ENERGY_DISCLOSURE	0.185851	0.1262	0.039609	0.3556
CARBORN_DISCLOSURE	-0.119512	0.0440	-0.468510	0.9019
MARKET_CAPITILASION	-0.134113	0.0987	-3.919512	0.9879
	Coefficient	*Probability*		
Cointeq01	*-0.109884*	*0.0221*		
Constant	*-1.919512*	*0.2755*		

Source: Authors' computation

PARDL test outcomes in Table 7 showed that if the p-value is <0.05, it means the connection among the variables is significant. Moreover, if the p-value is >0.05, it means the relationship among the variables is insignificant.

Column (1) presents the estimations of long run PARDL outcomes. Waste disclosure was positively and insignificantly correlated to equity capital growth in the long run; and a 1 percent change in waste disclosure led to approximately a 24.05% increase in equity capital growth. Water disclosure was positively and significantly connected to equity capital growth in the long run; and a percentage change in water disclosure led to about 41.47% improvement in equity capital growth. Energy disclosure was positively and insignificantly related to equity capital growth in the long run; and a percent change in energy disclosure led to about an 18.59% increase in equity capital growth. Carbon disclosure was negatively and insignificantly related to equity capital growth in the long run; a percent change in carbon disclosure led to about a 4.40% decrease in equity capital growth. Market capitalisation as a control variable was negatively and insignificantly related to equity capital growth in the long run; a percent change in market capitalisation led to about a 13.41% decline in equity capital growth.

Column (2) presents the estimations of short run PARDL results. In the short run, waste disclosure was positively and insignificantly related to equity capital growth; a percentage change in waste disclosure was associated with 86.11% growth in equity capital. In the short run, water disclosure was constructively related to equity capital growth and estimates were statistically insignificant. A percent change in

water disclosure led to a 47.87% growth in equity capital growth. In the short run, energy disclosure was positively and insignificantly related to equity capital growth; a percentage change in energy disclosure led to a 3.96% increase in equity capital growth. In the short run, carbon disclosure was inversely and insignificantly related to equity capital growth; a percentage change in carbon disclosure relates to a 46.85% decrease in equity capital growth. In the short run, market capitalisation was negatively but insignificantly connected to equity capital growth; a proportion change in carbon disclosure related to a 39.1% decrease in equity capital growth.

The model converged to equilibrium at a speed of approximately 10.99%. This implies that if there were disequilibria or instability in the estimated model, they would be corrected at a rate of 10.99% from one to another.

4.5. Models' Stability Test Results

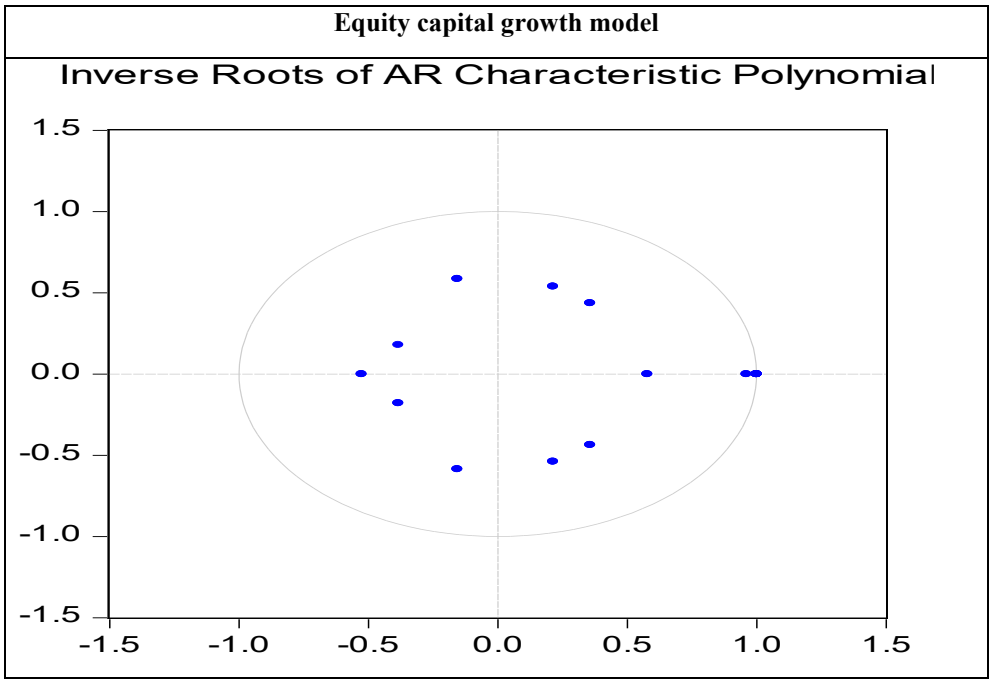

Figure 1. Inverse roots of AR characteristic polynomial for growth models

Source: Authors' computation

4.6. Discussion of the Equity Capital Growth Results

The results in Table 7 indicate that waste disclosure had an insignificant constructive impact on equity capital growth in both the long and short run estimates. In the long run, for example, water disclosure had a significant positive influence on equity capital growth as well as an insignificant positive impact on equity capital growth in the short run. Energy disclosure had an insignificant positive relationship with equity capital growth, both in the long and short run estimates. In both the long and short run, estimates showed that carbon disclosure had an insignificantly negative impact on equity capital growth. Market capitalisation had an insignificantly negative relationship with equity capital growth in both the long and short run estimates. Based on the outcomes, three out of five variables, namely, corporate environmental disclosure quantity were positive predictors of equity capital growth in both the long and short run estimates. Thus, based on dominance, it is determined that the CED quantity was positively correlated to equity capital growth.

The results agree with that by Amelia et al. (2025), who discovered a constructive and substantial relationship among ecological data disclosure and return on equity. Similarly, Bilal et al. (2024), Zang et al. (2023) and Aly et al. (2024) found that environmental disclosure mechanisms from a corporate standpoint had a positive effect on a study company's return on equity (equity capital growth). Conversely, Phrophayak et al. (2024) found a negative insignificant connection among environmental information disclosure and return on equity (equity capital growth). Additionally, Arévalo, González, Guzmán and Trujillo (2025) found a higher cost of equity, indicating that highly polluting companies face a disadvantage for investment. Evidently, according to Hu, Chen and Liu (2026), corporate environmental disclosure has an adverse influence on the ECG of a company, since the increase in equity capital costs will decrease the financial performance of the company. The legitimacy theory states that companies can create, influence or manipulate numerous disclosure-related policies, and can be inspired to disclose social and environmental data to legitimise their status within society (Hu et al., 2026).

The implications of the findings on the South African economy and the shareholder value of the companies used are stated below.

The results showing a positive impact of CED on equity capital growth suggest that the CEI benefits the economy and facilitates relief of environmental harms, thereby developing the SA economy and enhancing the competitiveness of local companies.

Moreover, the disclosure of ecological data by many companies can help prevent most environmental challenges, assist companies with equity capital growth for shareholders and increase profitability. As a result, most listed companies are working to prevent pollution, and in so doing discover innovative prospects of promoting new environmental solutions that enhance profitability and increase return on equity. These results will encourage listed companies to enhance and improve their environmental information disclosure policies, which would help them improve their return on equity for shareholders.

4.7. Conclusion

The results of study showed a constructive effect of corporate environmental disclosure quantity on equity capital growth, as shown in the model, which was derived from the research objective. The model of the study revealed that waste disclosure was positively and insignificantly linked to equity capital. In contrast, water disclosure was positively and significantly associated with equity capital growth; energy disclosure was positively and insignificantly correlated with equity capital growth; and carbon disclosure was negatively and insignificantly interrelated with equity capital and market capitalisation as a control variable, which was negatively and insignificantly related to equity capital growth.

A distinguishing feature of the study was its prominence on corporate environmental disclosures, which evaluated various combinations of waste management, water usage, energy usage and carbon emissions reduction and equity capital growth in divergence from most studies that focused exclusively on one environmental disclosure proxy. The outcomes of this study foster upcoming research to further explore alternatives of the corporate environmental disclosures of companies. Nonetheless, there is a necessity for JSE-listed companies to report further on corporate environmental disclosure and equity capital growth.

4.8. Contributions of the Study

Previous studies indicated a gap in understanding whether managers of companies can generate higher returns for their shareholders while satisfying the needs of their local communities by providing adequate measures for the pollution caused by the production (Amelia et al., 2025; Widuhung & Machmud, 2024; Zang et al., 2023). Based on the reviewed literature, there is limited research in South Africa on the

impact of CED quantity on equity capital growth. This study has bridged the identified gap in the literature by analysing whether and how the quantity of corporate environmental disclosure affects equity capital growth.

4.9. Recommendations

The researcher recommends that shareholders should invest more in CED, such as water usage disclosure, waste management disclosure, energy usage disclosure, and carbon emission reduction disclosure, as this would help enhance shareholder value in companies. Shareholders ought to investigate sustainability reports for a thorough insight into the corporate environmental disclosures that can assist in growing their wealth. The recommendation to the societies in which companies operate is that they ought to get involved in such companies to advance the socio-economic chances that they (companies) propose. This would assist in strengthening community security as they would receive support from the corporate environmental challenges faced by the surrounding societies.

Based on the results of the study, it is proposed that companies should participate more in CED as they progressively influence equity capital growth. Additionally, listed companies are advised to enhance their environmental information disclosure policies as this would help them improve their return on equity for their shareholders.

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From Financial Fragility to Financial Resilience of Households. A Systematic Review

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Abstract: The increasing prevalence of pandemics, climate change-related natural disasters, financial crises and wars is causing income loss, unemployment, indebtedness and ultimate financial fragility among households. Inequality gaps continue to widen, and previous redistributive policies raised the risk of credit growth and indebtedness. This systematic review of the literature sought to identify the causes of household financial fragility and recommend strategies of financial resilience from previous literature. One hundred and twelve (112) articles were retrieved from Scopus for analysis using the PRISMA protocol. The study found that social demographic factors, financial exclusion, inequality, natural disasters, financial illiteracy, digital poverty, and the financial and political system of a country are major drivers of financial fragility. Literature proposes capability-based strategies, such as financial literacy and life skills, resource-based strategies, such as financial inclusion, financial deepening through fintech, and social capital-based strategies, as major strategies for financial resilience. This study recommends the implementation of sound structural reforms that aim to attract investment consistent with job creation, economic development and growth in the country as a major strategy for addressing inequalities and household financial fragility.

Keywords: Financial literacy; financial resilience; financial inclusion; inequality

JEL Classification: A

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1. Introduction

The family stress model postulates that economic hardships caused by income loss or chronic economic conditions lead to household economic pressure, such as inability to pay bills and inability to meet basic needs like food, hence causing psychological stress and subsequent frustration, anger, anxiety, depressed mood, withdrawal from social interactions, marital conflict and disrupted parenting (Conger et al., 2020). The current wars, changes in international aid, climate change hazards, the previous COVID-19 pandemic, inflationary macroeconomic environments and global financial crises caused health and economic shocks to economies and households around the world, which triggered household financial fragility. Worrisome is the prevalence and rise of shocks, which have an ultimate economic and financial implication.

Surveys around the world indicate higher and worrying levels of financial fragility. In the United States the majority of households who participated in a survey could not raise $2000 within the next month in the event of an unexpected need (Clark & Mitchell, 2021). In the European Union, one third of European Union households who participated in a survey indicated that they were unable to handle an unexpected financial shock (Demtzs et al., 2020). Many developing nations in Africa faced financial and food challenges during the COVID-19 pandemic (Gumbo, 2023). Furthermore, the recent Middle East war is causing unexpected increases in fuel prices, which leads to price increases in many parts of the world. Hence, the urgent need for households and policymakers to develop strategies for enhancing financial resilience.

Being financially resilient is essential if individuals are to avoid adverse outcomes from unanticipated economic shocks. Financial fragility refers to the inability to cope with unexpected expenditures or income needs (Clark & Mitchell, 2024), whilst financial resilience refers to a household's ability to withstand acute shocks without harming financial well-being (Chen & Xiao, 2025). Household financial wellbeing is an important pillar for the achievement of sustainable development goals of no poverty, zero hunger, good health and wellbeing, quality education, gender equality and reduced inequalities. This research aims to determine the causes of household financial fragility and recommend strategies that can assist households to be resilient to financial shocks during a pandemic or financial crisis.

