



RESHAPING DEVELOPMENT

GOVERNANCE, AGRICULTURE AND DIGITAL FINANCE

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PREFACE

This volume brings together critical perspectives on development, governance, and innovation in emerging economies, with a focus on Nigeria. The opening study on Agro Processing and Value Chain Development explores how integrated agricultural systems can boost productivity and rural livelihoods. It sets the foundation for broader discussions on economic transformation.

Harvests and Hardships examines the paradoxes of protectionist policies under Buharinomics, highlighting their impact on rice and maize production. In contrast, Harnessing Wealth, Avoiding the Curse addresses governance challenges in resource-rich economies, advocating for transparency and long-term planning to avoid the pitfalls of resource dependency.

The final piece, Towards Smart Microfinance, explores how business intelligence can enhance risk management and service delivery in microfinance. Together, these studies offer fresh insights and practical approaches for scholars, policymakers, and practitioners seeking inclusive and resilient development.

Editorial Team
October 08, 2025
Türkiye

CHAPTER 1
**AGRO PROCESSING AND VALUE CHAIN
DEVELOPMENT**

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INTRODUCTION

Agriculture remains the backbone of many economies, particularly in developing countries, where it contributes significantly to gross domestic product (GDP), employment, and rural livelihoods. However, the predominance of low value primary commodity exports has historically limited the sector's capacity to drive sustained economic growth. Agro-processing the transformation of raw agricultural materials into intermediate or final products offers a pathway to overcoming this limitation by creating higher value goods, extending product shelf life, and opening new market opportunities (FAO, 2017).

The development of value chains complements agro processing by linking producers, processors, distributors, and consumers through coordinated activities that enhance efficiency and profitability at each stage (Kaplinsky & Morris, 2001). When effectively implemented, agro processing and value chain integration can transform subsistence agriculture into a competitive, market oriented sector, fostering industrialization and improving food security.

Economic theory underscores the role of structural transformation the shift from low productivity agriculture to higher productivity manufacturing and services as a driver of economic development (Timmer, 2009). Agro processing sits at the intersection of agriculture and industry, serving as an essential bridge in this transformation. By adding value domestically rather than exporting raw commodities, countries can retain a larger share of the value generated along the supply chain, stimulate rural industrialization, and diversify their economies (UNIDO, 2015). In sub Saharan Africa, for example, post-harvest losses in staple crops can reach up to 40% due to inadequate processing and storage facilities (World Bank, 2011). Expanding agro processing capacity not only mitigates these losses but also creates employment in rural areas, particularly for women and youth.

This chapter aims to:

- Analyze the theoretical foundations of agro processing and value chain development.
- Examine global trends and regional experiences in agro processing.
- Identify key challenges and opportunities in developing robust value chains.

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- Present case studies that illustrate successful interventions.
- Propose policy recommendations to enhance agro processing capacity and value chain integration.

The scope includes both food and nonfood agro processing subsectors, recognizing their shared characteristics and distinct challenges. The chapter adopts a multidisciplinary approach, drawing on literature from agricultural economics, industrial development, supply chain management, and rural sociology. It integrates qualitative analysis of case studies with quantitative data from international organizations such as the FAO, UNIDO, and World Bank.

The chapter is organized into eight sections. Following this introduction, Section 2 reviews theoretical and conceptual frameworks underpinning agro processing and value chain development. Section 3 explores global and regional trends, while Section 4 analyzes key challenges. Section 5 discusses emerging opportunities and innovations.

Section 6 presents case studies from selected countries. Section 7 outlines policy recommendations, and Section 8 concludes with reflections on the future trajectory of agro-processing and value chain development.

1. THEORETICAL AND CONCEPTUAL FRAMEWORKS

Conceptualizing Agro Processing

Agro processing refers to the transformation of agricultural products into value added goods through physical, chemical, or biological processes. This includes both primary processing (e.g., milling, drying, fermenting) and secondary processing (e.g., manufacturing packaged foods, textiles, biofuels). From an economic standpoint, agro processing serves as a vital link between agricultural production and industrial markets, functioning within broader agri food systems (FAO, 2017).