2. Materials and Methods

This study conducted a systematic literature review with bibliometric analysis to investigate the current literature trend and identify research gaps concerning financial fragility and financial shocks. The systematic literature review followed established systematic review guidelines from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol and Transfield et al. (2024) guidelines to avoid bias and to ensure transparency. This section explains the research methodology adopted by the study.

2.1. Research Questions

The PRISMA protocol and literature concur that systematic reviews should be guided by a research question (Transfield et al., 2024). This study aims to

1. Identify causes of financial fragility from the literature.

2. Determine strategies that can assist financially fragile households to be resilient from the literature.

2.2. Inclusion and Exclusion Criteria

Guided by the research questions, a search criterion ("financial fragility" OR "financial vulnerability" OR "financial stress" AND "financial resilience" OR "financial capacity" OR "financial well-being" AND "households" OR "families" OR "consumers") was used to search documents from the Scopus database. The database was selected due to its diverse literature. After analysing preliminary search results, the search was refined to include articles in English, published during the years 2019 – 2025 and published as book chapters, conference papers and articles. Figure 1 shows the screening process and the articles selected for analysis.

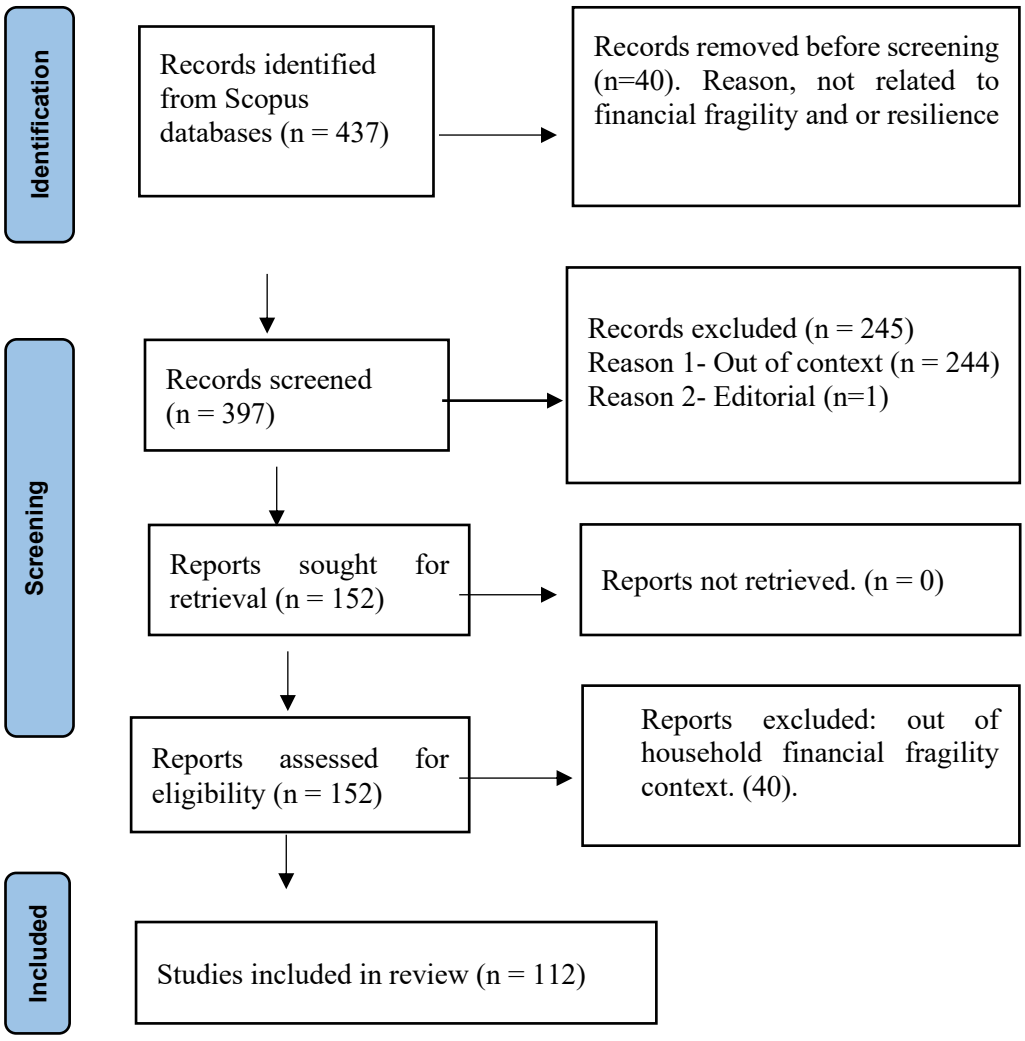

Figure 1. PRISMA flow chart of the literature review process

Source: Authors' compilation (2026)

2.3. Data Analysis

Qualitative data were analysed using content and thematic analysis. First findings were coded to identify recurring concepts and patterns, then these codes were used to identify themes. To ensure reliability, the review process was documented in

detail. Quantitative data were analysed using descriptive and bibliometric analysis. Document citations, authors' keywords, country contribution and collaboration were assessed. Excel and VOSviewer software were used to analyse quantitative data.

3. Results

3.1. Descriptive Statistics

Literature of the study was drawn from seventy-eight (78) journals and one hundred and twelve (112) articles. A total of three hundred and thirty-three (333) authors contributed to the selected literature. Five hundred and nineteen (519) keywords were identified, and the average citation per document was nineteen (19), reflecting significant contribution of the selected articles to literature. The timespan of the selected literature ranges from 2019 to 2026, and forty (40) countries contributed to the literature in relation to the author's affiliation country. Table 1 shows the descriptive statistics of the papers included in the systematic literature review.

Table 1. Descriptive statistics of the papers

Main information about the data	
Timespan	2019-2026
Sources (Journals)	78
Documents	112
Average citation per document	18.79
Document content	
All keywords	519
Author's Keywords	301
Authors	
Authors	333
Authors' collaboration	
Single-authored docs	7
Contributing countries	40

Source: Authors' compilation, 2026

3.2. Authors' Keywords Co-Occurrence

Keyword co-occurrences identify main topics or themes and trends discussed in literature. Only keywords that were used more than three times were considered important themes. The selected literature is grouped into five major clusters. First, the blue cluster includes themes such as financial literacy, financial resilience, financial capability, financial fragility, financial education and financial inclusion as dominant themes. The literature highlights financial literacy/capabilities and financial inclusion as major strategies for building financial resilience. Secondly, the red colour cluster is represented by economic and sociodemographic factors like age, gender and income as major determinants of household financial fragility. Third, the yellow cluster has the pandemic as a major determinant of financial stress and financial anxiety. Fourth, the green colour represents psychological issues like locus of control, the financial system, financial services and household finance, and lastly, the purple colour represents psychological resilience, family and literacy.

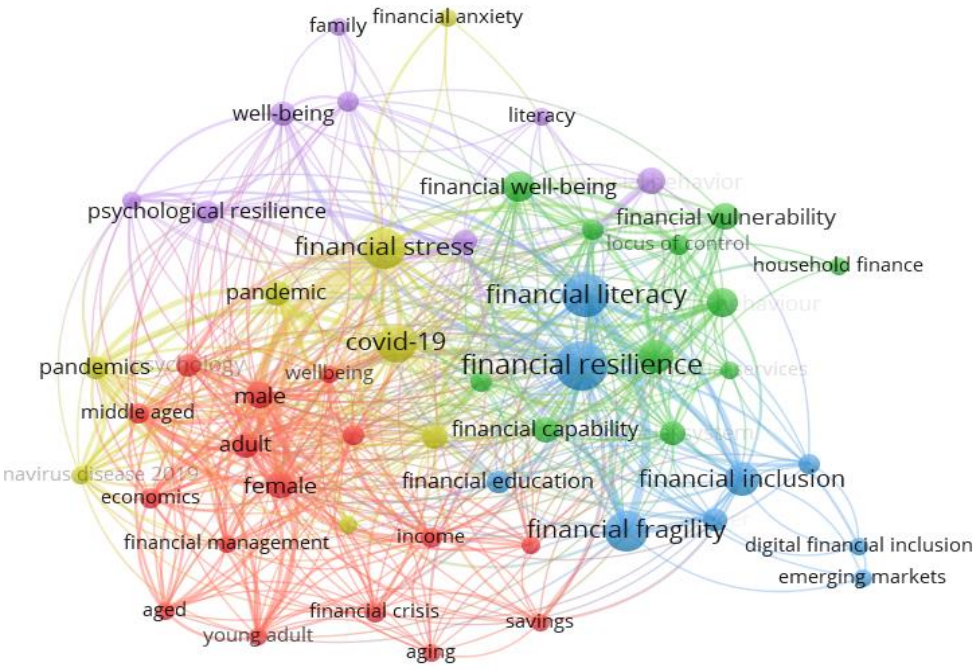

Figure 2. Keywords co-occurrence

Source: Authors' compilation (2026)

3.3. Country Contribution

United States of America authors were the major contributors of financial fragility and resilience literature. Authors from China, the United Kingdom, India, Australia, Malaysia and South Africa also contributed significantly to the literature. However, although financial fragility is high in Africa, African countries' research on fragility and financial resilience is still low. Further studies should consider an analysis of financial fragility in African countries and propose tailor-made strategies.

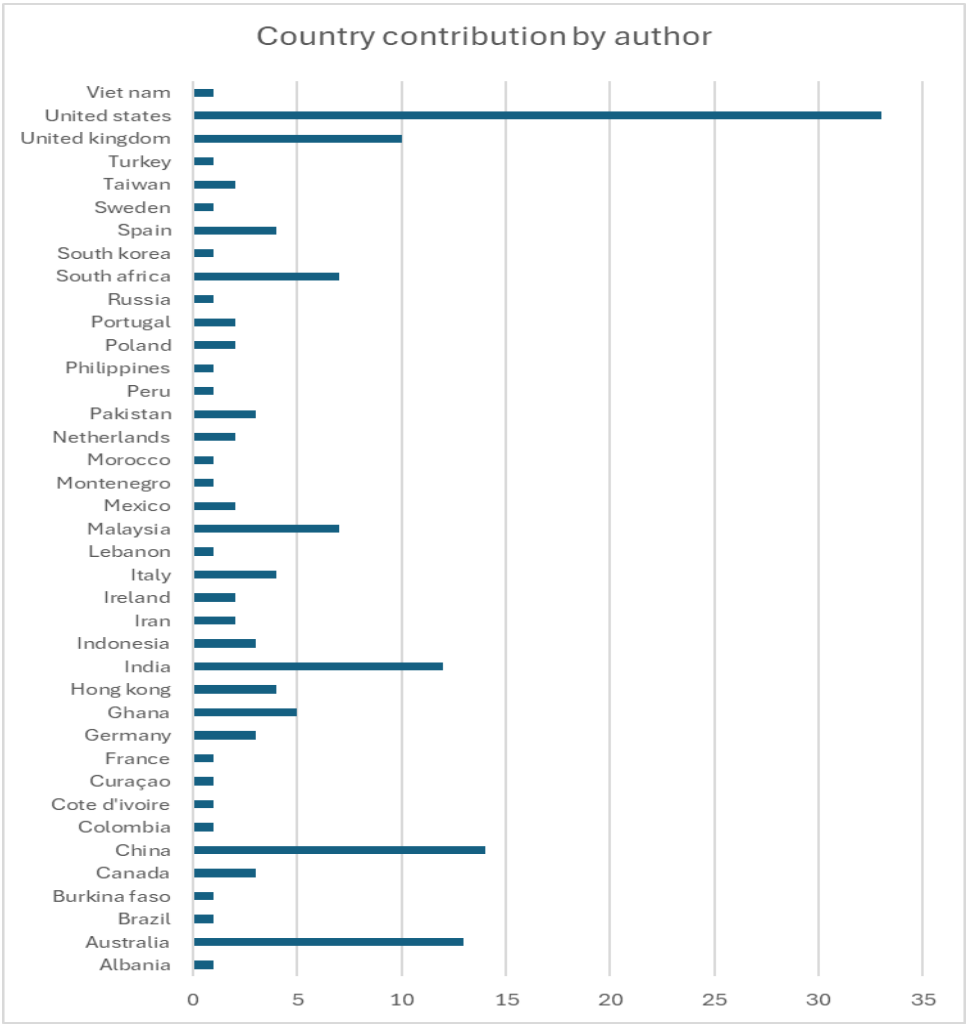

Figure 3. Country contribution

Source: Authors' compilation (2026)