The concept is often framed within the agro industrialization paradigm, which emphasizes integrating farming, processing, marketing, and distribution in ways that enhance efficiency and competitiveness (Reardon et al., 2009). The transformation from raw material to finished product increases utility in terms of form, place, time, and possession central tenets in marketing and supply chain theory.

The Value Chain Framework

The term “value chain” was popularized by Michael Porter (1985), who conceptualized it as a series of activities that an organization performs to deliver a valuable product or service. Porter’s Value Chain Model distinguishes between primary activities (inbound logistics, operations, outbound logistics, marketing and sales, and services) and support activities (procurement, technology development, human resource management, and firm infrastructure).

Applied to agriculture, the value chain perspective extends beyond farm level production to encompass upstream inputs and downstream distribution channels (Kaplinsky & Morris, 2001). This holistic view allows for the identification of inefficiencies, potential value addition, and leverage points for upgrading.

Global Value Chain (GVC) Theory

Global Value Chain theory emerged from the need to understand the increasingly fragmented and geographically dispersed nature of production (Gereffi et al., 2005). In agricultural contexts, GVC analysis examines how agricultural commodities are produced, processed, and marketed across borders. It identifies governance structures such as buyer driven or producer driven chains that determine power relations and profit distribution.

For example, in cocoa processing, multinational chocolate manufacturers exert significant influence over quality standards, branding, and retail pricing, while smallholder producers often capture a small fraction of final value (Fold, 2002). Understanding these governance dynamics is critical for designing interventions that promote equitable value capture for upstream actors.

Agricultural Value Chain Approaches

Agricultural value chain approaches (AVCA) adapt the GVC framework to rural and smallholder contexts. They emphasize inclusive market systems, horizontal coordination (e.g., producer cooperatives), and vertical integration (linkages between farmers, processors, and traders).

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AVCA also integrates sustainability dimensions, considering environmental impact, social equity, and resilience against shocks such as climate change (Donovan et al., 2015).

Linkages Between Agro processing and Value Chain Development

Agro-processing and value chain development are mutually reinforcing. Processing increases product value and diversifies output, while value chain optimization ensures that these products reach the right markets efficiently. Effective integration requires investment in logistics, cold chain infrastructure, quality assurance systems, and digital technologies for traceability. A robust theoretical framework, therefore, must incorporate both the micro level dynamics of firm competitiveness and the macro level structures of trade, regulation, and development policy.

2. GLOBAL AND REGIONAL TRENDS IN AGRO PROCESSING AND VALUE CHAIN DEVELOPMENT

Global Overview

The agro processing sector has undergone significant transformation over the past three decades, driven by globalization, technological advancements, and evolving consumer preferences. The sector accounts for approximately 70% of global agricultural output by value when processing activities are included, reflecting its critical role in converting raw agricultural commodities into market-ready products (UNIDO, 2020).

Global trade in processed agricultural products has outpaced trade in primary commodities, underscoring the increasing demand for convenience, quality, and diversity in food and nonfood products (World Bank, 2021). Emerging economies, in particular, have experienced rapid growth in agro processing due to urbanization, rising incomes, and integration into international value chains.

2.1 Technological Innovations in Agro processing

Globally, innovation trends include automation in food manufacturing, the adoption of **Industry 4.0 technologies** (e.g., sensors, IoT, and AI based

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quality control), and the development of precision processing systems that optimize yield and reduce waste (Pereira et al., 2022). Biotechnology and novel preservation techniques, such as high-pressure processing and cold plasma technology, are being used to improve shelf life while maintaining nutritional quality.

Digital platforms are also enabling **traceability and transparency**, allowing consumers and regulators to track products from farm to fork. These advancements are particularly relevant for export markets where food safety and certification standards are stringent.

African Perspectives

In Africa, agro-processing is recognized as a strategic driver for structural transformation and industrialization. Despite abundant agricultural resources, the continent accounts for less than 5% of global agro processed exports (AfDB, 2020).