3.4. Thematic Analysis on the Causes of Financial Fragility from the Literature

3.4.1. Theme One: Socio-Demographic Variables

Socio-demographic variables of households were cited as major determinants of financial fragility and resilience of households. Gender, age, employment, income, marital status, family size, region, education and net worth are core socio-demographic variables influencing the fragility and resilience of households (Klapper & Lusardi, 2019; Chen & Xiao, 2025). Generally, households with lower income, more dependants under 18, lower education, female-headed, divorced-headed, retired-headed and not employed faced higher levels of financial fragility compared to their counterparts (Dushku, 2023; Tinta, Ougraogo & Al-Hassan, 2025). Hence, financial capability educational programmes should target more women, the young and the less educated. Carton et al. (2024) found that young, educated females between the ages of 23 and 44 are the most resilient to financial shocks as compared to those above the age of 65, who are weak in planning, as they will not be able to plan for the long term. The authors went on to conclude that household heads or individuals above 65 years have weak financial knowledge and lack willingness to seek advice for them to withstand financial shocks. This finding contradicts the lifecycle hypothesis, which postulates that financial investments are accumulated as an individual grows and the retired above the age of 65 usually possess more wealth, which has been accumulated throughout their working years, and are the ones who assist their family by gifts and family financial support. There is consensus that level of education and employment status influence the financial fragility and vulnerability of a household. Financial vulnerability in Pakistan depends on the level of education, industry employment of the head of the household and employment status (Ali et al., 2020). Ali et al. (2020) alluded to the fact that the most financially vulnerable households are those without knowledge of financial information, formal education, communication and technology and are mostly engaged in agriculture.

Regarding employment status and income, household heads who were unemployed or retired were more financially fragile compared to families with employed household heads (Dakshu, 2023). Employment is a major source of income for most individuals; hence, the unemployed struggle to source money for buying family essentials. However, when measuring the employment status of individuals, self-employment, entrepreneurial endeavours and other forms of informal employment should be considered, especially in developing nations. In the United States of

America, the lower-income groups and African Americans are the most financially fragile individuals in the United States of America (Lusardi et al., 2020). Formerly incarcerated individuals also face severe financial fragility after a long period of unemployment. Reintegration of these individuals into society and securing employment is usually difficult (Bather et al., 2024). Family and partner support are vital to build financial resilience.

3.4.2. Theme Two: Lack of Financial Literacy

The majority of the literature concurred that financial literacy has a strong influence on financial fragility and financial resilience, as financially literate household heads were found to be more likely to be financially resilient. Gao, Rouxelin and Rojasavachai (2025) argued that financial illiteracy is a systematic risk that weakens household financial resilience and financial decisions and increases exposure to economic shocks. The authors argued that financial illiteracy increases financial credit default risk, inefficient asset allocation which contribute to broader market risk, macro-economic instability and wealth distribution inequalities. Without financial literacy the sustainable development goals of eradicating poverty, inequality and of promoting good health and wellbeing are far from being reached.

Hasler, Lusardi, Yugnick and Yukoboski (2025) argued that financial literacy matters in relation to financial fragility and financial risk, as financially literate household heads were found to be more likely to plan for retirement, manage their debts, and comprehend financial risk in times of crises. Clark and Mitchell (2024) also concurred that financial literacy is associated with financial resilience and is a protection against financial fragility. The authors investigated United States of America citizens aged 45-75 and concluded that more financially resilient individuals were more likely to select an annuity as a pension payout, which reflected knowledge of investment and growth. The age group of individuals aged 45-75 is usually composed of household heads. Additionally, Erdern and Rohahn (2022) confirmed the importance of financial literacy on financial resilience through a study of four European Union countries and established that financial literacy increases financial resilience.

Financial literacy is an evolving combination of financial capabilities namely, financial knowledge, financial attitude, financial behaviour and digital financial literacy. The measurement of financial literacy differs and very few studies measure all the components of financial literacy hence some results are not a complete reflection of financial literacy. Literature stresses the importance of good financial

behaviours; financial knowledge and good financial attitudes in building financial resilience.

3.4.3. Inequality, Mortgage Delinquency and Debt-Financed Consumption

Literature highlighted that income inequality contributes to excessive accumulation of debt, which ultimately leads to financial fragility. Medialdea and Martin (2022) suggested that income inequality in a country leads to households replacing income with debt to finance household consumption. The authors argued that the previous global financial crisis forced middle to low-income earners to increasingly resort to debt to finance their consumption. Debt-financed consumption and continuous increase in house prices led to household financial indebtedness as households failed to service their debts and mortgages (Medialdea & Martin, 2022). In the same vein, Zungu and Greyling (2023) confirmed that inequality contributes to high indebtedness, resulting in financial fragility among the working class. These findings are supported by the Rogan hypothesis cited by Zungu and Greyling (2023), who highlighted that rising inequality drives credit and household indebtedness, financial fragility and ultimate financial crash as reflected by the previous global financial crisis, which started in the United States of America. In South Africa, Zungu and Greyling (2023) identified inequalities and excessive borrowing among low-income earners from both informal and formal institutions, which leads to household indebtedness and financial fragility.

3.4.4. Financial Exclusion

Literature identifies financial exclusion as a factor contributing to household financial fragility. Kim, Xiao and Porto (2023) investigated the effect of financial capability on the financial fragility of the United States of America with different financial inclusion statuses during the COVID-19 pandemic. The authors established that higher financial capability and financial inclusion reduce the risk of financial fragility, as access to loans improves with financial inclusion. Additionally, Kumaralalita and Zheng (2023) also highlighted that digital financial inclusion provides opportunities for women who often face unequal access to financial services and access to loans that are required to be financially resilient. The authors argued that crowdfunded digital platforms play an important role in providing access to faster loans, providing better opportunities that lead to a better life. However, Carton, Xiong and McCarthy (2024) argued that while digital financial inclusion may facilitate financial resilience, there is a danger that it might increase vulnerability of households to predatory financial services and financial scams.

Financially including illiterate individuals has detrimental effects to the individuals and to the financial system stability (Gao, Rouxelin & Rojasavachai, 2025).

3.4.5. Pandemic and Natural Disasters

Literature concurs that the previous COVID-19 pandemic and the corresponding closure of businesses caused loss of income and financial fragility (Kulshreshtha, Raju, Muktineni & Chatterjee 2023). Tano and Putri established that the financial conditions of individuals during the pandemic were deficient, as the majority of households were traders who relied on daily earnings and COVID-19 pandemic restrictions that forced them to remain home affected their business income.

Naughton and Brady (2024) noted that in developing countries like Mozambique, where the major economic activity is agriculture, recent natural disasters like cyclones have ruined harvests and rural infrastructure, causing extreme poverty and other climate change implications like increasing variations in rainfall and prevalence of drought, increases poverty. Liu and Ding (2025) also provide evidence that natural disaster experiences cause a decline in household incomes and psychological stress, which translates to shifts in risk attitudes and a decline in financial market participation. Investing in insurance is vital in protecting farmers against climate related disasters.

3.4.6. Digital Poverty

Digital poverty increases fragility by increasing exclusion in access to digital financial services (Ma & Liu, 2025). The use of mobile devices and USSD codes increases access to cheaper digital financial services. Digital poverty also weakens social interactions which are vital in sharing financial information. (Ma & Liu, 2025).

3.4.7. Locus of Control

Sabri et al. (2025) also argued that locus of control, referring to an individual's belief in the degree of control over their lives and the events that are key, has an impact on one's finances and financial behaviour. Kleimier et al. (2023) further established that that the household's cognitive (financial literacy) and non-cognitive abilities (psychological resilience and internal locus of control) and non-cognitive psychological abilities assist in lessening higher financial fragility.

3.4.8. Physical and Psychological

Literature noted physical and psychological determinants as vital influences on financial fragility and resilience. Liu, Chen and Xiao (2025) argued that health status and disability have potential to affect one's income and financial resilience capability, whilst psychological, mental and cognitive status also affects one's capability to manage finances. Mundi's (2023) study focused on cognitive abilities and financial resilience of millennial parents and found that cognitive abilities of single parents have a significant impact on financial resilience, and that university degree, age, gender, staying with parents and employment status affects financial resilience of single parents.

3.4.9. The Financial and Political System of a Country

The financial and economic systems can either facilitate financial resilience or exuberate financial fragility. Rigid financial systems like collateral based lending restricts women's access to credit and promote financial exclusion. If supported by a political system with lower investor protections and weaker institutional support financial exclusion and unemployment will rise facilitating financial fragility. Matemane, Machokoto, Lemma and Majoni (2025) conducted an analysis of 2021-2022 Global Findex surveys data from 134 countries and found evidence that women face greater difficulty mobilising emergency funds within 7 and 30 days compared to men. Formal lending is considered an important source of funds to make ends meet. The authors stressed the need for policy interventions to alleviate women and strengthen women's financial resilience.

3.4.10. Economy and Economic Environments

Previous economic recessions and financial crises were identified as major causes of family financial fragility. The great recession and global financial crisis of 2007 - 2009 caused household indebtedness especially in the United States of America where low-income households were holding subprime mortgages (Friedline, Chen & Morrow, 2021). Macroeconomic factors like the counties gross domestic product, exchange rate, inflation, infrastructural development, unemployment level and the financial sector developments are major causes of financial fragility.

3.5. Thematic Analysis of Strategies That Can Assist Financially Fragile Households to Be Resilient

3.5.1. Capability Based Strategies of Financial Resilience

3.5.1.1. Improving Financial Literacy/ Financial Capability

Improving financial literacy emerged as one of the most important strategies of preventing financial fragility and building financial resilience. To move from the state of financial fragility of most household to financial resilience, households need to improve their financial knowledge, financial attitudes and practice good financial behaviours (Wiranatakusuma et al., 2024; Clark & Mitchel, 2024; Aristel et al., 2025). Good financial behaviours involve financial planning, saving, budgeting, responsible credit use, retirement planning, saving for emergencies, making a considered purchase, proper risk management and good money management (Hamid et al., 2023; Abreu et al., 2025; Tinta, Ougraogo; Zeka & Alhassan, 2024; Al-Hassan, 2025). Policy makers should facilitate the development of financial education programs that equip household heads with financial knowledge, encourage good financial behaviour, impart crucial digital financial skills and develop good financial attitudes especially among women, the youth and the old. Financial education should be integrated in basic education curricular as it is a basic human financial skill.

To avoid previous financial dilemmas caused by nationwide financial illiteracy and mortgage delinquency Gao et al. (2025), recommended the integration of financial literacy metrics into credit risk assessments, macro prudential oversight and investment framework to prevent household credit default and fragility. The literature also calls for support by policymakers and financial providers in terms of access to financial services and also availing resources and support services to indigenous citizens using flexible terms.

3.5.1.2. Financial Education, Education and Financial Coaching

Higher level education and financial education were cited as crucial strategies in enhancing financial literacy. The majority of individuals with lower levels of education underperformed individuals with higher education in financial resilience, hence the need for policy makers to facilitate the provision of education and incorporate financial education in basic education curriculum (Dakshu, 2023). Naughton and Brady (2024) noted that a financial training aimed at youths and women encouraged the uptake of formal services, mobile penetration and usage of payment systems. Liu and Chen (2024b) advocated for risk management education

to promote financial literacy and resilience since families preferring moderate risks and yielded significantly higher financial resilience scores than those with high and low risk tolerances. Financial coaching targeted at specific groups of people is also vital in enhancing practical financial behavioural skills. Financial education programs should consider adding practical lessons on practical financial behaviour skills, financial knowledge tailored to current economic conditions, understanding of financial stress, managing financial stress, credit and risk management, and improving financial problem-solving skills (Yumiseva, 2025).