The sector remains underdeveloped due to constraints such as inadequate infrastructure, limited access to finance, and weak integration between farmers and processors. Nonetheless, regional value chains are emerging, particularly in **horticulture (Kenya, Ethiopia)**, **cocoa (Ghana, Côte d'Ivoire)**, and **dairy (East Africa)**. Initiatives under the African Continental Free Trade Area (AfCFTA) are expected to enhance intra African trade in processed goods, harmonize standards, and improve market access.

Asian Innovations

Asia, particularly China, India, and Southeast Asian countries, has leveraged agro processing as part of broader industrial policy. The adoption of cluster-based development models such as India's Mega Food Parks and Thailand's agro industrial zones has fostered integration between smallholders, processors, and exporters. In addition, investment in cold chain logistics has enabled year-round supply to domestic and export markets.

Asian agro processing trends are also characterized by high value niche markets, including organic tea, spice extracts, and aquaculture products, which command premium prices in global markets.

Latin American Experiences

Latin America benefits from a strong comparative advantage in high value commodities such as coffee, soy, beef, and tropical fruits. Countries such as Brazil and Chile have invested heavily in export-oriented processing facilities, supported by robust quality certification systems.

However, market volatility, dependence on a few commodity exports, and environmental sustainability concerns particularly related to deforestation and water use pose long term challenges. Efforts to diversify into value added products, such as specialty coffees, fruit concentrates, and plant-based proteins, are gaining momentum.

Cross regional Insights

A comparative analysis of global trends reveals common success factors: investment in infrastructure, enabling policy environments, technological adoption, and strong producer processor market linkages. Conversely, regions lagging in these areas tend to remain dependent on exporting raw commodities, missing opportunities for value addition and higher income generation.

3. POLICY AND INSTITUTIONAL FRAMEWORKS SUPPORTING AGRO PROCESSING AND VALUE CHAIN DEVELOPMENT

The development of robust agro processing sectors and integrated value chains requires an enabling policy and institutional environment. Well-designed policies facilitate investment, improve market linkages, and enhance competitiveness, while institutional frameworks ensure effective coordination among stakeholders, including farmers, processors, distributors, and regulators (FAO, 2019). This section examines the policy instruments, institutional arrangements, and governance mechanisms that support agro processing and value chain development at national, regional, and international levels.

National Industrial and Agricultural Policies

Many countries have incorporated agro processing into broader industrialization strategies as a means of adding value to agricultural products

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and reducing dependency on raw commodity exports. These policies typically focus on:

- **Fiscal incentives:** Tax holidays, duty-free import of processing machinery, and subsidies for technology adoption.
- **Access to finance:** Credit guarantee schemes, concessional loans, and grants targeting agro-processing enterprises, particularly small and medium-sized enterprises (SMEs).
- **Research and development (R&D):** Funding for food technology research, post-harvest loss reduction, and product innovation.

For example, Ethiopia's Growth and Transformation Plan II (2016–2020) identified agro processing as a priority sector, leading to the establishment of industrial parks focused on agro industrial clusters (UNIDO, 2020).

Trade and Export Promotion Policies

International trade policies significantly influence agro processing competitiveness. Export-oriented agro-processing firms benefit from:

- **Trade agreements:** Such as the African Continental Free Trade Area (AfCFTA), which eliminates tariffs on a wide range of processed agricultural products.
- **Export promotion agencies:** Institutions that provide market intelligence, certification support, and participation in trade fairs.
- **Quality and standards harmonization:** Alignment with international food safety standards (e.g., HACCP, ISO 22000) to meet export market requirements.

For instance, Ghana's Export Development and Agricultural Investment Fund (EDAIF) provides targeted support for upgrading processing facilities to meet European Union market access standards.

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Institutional Coordination and Governance

Effective governance in agro processing value chains demands collaboration between public and private actors. Common institutional arrangements include:

- **Public private partnerships (PPPs)** for infrastructure development (e.g., cold storage, transport networks).
- **Sector-specific boards and councils (e.g., coffee boards, dairy councils)** that coordinate production, processing, and marketing strategies.
- **Inter-ministerial committees** to ensure policy coherence between agriculture, trade, and industry ministries.