3.5.1.3. Life Skills and Digital Literacy

Sabri, Suhaimi, Nazario, Law and Maglia (2025) consented that the development of life skills like problem solving, decision making, critical thinking, communication is crucial in achieving financial wellbeing and financial resilience. In the same vein Kass-Hanna and Liu (2022) argued that digital literacy is an important skill that stimulates the usage of online banking, mobile money, and other digital financial services that offer an efficient mechanism to foster saving and borrowing decisions. The authors argued that since most of financial services are now accessed through digital platforms, digital literacy has become a catalyst for improved financial behaviours', which are important as that of financial literacy (Kass-Hanna & Liu, 2022).

3.5.2. Resource Based Strategies of Financial Resilience

3.5.2.1. Financial Inclusion

Zeka and Alhassan (2024) concurred that financial deepening and digital finance has potential to mitigate household financial vulnerability through the provision of more tailor-made financial services, reducing financing cost and optimising asset allocation. The authors argued that digital poverty restricts access to financial resources, limits social interactions and exposes households to greater financial risk in decision making. Specifically, the availability of savings acts as an early form of financial resilience; these savings can be formal and non-formal yet represents important safety net in emergencies.

Omuru and Awetey (2024) outlined four channels in which financial inclusion impacts financial resilience. First, financial inclusion facilitates production of investments where households that take advantage to invest in financial services gain higher returns, which acts as a buffer against economic challenges. Secondly, financial inclusion facilitates risk mitigation by providing health insurance and

access to credit, which mitigates financial emergencies. Thirdly, financial inclusion facilitates emergency preparedness by providing households with an opportunity to accumulate savings and acquire assets that can be relied upon during emergencies. Fourth, financial inclusion facilitates cost-effective solutions, such as low-cost payment systems, to transfer money without physically sending it. However financial inclusion should work hand in hand with financial literacy, to facilitate effective use of money.

3.5.2.2. Government Support

Clark and Mitchell (2022) established government support as a vital strategy to improve household financial resilience during a crisis, with assistance available within a year of the effecting crisis, more effective. Government and policy makers should consider availing emergency grants, debt relief programs, financial training, cheaper housing schemes and avail affordable financial advice or counselling services (Sun, Small, Huang & Ger, 2022).

3.5.2.3. Insurance

Collier and Kousky (2025) stressed the importance of insurance in mitigating against financial shock caused by climate change. The authors highlighted the importance of insurance as a financial risk transfer tool available to household heads for addressing the unexpected risk. Zeka and Alhassan (2024) also established that risk management behaviour, represented by having an insurance, was the greatest driver of financial resilience, followed by planning for retirement, savings and having access to credit. However, there is generally low uptake of insurance due to trust and affordability issues.

3.5.2.4. Credit Services

The ability to borrow and access financial resources was considered an important strategy for financial resilience. Both formal and informal borrowing are crucial as borrowing from social, family, and friends is also crucial and can also provide cheaper funds, however it is also associated with social pressure. Formal credit services, like loans from Banks or microfinance, offer loans with structured repayment plans but may exclude the poor households and may have higher interest rates and unfavourable payment terms (Jalili et al., 2025). Donou-Adonsou and Leslie-Piper (2025) established that the Buy now, pay later credit service is a convenient payment alternative to traditional credit for those who lack emergency

savings, income irregularities and perceived financial insecurity. However, credit services cause financial stress if not used appropriately.

3.5.2.6. Financial Deepening

Naughton and Brady (2024) emphasised ways in which greater financial resilience has been built among vulnerable populations with limited resources through financial services deepening and innovative uses of digital financial services. The authors also argued for micro insurance and financial technology availability to improve financial inclusion and increase resilience, closing the gendered equality gap. The successful implementation of a sandbox project in Mozambique in has contributed to advancing financial inclusion through expanding financial services and financial deepening, with the potential to disrupt traditional financial services through reduced cost and digital transactions.

3.5.2.7. Savings Groups

Naughton and Brady (2024) noted that savings groups platforms improved the financial resilience of households. Redford and Verhoof (2022) had the opinion that savings group foster financial resilience, financial inclusion and economic development in Africa. Formalising and facilitating savings groups among peers, communities and households enhance financial resilience. Jalili et al. (2025) called for the formalisation of informal financial networks such as Rotating Savings and Credit Associations (ROSCAs), burial societies, and community lending pools as they already help as critical financial shock backups in low-income countries.

3.5.2.8. Structural Reforms

Literature recommends the implementation of structural reforms that aim to bring investment consistent with employment creation, economic development and growth in the country as a major strategy for addressing noted income inequalities and household financial fragility. Rigid financial system reforms should be altered to improve financial inclusion and financial access (Matemane, Machokoto, Lemma & Majoni, 2025).

3.5.2.9. Financial Social Work

The tradition of addressing financial fragility of the poor through social work is still significant. Thorough social work specialised programs providing borrowing opportunities, facilitating savings and training the poor on the development of personalised financial plans are provided. The introduction of financial social work

addresses some complex family financial dynamics related to family financial decision making, psychological attitudes, cultural patriarchal systems, financial behaviours and financial inclusion. Financial social work creates a supportive environment and considers emotional and psychological factors (Anvari-Clark et al., 2026).

3.5.2.10. Investment and Multiple Income Stream

Household diversify their income streams by combining their income from formal employment with income from side hustles, farming activities or gig work as relying on a single income source increases vulnerability. Investing in productive assets was also considered vital in ensuring financial resilience although some assets are less liquid. Depending on the development of the economy households invest in formal capital markets whilst others invest livestock or tools which provides long-term security (Jalili et al., 2025).

3.5.3. Social Capital

3.5.3.1. Social Capital and Family Identification in Cohesion

Social networks and community support through financial loans, in kind aid, or emotional backing helps maintain assets and mental well-bein (Jalili et al., 2025). Stevenson, Coste, Wakefield, Kellezi and Stack (2020) established family identification and cohesion in family support as an important contributor to financial resilience. Family cohesion and identification promote mental well-being, family support and effective coping with financial problems. The authors argued that household financial fragility can be well explained with the family stress model, which posits that household financial fragility has an adverse influence on the financial and psychological well-being of families.

4. Discussion and Direction for Further Study

Literature highlights the need for financial resilience because the majority of households are in a state of financial fragility. Social demographic factors, such as income, employment status, level of education, and gender, were cited as major causes of household financial fragility. Generally, low-income earners have challenges making ends meet and individuals with no or low levels of education do not have the capabilities to manage their finances easily. Women-headed households were indicated to be more prone to financial fragility. Hence financial education

trainings should be targeted to these vulnerable population. Furthermore, financial illiteracy, financial exclusion and inequality were cited as major causes of financial fragility. Inequalities exist in some countries where the majority of the populace are low-income earners financing most of their consumption with borrowed funds, which causes higher levels of indebtedness and financial fragility. Financial inclusion without financial literacy exposes households to making mistakes in financial decisions exposing households to financial risk. Financial literacy, financial inclusion and financial deepening through fintech were cited as major strategies of building financial resilience. Strategies like financial education, life and digital skills training, savings groups and social capital we sighted as pathways to foster financial resilience coping skills, building capabilities to practice good financial behaviours not only vital in using or making financial decisions but vital in keeping and building financial resources required for financial resilience. Building social networks and family support was identified as an important strategy to build financial resilience. Training programs can be targeted to these social networks. In terms of pandemic and natural disasters, government support in the form of grants shelter and food provision was cited as vital in assisting affected households. The current literature is mainly concentrated in developed countries; there remains a study gap in developing countries, especially in Africa, where financial distress is high. Research needs to explore how household heads from various socio-demographic backgrounds can be assisted to become financially resilient.

5. Conclusion

Financial literacy and socio-demographic variables emerged as the major variables associated with financial fragility and resilience. Policy makers should focus on improving the financial literacy capabilities of household heads and also target women, the unemployed and less educated in providing financial education and financial assistance as they are more vulnerable to financial fragility. Digital financial inclusion and financial deepening have potential to provide financial services widely at a lower cost. Financial social work and strengthening of family support systems remain vital in promoting financial resilience. Structural inequalities need to be addressed and policies that aim to increase employment opportunities in the country were cited as more effective.

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Climate Risk and Access to Agricultural Credit: Do Climate Adaptation Strategies Matter?

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Abstract: The study aims to determine the relationship between climate risk, adaptation strategies and access to agricultural credit among agribusinesses in Bulawayo Province in Zimbabwe. It endeavours to reveal if climate adaptation strategies alleviate the problem of access to credit for firms in climate risk prone areas. The research builds on research on climate risk and access to credit by examining the role of climate adaptation strategies in a semi-arid region. It relies on survey data from 367 agribusinesses, collected through structured questionnaires and interviews. Thematic analysis and logistic regression were used to analyse data. The results indicated that climate risk significantly lowers the chances of credit access. Financial institutions react to climate risk by imposing stricter lending standards, increased collateral requirements, and pulling out of vulnerable segments. Though results show that adaptation strategies positively influence credit access, lenders do not directly incorporate these in credit models. Therefore, climate risk will continue to act as a constraint to finance availability unless climate-sensitive credit scores and adaptation strategies are incorporated into the lending models. The study brings out the impact of climate adaptation strategies on credit access of agribusinesses operating in semiarid regions.

Keywords: Climate risk; agricultural credit; adaptation strategies

JEL Classification: D01, D02, D52, E51, G21, Q14, Q54

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1. Introduction

The world is experiencing the transformation of agriculture due to climate change, and Zimbabwe is not an exception. Over the past couple of years, the erratic weather conditions, extended dry seasons, and increase in temperatures have affected agricultural productivity, exerting pressure on farmers, other agribusinesses and the financial institutions that finance them. This has particularly been the case with regions such as Bulawayo where the agribusinesses are experiencing increasing climate risks and yet they lack access to credit that would allow them to adapt and expand. This has resulted in business stagnant growth, company failures and higher unemployment. Climate change remains one of the most pressing threats to global agricultural systems, posing significant challenges to food production and rural livelihoods. Projections by the Intergovernmental Panel on Climate Change (IPCC) (2022).

indicate that global agricultural yields could decline by 5% to 30% by 2050 due to rising temperatures, erratic rainfall, and an increase in extreme weather events. The resulting alterations affect the smallholder farmers negatively as they contribute over 70 percent of the world food supply yet do not often have access to adaptive technologies, formal insurance, and financial services (Food and Agriculture Organization (FAO), 2023).

Numerous studies have shown that agricultural systems based on smallholders cannot be sustained without structural adaptation to the pressure of climate change (Mwadzingeni et al., 2021; Jiri et al., 2015). One of the building blocks of resilience would be agricultural credit that enable investment in drought-resistant seeds, irrigations, and improved storage (Chigunhah et al., 2020). There is empirical evidence indicating a change in the approach of financial institutions in agricultural sector funding due to climate-related risks (Chigunhah et al., 2020; Kuipa, 2019; Moyo et al., 2012). This change and its impact on access to credit forms the basis of this research. Evidence shows that financial institutions are implementing conservative lending practices after an upsurge in default rates in response to extreme weather events (Chigunhah et al., 2020; Kuipa, 2019). Banks have cited higher non-performing loan ratios among agricultural customers; as a result, they have either pulled out of the rural markets or tightened loan terms (Chigunhah et al., 2020; Kuipa, 2019; Moyo et al., 2012). Resultantly, the percentage of agribusinesses who have access to formal agricultural loans is decreasing because of the increased risks of non-repayment and rigid collateral arrangements (Chigunhah et al., 2020;

Moyo et al., 2012). Though relevant, these studies have taken an oversimplified view of the Zimbabwe experience in terms of failing to take into consideration geographical variations in vulnerability, financial behaviour, and agro-ecological setting (Jiri et al., 2015). Therefore, this study aims to fill this gap by paying attention to Bulawayo Province which is a strategic yet unique region. Bulawayo is the second-largest province in Zimbabwe, and it is estimated to have more than 650,000 inhabitants (Zimbabwe National Statistics Agency, 2022). It is a semi-arid region characterized by long dry spells which largely relies on resilient agriculture and innovative urban farming. Bulawayo, as is the case in many peri-urban areas, has been left out in the national studies of agricultural financing that mostly generalize the rural situations and fail to consider the local dynamics (Jiri et al., 2015). A local investigation will provide important clues as to how macro pressures related to climate are translated into financial behaviors and distortions in the credit market on the micro level.