In Kenya, the Horticultural Crops Directorate plays a critical role in regulating quality, promoting exports, and fostering industry government dialogue.

Regional and Continental Frameworks

At the regional level, Regional Economic Communities (RECs) such as ECOWAS, SADC, and EAC have introduced policies to enhance cross-border value chains. These include harmonizing product standards, improving regional transport corridors, and promoting regional investment in agro-processing hubs.

The Comprehensive Africa Agriculture Development Programme (CAADP), under the African Union's Agenda 2063, emphasizes agribusiness and value chain upgrading as part of its agricultural transformation goals (NEPAD, 2013).

International Development Assistance and Donor Programs

Multilateral organizations such as the World Bank, FAO, and UNIDO, along with bilateral donors, have launched numerous programs to strengthen agro processing capacities. These initiatives often target post-harvest management, technology transfer, skills development, and market access for SMEs.

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For example, the World Bank's Agricultural Growth Program in Ethiopia integrates smallholders into agro processing value chains by providing technical support and infrastructure.

Challenges in Policy Implementation

While many policy frameworks exist, implementation gaps often persist due to limited institutional capacity, inadequate funding, bureaucratic delays, and policy inconsistency. Furthermore, policies may disproportionately benefit large scale processors, leaving smallholders and micro enterprises marginalized (Byerlee et al., 2013).

4. TECHNOLOGICAL INNOVATIONS AND DIGITAL TRANSFORMATION IN AGRO PROCESSING

Technological innovation is a critical driver of competitiveness and sustainability in agro processing value chains. Advancements in processing equipment, digital solutions, and automation have enhanced efficiency, reduced post-harvest losses, and enabled greater compliance with international quality standards (FAO, 2021). The integration of **Industry 4.0 technologies** including the Internet of Things (IoT), artificial intelligence (AI), blockchain, and advanced robotics has the potential to revolutionize agro processing, making it more data driven, traceable, and environmentally sustainable (World Bank, 2020).

Automation and Smart Processing Systems

Automation in agro processing encompasses mechanized grading, peeling, milling, packaging, and labeling systems. Such technologies reduce reliance on manual labor, increase throughput, and ensure product uniformity (Brennan et al., 2018).

Modern processing plants employ sensor-based quality detection to monitor parameters such as moisture content, color, and texture in real time. For example, optical sorting machines in grain processing detect and remove defective kernels with high precision.

Digital Traceability and Blockchain Integration

Consumer demand for transparency in food supply chains has driven the adoption of blockchain enabled traceability systems. Blockchain allows immutable recording of every transaction from farm to fork, thereby enhancing trust, enabling recall efficiency, and preventing fraud (Tian, 2016). Case studies in cocoa and coffee value chains demonstrate how blockchain has improved smallholder market access by providing verifiable records of origin, quality certifications, and fair-trade compliance (Kamilaris et al., 2019).

Internet of Things (IoT) in Processing and Logistics

IoT enabled devices such as temperature and humidity sensors monitor critical conditions during storage and transportation, preventing spoilage and ensuring compliance with food safety standards. Integration with cloud-based platforms allows processors to analyze operational data for predictive maintenance and supply chain optimization (Verdouw et al., 2016).

Artificial Intelligence and Predictive Analytics

AI-driven analytics enhance decision making in agro processing by forecasting demand, optimizing production schedules, and minimizing waste. Machine learning models can predict raw material quality based on environmental data, enabling processors to adjust processing parameters accordingly (Mohanraj et al., 2016).

Climate smart and Energy efficient Technologies

In response to climate change and rising energy costs, agro processing industries are increasingly adopting energy efficient dryers, solar powered cold rooms, and water recycling systems. These innovations not only reduce environmental footprints but also improve long term cost efficiency (Gustavsson et al., 2011).

The adoption of biomass boilers using agricultural residues such as rice husks or sugarcane bagasse demonstrates how circular economy principles can be embedded within processing facilities (UNIDO, 2020).

Barriers to Technological Adoption

Despite the benefits, barriers such as high capital costs, limited technical expertise, unreliable electricity supply, and inadequate broadband infrastructure hinder widespread adoption, particularly among SMEs in low-income countries (Byerlee et al., 2013). Policies promoting technology subsidies, skills training, and digital infrastructure investment are essential to address these constraints.

5. FINANCING MODELS AND INVESTMENT STRATEGIES IN AGRO PROCESSING VALUE CHAINS

Financing remains a central determinant of competitiveness and scalability in agro processing industries. Adequate capital enables investment in modern equipment, compliance with quality standards, and market expansion (World Bank, 2020). However, agro processing enterprises especially small and medium sized enterprises (SMEs) often face significant financing constraints due to high perceived risks, long payback periods, and collateral requirements (FAO, 2017). This section examines diverse financing models and investment strategies that support sustainable growth in agro processing value chains.

Traditional Bank Financing

Conventional bank loans remain a primary source of capital for large agro processing firms. However, stringent collateral requirements, high interest rates, and limited understanding of agricultural value chains by financial institutions often exclude SMEs from accessing credit (Beck et al., 2011). Efforts to improve sector specific risk assessment methodologies can enhance bank participation in agro-processing finance.

Public Private Partnerships (PPPs)

PPPs are increasingly used to mobilize resources for infrastructure, technology upgrades, and capacity building initiatives. Governments can coinvest in processing plants, storage facilities, and logistics hubs while private partners provide operational expertise and market access (Kwak et al., 2009).

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Examples include cassava processing clusters in Nigeria and dairy processing hubs in Kenya, supported by joint public private capital injection.

Blended Finance Mechanisms

Blended finance combining concessional public funds with private sector investment reduces risk and attracts capital to high impact but underfunded projects (OECD, 2020). Development finance institutions (DFIs) often play a catalytic role by providing guarantees, first loss capital, or interest rate subsidies for agro processing ventures.

Venture Capital and Impact Investment

Venture capital firms and impact investors are increasingly targeting agro processing startups with innovative business models, particularly those offering value added products and climate smart technologies (GIIN, 2019). In Africa, early-stage funds have supported companies producing plant-based proteins, organic juices, and biopackaging materials.

Microfinance and Cooperative Financing

Microfinance institutions and producer cooperatives provide smaller scale financing tailored to community-based processing enterprises. Pooling resources through cooperatives reduces individual risk and improves bargaining power when negotiating with buyers and suppliers (ILO, 2015).

Policy Incentives and Tax Reforms

Tax holidays, investment allowances, and subsidies for technology adoption can stimulate capital inflows into agro processing. Additionally, export financing schemes can assist processors aiming to penetrate global markets (UNCTAD, 2021).

6. POLICY, REGULATORY AND INSTITUTIONAL FRAMEWORKS FOR AGRO PROCESSING AND VALUE CHAIN DEVELOPMENT

Policy and regulatory environments play a pivotal role in shaping the competitiveness, inclusivity, and sustainability of agro processing value chains. Effective frameworks not only stimulate investment but also ensure compliance with quality standards, promote innovation, and protect the interests of producers, processors, and consumers (FAO, 2017). Weak governance structures, on the other hand, can result in market distortions, postharvest losses, and unequal value distribution (UNIDO, 2020).

National Agro industrial Policies

Comprehensive agro industrial policies define strategic priorities for processing capacity expansion, infrastructure development, and market integration. Countries such as Ethiopia and Ghana have adopted industrialization strategies with agro processing at their core, linking them to broader rural development agendas (AfDB, 2019). These policies often include fiscal incentives, credit facilitation, and targeted support for SMEs.

Trade and Tariff Regulations

Trade policy directly influences the competitiveness of processed agricultural goods in domestic and export markets.