The current seeks to bridge this gap by examining the impact of climate risk on agriculture financing in a semi-arid peri urban set up forcing on agribusinesses. Furthermore, it explores role of climate adaption strategies in enhancing agriculture finance. Utilizing surveys and logistic regression, the results show that climate risk reduces access to agriculture finance. Even through climate adaptation strategies improve access to finance, financial institutions do not directly include them in lending models. Financial literacy, record keeping, collateral security and registration status influence credit access for agribusinesses.

2. Literature Review

This paper is anchored by two interconnected theories, Risk Management Theory and the Access to Finance Framework, to gain insight into the climate- risks and agricultural credit nexus.

2.1. Risk Management Theory

Risk Management Theory (RMT) focuses on how organizations prepare and react to operational and environmental shocks. This essentially involves identifying, assessing and management of risks that might impact the organisation. Smith (2015) highlights that effective risk management allows organisations to take advantage of

opportunities while at the same time minimising losses. The RMT therefore assumes that financial institutions, embody organized procedures of detecting, measuring, and mitigating risks that may impair income streams or capital repayment to enhance performance and create shareholder wealth (Gates et al., 2012). This helps lenders to determine the likelihood and severity of default situations, and to design mitigation strategies. Response strategies to risk such as climate risk could include recovery lending, reallocation and repricing of loans, and relational transformation (Brüggemann & Lueg, 2026). There is ample evidence that climate risk has been incorporated by banks in their risk management framework, however challenges around nonlinearity, industrial and location dependence and in some instances, measurability remains (Redondo & Aracil, 2024). Implementing risk management can be challenging in instances where risk cannot be objectively measured. This might not be true for small to medium enterprises exposed to new threats that are unpredictable, for example climate risks. Qualitative aspects like adaptation strategies could be difficult to capture due to under or inconsistent reporting, resulting in misrepresentation of borrower realities.

2.2. Access to Finance Framework

The Access to Finance Framework (AFF) was initially developed by Beck et al. (2007), emphasising how obstacles to access formal financial services were negotiated by individuals and firms. It is relevant in developing economies such as Zimbabwe where informal economies and a lack of financial infrastructure may tend to exclude the marginalised sectors such as smallholder agriculture. The framework distinguishes between supply-side and demand-side constraints based on the level of transaction costs, poor rural branch networks, and risk aversion of lenders on the supply side and the absence of collateral, poor financial literacy, and informal land tittle on the demand side. These structural factors strengthen credit rationing, which determines whether uncreditworthy borrowers access credit at all or on very disadvantageous terms (Khan et al., 2024). This is even worse in agriculture where the seasonal income, high exposure to risk and dependence on natural resources contribute to the unwillingness of lenders to engage (World Bank, 2022). At the core of the concept is the belief that financial access is not only about the geographical access to banks but also about the willingness of the institutional unit to lend to risky or low-income individuals. Banks could justify these decisions citing regulatory and

risk management constraints as the reasons to exclude them, more so in areas with constant droughts or economic disruptions (Mhlanga & Dzingirai, 2024).

2.3. Conceptualization of Climate Risk

Climate risk is defined as the possibility of negative consequences because of the climate variability and long-term climate change, and it includes both the extreme weather and the slow environmental changes (IPCC, 2022). It encompasses both physical risks, e.g. droughts, floods, heatwaves, and storms and transition risks that are caused by the shift toward policy and technology and the preferences of the markets to mitigate climate (World Bank, 2022). The risks are not only to the ecosystems and infrastructure but also to economic sectors dependent on environmental stability like agriculture and finance (FAO, 2021). In agricultural sector, climate risk has a direct impact on production, investment and access to finance. Climate change, manifests through irregular rainfall, warmer climate, and increased cases of extreme weather. This reduces crop production, complicates planting cycles, and introduces unpredictability among lenders and famers. This volatility reduces income stability and repayment predictability of agribusinesses and increases the perception of risk among the financial institutions who then tighten their lending terms or even give up on agriculture lending (Abate et al., 2016; Mhlanga & Dzingirai, 2024).When lenders restrict lending they do not affect current production but they also increase susceptibility of agribusinesses through depriving them infrastructure and technology that improves resilience and adaptability (World Bank, 2022). In the semi-arid areas like Bulawayo, the main form of climate risk manifests as rainfall variability, long dry periods, and a reduction in the level of groundwater, which affects both rainfed and irrigated agriculture (FAO, 2021). Coupled with macroeconomic instability that characterise Zimbabwe, financial institutions become cautious about lending to agriculture businesses (Mhlanga & Dzingirai, 2024).

2.4. Conceptualisation of Access to Agricultural Credit

Access to agricultural credit means that the farming households and agribusinesses can access timely, affordable, and appropriate funding to use in production, marketing, and capital investment. It does not only depend on how close a person is to financial institutions, but also on a complex of structural, institutional and

behavioural processes that define whether credit is accessible, to whom, and on what terms (World Bank, 2022; FAO, 2021). Credit allows agribusinesses to use productivity-enhancing technologies and diversify production to allow smooth functioning under stressful conditions. It affords them to hire skilled labours, source raw materials, market their products and fight competition (FAO, 2021; World Bank, 2022). However, financial system still fails to serve the small agricultural producers effectively, especially in low- and middle-income countries, because of the perceived risk, lack of collateral, and informality of land ownership and enterprise structure (Khan et al., 2024). This does not only impact viability of farmers in these communities but also impact the whole ecosystem of agribusinesses that rely on supplying goods and services to farmers, process agriculture produces and distribute agriculture products. Mhlanga and Dzingirai (2024) found that commercial banks view agriculture as a high-risk and low-margin activity and, therefore, adopt a conservative lending policy that leaves out small-scale or informal actors. Access barriers are compounded by the spatial barriers, poor infrastructure, inefficiencies of the institutions, regulatory barriers, and lack of investment which disproportionally impact women, the youth, and the producers in the peri-urban areas (IFAD, 2023). Although the use of innovations in mobile money and microfinance has enhanced reach in certain countries, the tools are usually limited in terms of their depth or scale to transform agriculture in the long run (FAO, 2021; World Bank, 2022).

Most agribusinesses are informal, without formal land titles or registration and cannot take advantage of most credit products provided by formal financial institutions. In addition to that, macroeconomic instability and high inflation have shaken the confidence of lenders and raised the cost of borrowing, which supports the tendencies of exclusion (Mhlanga & Dzingirai, 2024). Resultantly, most agribusinesses in the economies rely on informal credit, that is inadequate and expensive.

2.5. Determinants of Agricultural Credit Access

The structural, social-economic and institutional factors that restrict access to agricultural credit are well documented. The lack of collateral, especially land titles or registered assets, is one of the major impediments as this is a key requirement of most commercial lending institutions. Lack of verifiable security means that even when businesses are productive or have commercial potential, they may be ineligible to take out loans (Abate et al., 2016). Financial literacy is another important

determinant. There is an increasing amount of evidence showing that businesses unable to prepare basic farm budgets, financial statements, and loan repayment plans are less likely to be allocated formal credit (Changwesha & Mutezo, 2023). It also impacts usage of credit, decision making based on knowledge of interest accumulation, amortization, and loan compliance procedures (Abate et al., 2016). This could negatively affect business viability and repayment capacity when financial literacy is low. Socio-demographic factors including gender, age, and education also have a long-term influence on access to credit. For instance, women are often discriminated against with regards to access to financial resources, in large part because of gender differences in land ownership, legal vulnerabilities and patriarchal attitudes (Patt et al., 2010; Ceballos et al., 2019). The level of education, also, tends to be correlated with access to credit as it determines how well a person will be able to navigate the application process, digital literacy, wealth accumulation and trustworthy (Adjognon et al., 2017). Other constraints include the geographical nearness to financial institutions, availability of infrastructure, interest rates, education and design of credit products, (Abate et al., 2016). For instance, the structure of repayments might discourage borrowers with seasonal and weather-dependent income (Ceballos et al., 2019).

2.6. Climate Adaptation Strategies and Creditworthiness

There is a growing role of climate adaptation in the discussion of agricultural resilience and finance, but its connection with creditworthiness has not been adequately explored. The types of adaptation include technological responses in the form of solar irrigation and seed varieties resistant to drought, as well as behavioural responses, including revenue diversification, soil conservation, early planting, planting trees and land-use change (Gebru et al., 2020). Research demonstrates that such adaptations may considerably enhance the productivity of agribusinesses and limit the risk of exposure to climate shocks thereby improving productivity (Ogundeji, 2022; Sawadogo et al., 2025). Unfortunately, such adaptations are frequently funded by informal savings or remittances. Such self-financed resilience may not enhance creditworthiness to formal lenders as there are no institutional structures that can convert adaptation into financial soundness. The first big explanation of this disconnect is in the character of adaptation itself. In contrast to formal financial indicators, e.g., credit history or audited balance sheets, climate adaptation plans tend to be qualitative, situation- and context-specific, and they are

often implemented without any documentation. As an example, a farmer who decides to change his farming method to conservation tilling can lessen the amount of soil erosion and enhance drought resistance, but when this is not reflected in any official reporting, banks will not see it. The fact that many agribusinesses in Zimbabwe are not registered only exacerbates the situation because these businesses cannot rely on formal data systems (Mhlanga & Dzingirai, 2024). Such invisibility becomes a self-reinforcing cycle: adaptation is not acknowledged, no trust is bult and credit is out of reach.

A wider meaning of creditworthiness should consider adaptive capacity involving social capital, innovation practices, and climate knowledge. However, adaptation investments, such as the installation of small-scale irrigation, the adoption of agroforestry, or cooperative marketing, are often ignored, as the collateral security and repayment history are prioritised by the institutions. Due to institutional attitude towards innovation, other banks view innovation, including changing the crop varieties or un-proven farming techniques, as speculative behaviour (IFAD, 2023). When borrowers that seek change to reduce risk are punished for being unconventional. This conservatism is not only based on financial rationale but the lack of training on sector specific knowledge (Mhlanas speculative, 2024).

2.7. Empirical Review

Adjognon et al. (2017) examined the determinants of access to agricultural input credit in Sub Saharan Africa. The results showed that cooperative membership and closeness to urban markets were the most common determinants of credit access, and exposure to climate was not a significant element in the regression models. Matondi and Dekker (2011) studies the effect of Fast Track Land Reform Programme in Zimbabwe on credit access. The study revealed that lack of formal land titles was a major hindrance to farmers to access formal credit since most financial institutions were not ready to use untitled land as security. Liu et al. (2025) show that climate risk reduces agriculture production, farmer's ability to repay loans, demand for credit and increases credit constraints in China. Jonas et al. (2025) found a positive association between climate resilient assets and credit access for farmers in South Africa. Sawadogo et al. (2025) found evidence that adaptation strategies enhance food security and farm income in Burkina Faso. Similar evidence was found by Ogundeji (2022) in South Africa. The examined studies highlight climate risk as an important factor in accessing to agricultural credit. Adaptation strategies are

shown to improve productivity and income. However, the studies do not directly link climate adaptation strategies to credit access for agribusinesses. This study addresses this gap.

3. Methodology

The research utilised a mixed-methods approach, combine both quantitative and qualitative techniques. This facilitated the gathering and analysis of both numerical patterns and narrative observations to have a multidimensional picture of how climate risk and adaptation strategies affect credit availability. We utilised logistic regression to analyse relationships between climate risk variables and access to credit. In-depth interviews with loan officers, investigated institutional perceptions and risk ratings that are difficult to capture in numerical data. This convergence of methods boosted the validity of the findings and made it possible to triangulate behavioural information and statistical evidence.

3.1. Econometric Model Specification

The study used binary logistic regression to study the determinants of access to agricultural credit in the presence of climate risk. This selection was suitable because the dependent variable, access to formal credit, is binary, coded as 1 whether credit was accessed or 0, otherwise.

3.2. Model Specification

The logistic regression is expressed as:

$$\begin{aligned} Logit\ (P_i) &= \ln\left(\frac{P_i}{1-P_i}\right) \\ &= \beta_0 + \beta_1 CR_i + \beta_2 AD_i + \beta_3 FL_i + \beta_4 FS_i + \beta_5 ES_i + \beta_6 G_i \\ &+ \beta_7 REG_i + \varepsilon_i \end{aligned}$$

Where: P_i is probability of accessing formal credit (Access = 1, No Access = 0), CR_i is climate risk exposure indicator, AD_i is adaptation strategies measure, FL_i is financial literacy score, FS_i is financing source (categorical dummy), ES_i is enterprise size (micro, small, medium), G_i is gender of business owner, REG_i is registration status and ϵ_i is the error term.

Table 1. Variables for Logistic Regression

Variable	Definition	Measurement	Expected Sign
Access to Credit (Dependent)	Whether the agribusiness accessed formal credit	Binary: 1 = Accessed; 0 = Not accessed	N/A
Climate Risk Exposure (CR)	Frequency/severity of droughts, floods, erratic rainfall	Index (0–5 events in 5 years)	−
Adaptation Strategies (AD)	Number of climate-smart practices adopted	Count of practices adopted (0–5)	+
Financial Literacy (FL)	Ability to keep records, prepare statements, understand credit	Scale from questionnaire (1–5)	+
Financing Source (FS)	Type of institution approached for credit	Dummy: Bank = 1, MFI = 2, Cooperative = 3, Government = 4	Mixed
Enterprise Size (ES)	Firm size (employees)	Dummy: Micro = 1, Small = 2, Medium = 3	+
Gender (G)	Gender of owner	Binary: Male = 1, Female = 0	Mixed
Registration Status (REG)	Formal registration with authorities	Binary: Registered = 1, Not registered = 0	+

3.3. Population and Sample

The study concentrated on events that affected the firms between 2020 and 2025. This period was chosen to represent the recent changes in climatic conditions, credit access and lending patterns. The target population comprised of two groups that included agribusiness people and loan officers from commercial banks, microfinance institutions, and agricultural cooperatives. Agribusinesses encompassed participants in agricultural production and value addition, which included smallholder farmers, agro-processors, and suppliers of agricultural inputs. A sample size of 367 businesses was deemed enough to draw meaningful conclusions.

3.4. Data Collection Methods

Structured questionnaires were administered to agribusiness operators who were identified. Further processing resulted in eliminating operators who had not applied for funding in the past five years. The questionnaire contained dichotomous

questions, ordinal questions on a Likert scale and continuous variables all of which could be subject to econometric processing. To supplement the quantitative data the study also carried out semi-structured interviews with credit officers. These interviews were intended to gain some deeper insights into decision making about credit approval and borrower experiences about climate variability.

3.5. Ethical Considerations

The study was given ethical approval by the appropriate university ethics committee before the fieldwork was initiated. Clearance of the institutions meant that the research process satisfied the general ethical expectations of the social science research, particularly regarding human participants. Every participant was well educated on the intention of the study, what was expected of them and their rights which included the right to withdraw at any stage without penalty. Data were anonymised during transcription and storage to maintain privacy of the participants.

4. Results

4.1. Response Rate

A total number of 367 questionnaires were administered to businesses that had applied for funding in the past 5 years. Out of these, 289 questionnaires were returned and used in analysis, constituting a 78.7% response rate. A total of 18 interviews were carried out successfully across the commercial banks, micro finance institutions, agricultural cooperatives.

4.2. Frequency of Climate Events

A large proportion of respondents reported experiencing multiple climate events.

Droughts (82%) and erratic rainfall (68.2%) were the most common, followed by heatwaves (42.9%). Flooding (18.7%) and hailstorms (8.0%) were less frequent but still contributed to agricultural losses. Majority of respondents (85%) confirmed that climate events had negatively affected production and sales, there by potentially heightening the riskiness of these businesses to lenders. A paltry 15% indicated no impact from these reported weather events. However, this could indicate failure of business owners to link business performance to these unfamiliar events.

4.3. Credit Application and Approval Rates

Out of 289 respondents that applied for credit, 153 (53%) were approved. Though the figure is above half, 47% of applicants fail to access credit.

4.4. Distribution by Institution Applied To

As shown in Figure I, applications were concentrated in commercial banks (50%), followed by microfinance institutions (30%), cooperatives (15%), and government schemes (5%). The distribution indicate that commercial banks remain the funding source of choice for most agribusiness. However, this preference could also explain the low approval rate since banks are more risk averse compared to other lenders.

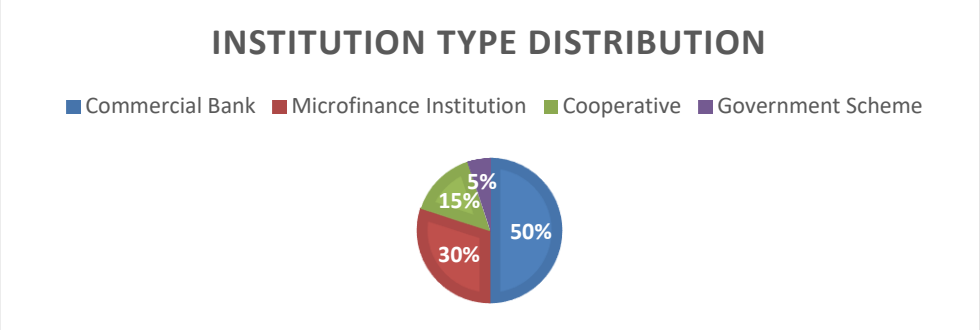

Figure 1. Institution type distribution

4.5. Reasons for Loan Rejection

Figure II shows that the most frequently cited reason for loan rejection was insufficient collateral (47.8%), followed by lack of business records (29.4%). Poor credit history accounted for 13.2% of rejections. In 6.6% of cases, no reason for rejection was communicated to the applicant, while 2.9% cited other reasons.

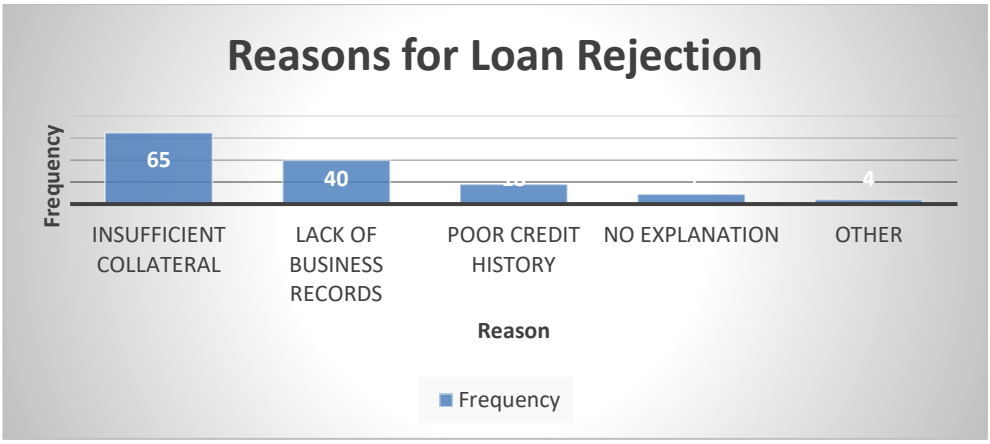

Figure 2. Reasons for loan rejection

4.6. Lender Attitude Due To Climate Risk

Respondents from financial institutions recognized that especially recurring droughts and irregular precipitation, has played a major role in risk evaluation in agricultural lending. However, there were different policy responses from the various lenders. Three key themes are presented here.

4.6.1. Climate Risk as a Credit Risk Multiplier

Majority of the loan officers (78%) indicated that climate variability has had a direct impact on their perception of agricultural default risk. The shift was mostly attributed to the severe droughts and the increase in non-performing loans (NPLs) on agricultural portfolios. The other remaining officers (22%) acknowledged presents of climate risk but highlight that the ability of borrowers to adapt to these risks can counter perceived risk. They gave examples of horticulture and poultry clients who were experiencing good repayment performance even in the face of climate shocks. This suggests that sensitivity to climate risk is dependent on type of business.

4.6.2. Adjustments to Lending Terms

Most loan officers (61%) highlighted that their institutions have tightened lending standards as a reaction to climate risk. Adjustments that are common include increasing interest rates to accommodate higher risk premiums, collateral requirement of 150 per cent or higher on high-risk agricultural areas like dryland maize and shorter repayment periods to reduce exposure to long-term production

risks. The remaining lenders outlined other corrective measures such as limiting the amounts of loans issued to limit exposure; favouring short-term working capital loans over long-term investments and selectively lending to borrowers with demonstrable adaptability measures.

4.6.3. Selective Withdrawal from High-Risk Segments

A smaller number of loan officers (33%) indicated that their institutions had already pulled out of some of the climate-vulnerable sectors, especially smallholder production of maize without irrigations. Recurrent defaults, failure to obtain insurance cover, and failure to put in place risk-sharing mechanisms made it financially unsustainable to expose lenders further. The remaining majority said that their institutions have not pulled out altogether. Instead, they have transitioned lending into less risky forms of lending (poultry, horticulture, agro-processing) and continued lending to crop producers who had sound adaptation plans (e.g., irrigation, conservation agriculture, secured off-take contracts).

4.7. Strategies Used by Agribusinesses and Financial Institutions to Adapt to Climate-Induced Risks

4.7.1. Adoption of Adaptation Strategies

Respondents highlighted several adaptation strategies that range from revenue diversification, adopting climate proof crops, water security, out of region sourcing, conservation agriculture, smart agriculture, parametric insurance, regenerative practices and climate scenario modelling. Businesses relied on more that one strategy.

4.7.2. Lender Response to Adoption Strategies

Interviews with loan officers revealed that the degree to which adoption of mitigation strategies influenced lending decisions varies significantly across institutions.

4.7.2.1. Proactive Production Adjustments

A majority (67%) of the loan officers indicated that they recognise use of mixed cropping systems, revenue diversification, use of drought tolerant varieties and shifting planting schedules to meet changes in rainfall patterns. However, although these were factors that reduce risk, they were not yet factored into risk scores. The remaining officers (33%) recognised that these adjustments are in place, but their

use is restricted to the better-capitalised businesses, suggesting that their impact on lending affect businesses that would otherwise qualify for credit due to high collateral and quality financial statements.

4.7.2.2. Investment in Irrigation and Water Harvesting

There was agreement (61%) that relying on irrigation systems and water harvesting techniques and selling the same stabilise income. However, most of these are self-funded investments. The remaining (39%) concurred that there are signs of increasing adoption, but pace was limited by high upfront costs. This largely impacted small agribusinesses, forcing them to rely on rainfed systems. These usually approached microfinance institutions for credit as opposed to commercial banks.

4.7.2.3. Limited Institutional Recognition of Adaptation

Although there is evidence of adaptation on the part of borrowers, 33% of loan officers indicated that their institutions do not formally incorporate such measures into credit risk measures. Adaptation measures like irrigation, conservation agriculture, revenue diversification are usually unofficially recognized during client appraisal, but there are no systematic ways to formalize them into better credit terms or risk grades. The majority (67%) reported that although formal recognition is not yet in place, there is an emerging internal debate on working out lending products or risk models that will reward the borrower who adopts proven adaptation measures.

4.8. Financial Literacy, Adoption Strategy and Credit Uptake

The statistical analysis provides validation of the patterns identified in the descriptive and qualitative findings.

4.8.1. Pearson's Correlation Analysis

The results show that there is a moderate positive correlation between the financial literacy and adaptation strategies ($r = 0.412$), and between the financial literacy and the uptake of credit ($r = 0.389$). Similarly, there is a positive correlation between adaptation index and credit uptake. This result suggests that agrobusiness owners who exhibit higher levels of financial literacy were likely to utilise more adoption strategies and demand credit.

Table 2. Pearson's Correlation Matrix

Variables	Financial Literacy	Adaptation Index	Credit Uptake
Financial Literacy	1.000	0.412**	0.389**
Adaptation Strategy Index	0.412**	1.000	0.365**
Credit Uptake Level	0.389**	0.365**	1.000

** $p < 0.01$

4.9. Determinants of Access to Credit

Results in Table 3 show that climate risk exposure has a negative impact on access to credit (OR = 0.481). A 1 unit increase in exposure to climate risk the log odds of accessing credit reduces by 0.732. Adoption strategies enhance credit access with a 1-unit increase associated with higher odds accessing credit (86% increase). Similarly, registration status and financial literacy increase the chances of accessing credit for agrobusinesses.

Table 3. Logistic Regression Results

Variable	Coefficient	Wald χ^2	Odds Ratio
Climate Risk Exposure	-0.732** (0.258)	8.04	0.481
Adaptation Strategy Index	0.621** (0.221)	7.89	1.861
Financial Literacy Score	0.452* (0.187)	5.84	1.571
Gender (Male=1)	0.238 (0.214)	1.23	1.269
Registration Status	0.819** (0.247)	10.96	2.269
Enterprise Size	0.194 (0.121)	2.56	1.214
Constant	-2.318** (0.634)	13.35	
Hosmer–Lemeshow Test (p)	0.421		
Nagelkerke R^2	0.372		

The gender of the owner and size of enterprise were not statistically significant. A Hosmer-Lemeshow p-value of 0.421 means that the model fit the data well implying the predicted probabilities are not statistically different from the actual outcomes. Nagelkerke R^2 of 0.372 show a strong explanatory power, indicating that the predictors account for 37% of the variability in predicting credit access.

4.10. Discussion of Findings

The results show that climate events have frequently impacted agribusinesses in Bulawayo province. This heightened climate risk, which is viewed as a risk multiplier by lenders, thereby making agribusinesses highly risky. This resulted in tightening of credit standards through increasing collateral requirements, risk premiums and total withdrawal out of the agribusiness segment. Most of agribusinesses seek loans from commercial banks as opposed to other sources of credit, indicating capacity issues and concentration risk. However, a significant portion of businesses are still denied access to credit due to lack of collateral and financial statements. This suggests existence of systematic barriers. This does not only impact survival and growth of firms in this sector, but it also limits their capacity to build resilience. To mitigate the effects of climate change, agribusiness have adopted mitigation strategies such as use of climate proof crops, revenue diversification, irrigation and conservation agriculture. Those along the value chain have resorted to out of region sourcing and showing a bias towards goods and services that assist in drought mitigation such as irrigation equipment, greenhouse construction and smart agriculture. However, lenders are not factoring these efforts in credit scores despite recognising their positive impact.

Despite this, evidence from regression results show that adaption strategies positively impact probability of accessing credit among other factors such as registration status and financial literacy. This suggests that even if banks are not factoring adoption of adaptation strategies in their models, these strategies impact financial health of firms as found by (Ogujedhi, 2022; Sawadogo et al., 2025). This in turn positively impact credit access. More light is shed by correlation results, that show positive correlation between financial literacy, adaptation strategies and credit access. This suggests that firms demonstrating higher financial literacy are likely to implement good financial management, adaption strategies, thereby accessing more credit. As expected, climate risk exposure reduced access to debt in line with results by (Liu et al., 2025). Climate risk result in cashflow volatility for all businesses along the agribusiness value chain since most rely on good weather conditions. As a result, financial institutions responded heightening credit standards to reduce their exposure to credit risk. This concurs with the risk management theory, which brings out presence of institutional risk aversion when there is environmental uncertainty. Similarly, the study results also support the access to finance framework that suggests that systematic perceptions of sectoral risk including risk brought about by

climate exposure can limit access to credit despite the high demand (Beck et al., 2007).

The findings review important institutional failures. Most commercial banks are not flexible enough to alter their decision-making processes either because policy decisions are made in overseas head offices that are far away from their operating ground or due to lack of innovation. Moreover, they tend to be more risk averse compared to NGOs, government agencies and microfinance institutions. Inflexibility of loan products contributes to such structural inhibitors. The terms of the repayment do not always reflect the reality of agricultural production cycles, especially in times of drought. Over reliance on commercial banks as the main lender reflect their capacity to lend but could also explain low access to credit. Lack of climate-informed credit scoring and risk-sharing arrangements meant that high climate exposure was still inhibiting agricultural finance despite adoption strategies put in place. Results demonstrate a tendency of moving towards risk avoidance where climate variability has become an overt consideration in risk assessment. This has resulted in restructured internal lending models that make agriculture ineligible even where there are risk abatement mechanisms like irrigation and other adaptation strategies. Resultantly, there has been tightening of lending conditions due to higher collateral requirements, increased interest rates, and reduced repayment periods and other institutions have cut lending or ceased lending to the most climate-vulnerable crop sectors. These findings agree with access to finance framework (Beck et al., 2007) as it points out that many otherwise viable borrowers tend to be shut out by systemic institutional practices. Lack of collateral and poor record keeping are important impediments to credit access. This difficulty is further complicated by the fact that 99-year leases or communal tenure arrangements held by most farmers are still not accepted as security.

Results are robust different techniques, showing the negative impact of climate risk exposure, limited recognition of climate adaption strategies and different levels of sensitivity to climate risk depending on nature of operations. These results are an important extension to practice. Banking models being applied in climate sensitive regions are inappropriate, depriving lenders access to credit and limiting shareholder profits by failing to capture climate adaption strategies in risk modelling. Considering this, there is need for governments to bridge this gap to address this market failure. Promoting emergence of microfinance institutions and NGOs could reduce the gap, since their appetite for risk, operating objectives and management incentives could be different from those of commercial banks. On the side of

agribusinesses, access to credit requires a holistic approach that improves different facets of their operations ranging from improving financial literacy, adopting adaptation strategies, investing in tangible assets, formally registering business and keeping financial records. Piecemeal improvements are not enough.

5. Conclusion

The study sought to examine the role of climate adaptation strategies in the climate risk- credit access finance matrix in a semi-arid region. The study demonstrate that that climate risk lowers credit access for agribusinesses. Lenders consider agribusiness borrowers in Bulawayo to be highly risky borrowers due to their exposure to climate risk However, the riskiness of the firms depend on the line of business. This had resulted in a significant portion of borrowers failing to access credit. Climate adaptation strategies enhance credit access, but they are not directly incorporate in credit risk models. There exists a glaring gap between the enterprise level resilience and institutional credit rating. The results bring out weaknesses on the part of financial institutions, particularly in the design of credit models. Incorporating adaptation strategies in lending decisions could enhance credit access, increase profitability and shareholder wealth. Therefore, the current lending systems do not incentivize resilience, and it contributes to under investments in adaptation. Agribusiness owners should improve financial literacy as this promote financial management, adoption of adaption strategies and improve credit access. Government on the other hand can bridge the gap left out by commercial banks through promoting an environment in which microfinance institutions, cooperatives and NGOs can thrive. In higher climate exposed regions, government should extend funding to help firms to build resilience. Lastly government should change 99-year leases into bankable tittle deeds to allow farmers to use them as collateral. The results lack generalisability to businesses outside the agribusiness value chain and analysing different forms of business along the agribusiness value chain could have brought more insight. Future research should focus on comparative studies across regions. Also, sub-sectors would bring granular understanding of whether credit access patterns and institutional reactions are universal across different exposure levels to climate.

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Nexus between Average Collection Period and Profitability of Registered Industrial Companies in Tanzania

James Daniel Chindengwike[1]

Abstract: Working capital management is vital to wholly registered firms with numerous depositors in the community, including the industry, which is characterized by popular inventory actions, money, borrowers, and account payables, which are key working capital components. This study determines the relationship between the average collection period and effectiveness of registered industrial firms on the Dar es Salaam Stock Exchange (DSE). This study adopted a descriptive research design, utilizing secondary data from five ages from 2015 to 2020. Seven firms from one industrial zone are employed in this study. Research indicates that average payable days have an optimistic association with profitability. The study recommends that DSE managers endeavor to ensure that the average collection period is too short to recover their profitability level and ensure effective credit standards and credit analysis; bosses must pay kindness to the size of their companies' turnover in the development plan of the association.

Keywords: Average Collection Period; Profitability; Listed Industrial Companies

JEL Classification: G3

1. Introduction

Working capital management is vital to wholly counting registered firms, with numerous savers counting the community, such as the industry, which is

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characterized by mainstream inventory schedule debtors, cash, and creditors, which are key components of working capital (Fauziah et al., 2025). Suitable administration of working capital is imperative for the basic monetary health and working achievements of commerce as a business. The capability to utilize working capital and maintain a hard balance between development, liquidity, and profitability is an indicator of good business management of working capital (Fauziah et al., 2025).

Gross working capital mostly signifies the current assets of a company, which is a subset of the firm's monetary properties, and changes from one type to another during the everyday implementation of a commercial (Mandipa & Sibindi, 2022). Current assets include outstanding income, prepaid expenses, cash, trade debtors and investments, short-term investments, and current liabilities including bank overdrafts, outstanding expenses, and trade creditors. Working capital can be defined as a bookkeeping method that emphasizes upholding an adequate amount or ensuring appropriate heights for both liabilities and assets (Jaworski & Czerwonka, 2022). Working capital management offers sufficient cash to obtain the temporary duties of a company (Demiraj et al., 2022).

This procedure aims to safeguard the industrial sector toward human growth, work formation, and financial change through sustainable financial development, conservation defense, and democratic growth (Karim et al., 2024). However, the zone has been facing profitability difficulties, and deprived organizations of working capital have been the reason for deprived profitability attainment (Hecht et al., 2022).

Mechanization has been the chief policy program for the 5th Stage Government and is essential for understanding Tanzania's drive to develop a middle-income budget by 2025. Mechanization energy is reliable with work that places mechanization in the middle of financial alteration, employment, and growth (Kalbuana et al., 2022). Manufacturing is the essential subsector for heavy mechanization in the greatest republics, while also determining the long-run maintanable of a cheap.

This study assesses such fluctuations, which may be a result of working capital component management coming out with a way forward or a solution to improve the growth and contribution to the overall economy of Tanzania.

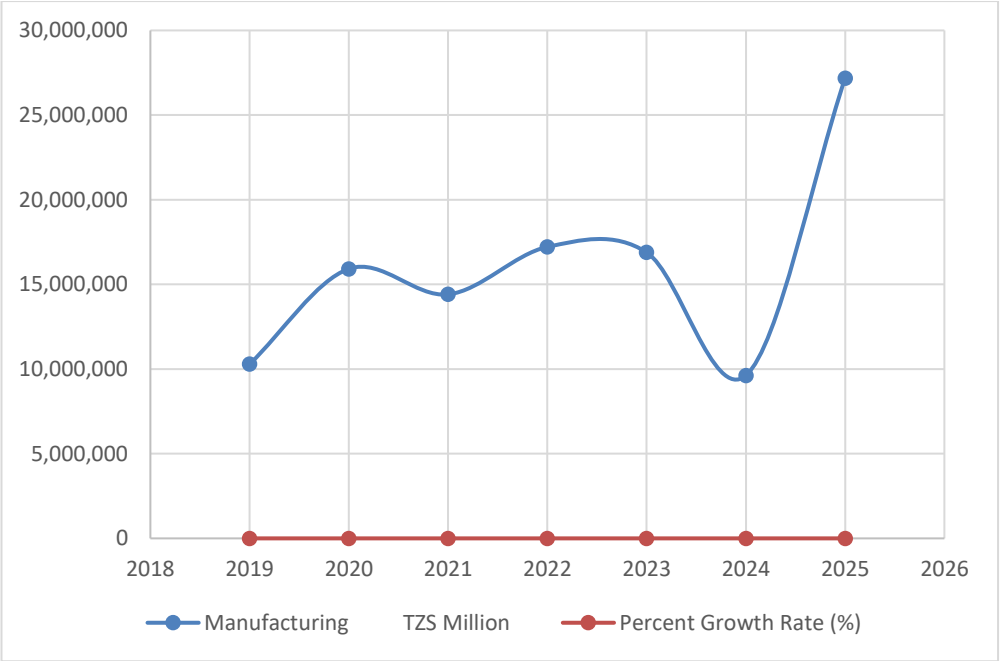

Figure 1. Contribution by Manufacturing Industry
Source: Nguyen et al. (2023)

Figure 1. shows that manufacturing companies contribute 25% of Tanzanian GDP (Nguyen et al., 2023). The economic importance of assessing manufacturing companies' profitability is due to its role in the economy of Tanzania, which is ranked as the third critical sector, contributing 25% of the GDP of a country and acting as the main sector leading to the country's industrialization policy (Nguyen et al., 2023; Chindengwike, 2024e). Therefore, this study assesses the nexus between the average collection period and profitability of registered industrial companies in Tanzania.

The results obtained from this research might be useful to finance managers responsible for the management of working capital policy, as they indicate the effect of WC components on the effectiveness of firms (Chindengwike, 2025). The research findings contribute to the form of prose in related fields by adding knowledge to the respective fields.

The existence of safety is prejudiced by a real working capital administration strategy that leaves the firm endure process and affluence by maintaining a compromise between profitability and liquidity in the move to the wealth expansion

of the firm (Gruber et al., 2022). Investment techniques, strategies, and decisions on working capital may differ between firms because of the nature of the operation, economic and business environment of the nation, and policies followed by management (Chindengwike, 2024a).

2. Literature Review

Contingency theory lays an unhappy supposition that no solitary type of administrative construction is similar to all organizations; nonetheless, it is contingent on its aptitude to raid equilibrium between those issues that affect its building, which comprise atmospheric instability, material scheme, size of the firm, and topographies that exist in group creation (Chindengwike, 2024b).

The regular collection period involves a time cast-off by a firm to gather or adapt its praise auctions into money. This raises the regular distance of the period obligatory to convert the company's receivables into money subsequent to an auction. It is designed by in-between debtors using average credit sales per day. A lengthier regular collection period means advanced speculation in debtors, which means that less money is obtainable to conceal money discharges.

Chindengwike (2023) pierced out that if an organization fails to professionally achieve debtors, it will result in an advanced collection period that decreases fund flows by obstructive funds with borrowers without any extra welfare, henceforth moving the effectiveness and liquidity of the secure. Chindengwike (2024c) found an important statistically adverse association between profitability and average collection period. Companies can upsurge their success by plummeting the period in which book arrears are unpaid. That income is less than gathering retro the additional money is accessible to refill records later, an upsurge in sales foremost to an upsurge in the achievement of security. Therefore, bosses can recover profitability by plummeting the credit decided by their consumers (Chindengwike, 2024c).

Chindengwike (2024d) proposed that business profitability can be augmented by a boss plummeting the regular collection period. Thus, the longer the number of days unresolved on book receivables, the more advanced the option that the firm may end up wounded. If borrowers are not well achieved, the secure firm may lose a switch owing to summary cash flow because of an increased rate of bad arrears. That income the lengthier the borrowers owe the secure cash the advanced the accidental that the secure will not get salaried, as the consequence the income can lone be read when

the quantity in arrears is curved into money. The income that the organization of areas is vital and unavoidable, and this can be done by founding a good recognition strategy and group events that provide rules to the gathering of voluntary demands that determination reduce the number of days' arrears are unpaid.

Majumder (2025) concentrated on Breweries Firms, pragmatically, an imperative optimistic connotation between the profitability and inventory conversion periods of breweries firms. However, in the case of TBL, these results are undesirable. He expired that the optimistic consequence was not as predictable, because working capital organizations proposed a negative relative rather than an optimistic one for a firm to increase its income.

Angsoyiri et al. (2025) also enlightened their answers to the Breweries Firm, whereby they decided in their learning that the inventory conversion period definitely influences profitability. This supposition was stretched after H0 was disallowed, which indicated that ROA is not meaningfully pretentious by the number of days' lists held by brewery businesses.

Batool et al. (2025) approved their research on pharmaceutical firms and established that as record days were augmented by one day, this reduced the success of the group by 0.031 units. This led to the deduction that the list-change period is negatively related to the success of pharmaceutical governments. They also found that the discount of loss and uselessness was linked to the discount of the inventories adaptation period, thus exploiting the group and profit at big.

Kayani et al. (2025) considered airline manufacturing, whereby the inventory adaptation age was adversely related to profitability. Therefore, this association is important. They planned for airline companies to decrease the inventory conversion period by justifying extra aircraft parts and providing supervision while guaranteeing dependability in record construction.

3. Research Methodology

This study used a panel data design. The qualitative analysis illustrates the uncaring and deviation of the standards of dissimilar variables of attention in this research. This study adopted a quantitative research approach, in which secondary data were used, which is a more practical way of finding a solution to the problem stated numerically.

In this study, seven industrial firms (TBL, TCC, TATEPA, TPCC, TOL, EABL, and TCCL) were employed to direct this research to jacket the history of the five ages from to 2015-2020.

3.1. Model Specifications

A multiple linear regression model was employed by (Karim et al., 2024). A logical model was used in this study.

$$Y = a + \beta 1ACP_{it} + \beta 2COSIZE_{it} + \beta 3CR_{it} + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (I)$$

where Y= Profitability of firm i at time t, as expressed by the return on asset ratio; a is a constant, the value of ROA when the independent variables are at zero; β 1- β 4 = Coefficients of Parameters; ACP_{it} = Account Collection Period of firm i at time t; COSIZE: the size of the company; CR = Current Ratio; ε_{it} = error term.

3.2. Measurement of Variables

This section elaborates on each variable used in the study together with its measurements Table 1.

Table 1. Dimension of Variables

Items	Source	Measurements
Return on Asset (ROA)	Dependent variable	Earnings Before Tax and Interest/Total Assets PBIT/ (TA)
Account Collection Period (ACP)	Independent variable	(Account receivables ÷ Net annual sales) x 365 days
Current Ratio (CR)	Controllable variable	Current asset ÷ Current liabilities
Size of Firm (Sf)	Controllable variable	Total Revenue

Source: Shekalaghe (2026)

4. Results and Discussion

It scrutinizes, classifies, and arranges the data to present the objective of the research, nexus between the regular collection period, and profitability of registered industrial firms in Tanzania.

4.1. Descriptive Statistics

The qualitative analyses of the variables employed in the model are summarized in Table 2.

Table 2. Descriptive Statistics for the Averages of Variables

Variables	N	Minimum	Maximum	Mean	Std
ROA	7	0.22	0.35	0.37	0.00
CR	7	0.74	0.89	0.81	0.06
COSIZE	7	13.8	17.8	15.6	1.35
ACP	7	56.91	64.71	61.77	3.55

Source: Stata Output, 2026

Table 3 shows qualitative analytical for the means of the variables of the registered industrial firms in Tanzania. The regular collection period (ACP) was cast-off to amount how several days it receipts registered industrial companies to gather cash from sales. The registered engineering firms in Tanzania the ACP had a smallest value of 57 days, a supreme period of 65 days, a mean of 62 days and a standard deviation of 4 days. The disparities could be as a consequence of changes in profitable rules, competitive burden or incompetent organization amongst the listed industrial companies over 5 years.

Table 3. Pearson Correlation Matrix

Variables	ROA	CR	COSIZE	ACP	APP	CCC	INTD
ROA	**1.000**						
CR	0.634**	**1.000**					
COSIZE	0.524	0.713	**1.000**				
ACP	.586	.714	0.631*	**1.000**			

Source: Stata Output, 2026

Table 3 indicates a correlation matrix table that includes the variables used.

The Table also shows that ROA is positively related to ACP, APP, CCC, INTD and CR.

The positive relative between ROA and ACP is reliable, with the view that the less time it takes for the company to pay their bills, the more cash is obtainable to refill the inventory henceforth foremost to more sales, which increases profitability. The positive association between ROA and ACP can be explained by the fact that firms that uphold high inventory levels reduce the cost of interrupting the manufacturing process. This helps stop the loss of commercial goods due to the lack of products and reduces the cost of providing the goods.

4.3. Inferential Statistics

Table 4. Model summary

Model	R	R2	Adjusted R	Std. Error Estimate
1	.639a	.508	.001	.67511

a. Forecasters: (Continuous); average collection period

b. Response Variable: profitability

Source: Stata Output, 2026

The results in Table 4 demonstration that the value obtained for R, which is the model correlation coefficient, is r = .639 which is more advanced than the zero-order price in the table. The r-square worth = .50.8 likewise designates that inventory turnover might explain approximately 50.8% of the differences in the profitability of listed manufacturing companies in the Dar es Salaam Stock Exchange (DSE).

Table 5. Analysis for Variance

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.001	2	.022	241	.0.11b
1 Residual	31.12	88	.321		
Sum	36.99	89			

a. Response variable; profitability

b. Explanatory: average collection period

Source: Stata Output, 2026

From the ANOVA in Table 5, the results indicate that the completely perfect is statistically significant. Additionally, the results suggest that the explanatory variables are good forecasters of profitability. This was reinforced by an F statistic of 151 and a p-value (0.000) which was less than the conservative 0.05 significance

level. Therefore, the ANOVA results from the ANOVA presented that there was an important association between the explanatory variables and the response variable.

Table 6. Regressions coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	P-Value
1		B	Std. Error	B		
	Constant	.576	.146		3.955	.000
	Average collection period	.018	.175	.067	4.310	.012
	Company size	.026	.016	.252	1.593	.076
	Current Ratio	.084	.025	.440	3.330	.002

Source: Stata Output, 2026

From the data in table 6, our model is as follows:

$$Y = a + \beta 1ACP_{it} + \beta 2\ COSIZE_{it} + \beta 3CR_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots ii$$

$$ROA = 0.576 + 0.018ACP + 3026\ COSIZE + .0844CR_{i_t}$$

From the results presented in table 6, the standard coefficients are .067,.252, and .076 for ACP, COSIZE, and CR, respectively; their P-value are .012,.476 and .002 (P-Value<0.05), respectively, which are significant in influencing the profitability of listed manufacturing enterprises on the DSE. The positive sign in COSIZE indicates that company size and CR have positive and important consequences on a firm's profitability.

4.3.1. The Influence of Average Collection Period on Profitability of Registered Industrial in DSE

Moreover, the research revealed that the model for the effectiveness of listed manufacturing enterprises on the DSE was a good model because the independent variables covered in the model accounted for more than 50% of the variance in the profitability of registered industrial enterprises on the DSE. Furthermore, the explanatory factors included in the model had a substantial influence on the industrial sector's profits in the DSE (P<0.05). The average collection period influences the return on assets since (P=.012), which is less than 0.05, and has a positive regression coefficient (.067). This suggests that gathering expenditures from

clients inside the straight time likely and reducing the period of collation of raw materials meaningfully upsurges a firm's profitability. This implies that the ROA for listed manufacturing companies rises by 6.7 per cent for each unit increase in the average collection period. Thus, we exclude Ho and hypothesize that the average collection period has a significant influence on the profitability of listed manufacturing companies on the DSE. This finding is consistent with Batool et al. (2025), who argue that a decrease in the average collection period increases a company's profitability.

5. Conclusion and Recommendations

The study found that the average payable days had an important optimistic association with profitability. The study recommends that DSE managers endeavor to ensure that the average collection period is low to recover their profitability equally, along with ensuring effective credit standards and credit analysis, and must pay consideration to the income and scope of their businesses in the development plan of the company.

Data Availability Statement

Data supporting the findings can be obtained upon reasonable request from the corresponding author.

Conflict of Interest Statement

No potential conflict of interest was reported by the author.

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