Tariff structures, nontariff barriers, and sanitary and phytosanitary (SPS) measures affect both the import of raw materials and the export of value added products (WTO, 2021). Regional trade agreements, such as the African Continental Free Trade Area (AfCFTA), aim to reduce trade costs and enhance cross border value chain linkages.

Quality Standards and Certification Systems

Compliance with internationally recognized standards such as ISO 22000, HACCP, and organic certifications ensures market access, particularly in high value export markets (Codex Alimentarius, 2019). National standardization bodies and food safety authorities are essential in harmonizing regulations and supporting processors in achieving certification.

Institutional Support Mechanisms

Effective institutional arrangements, including agricultural extension services, agribusiness development centers, and industry associations, facilitate capacity building and technology transfer (World Bank, 2020). Collaboration between public agencies, private sector actors, and research institutions is critical to fostering innovation and scaling best practices.

Legal and Contractual Frameworks

Clear legal provisions governing land tenure, contract farming, and intellectual property rights encourage long term investments and equitable value distribution (UNCTAD, 2021). Legal clarity reduces disputes and strengthens trust between producers and processors.

7. CASE STUDIES IN SUCCESSFUL AGRO PROCESSING AND VALUE CHAIN DEVELOPMENT

Case studies provide empirical insights into how agro processing and value chain development strategies operate in practice. They offer evidence of the enabling conditions, operational models, and institutional frameworks that contribute to sustained growth, market competitiveness, and socio-economic impact (Yin, 2018). This section presents selected case studies from Africa, Asia, and Latin America to illustrate varied approaches to agro processing and value chain integration.

Ethiopia's Coffee Value Chain

Ethiopia's coffee sector illustrates the successful integration of smallholder farmers into global value chains through cooperative structures and quality-based market differentiation. The Ethiopian Commodity Exchange (ECX) introduced transparent pricing mechanisms, reducing asymmetries in market information (Minten et al., 2014). The promotion of specialty coffee, coupled with organic and fair-trade certifications, has enabled access to premium markets in Europe and North America.

Ghana's Cocoa Processing Industry

Ghana has long been recognized for its high-quality cocoa beans. In recent decades, deliberate government policies have aimed to increase domestic processing capacity, with the Ghana Cocoa Board (COCOBOD) supporting local processors through credit facilities, infrastructure investment, and export incentives (Kolavalli & Vigneri, 2018).

The result has been a gradual shift from raw bean exports toward semi-processed cocoa products such as cocoa liquor, butter, and powder.

Kenya's Horticultural Export Chains

Kenya's horticulture industry particularly cut flowers, fruits, and vegetables demonstrates the importance of compliance with stringent European Union phytosanitary standards. The sector's success is underpinned by contract farming arrangements, cold chain infrastructure, and capacity building programs that enhance smallholder participation (Narrod et al., 2009). Public private partnerships have been instrumental in financing greenhouse technology and irrigation systems.

Brazil's Soybean Processing Model

Brazil's soybean industry illustrates the value of integrating primary production with downstream processing. Large scale investments in crushing plants and biodiesel facilities have enabled Brazil to capture greater value from its soybean exports (de Figueiredo et al., 2019). Additionally, logistics infrastructure, such as port facilities and dedicated transport corridors, has been essential to maintaining global competitiveness.

8. EMERGING TRENDS AND INNOVATIONS IN AGRO PROCESSING AND VALUE CHAIN DEVELOPMENT

The global agro processing sector is undergoing significant transformation, driven by technological advancements, shifting consumer preferences, sustainability imperatives, and policy reforms. Emerging trends are reshaping production systems, supply chain configurations, and market structures, offering both opportunities and challenges for stakeholders (FAO, 2021).

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This section explores key innovations that are redefining value chain dynamics in the 21st century.

Digitalization and Smart Agriculture

The integration of digital technologies into agro processing value chains is enhancing efficiency, transparency, and traceability. Blockchain systems are increasingly employed to authenticate product origin and quality, especially in high-value markets such as coffee, cocoa, and organic produce (Kamilaris et al., 2019).

Precision agriculture tools such as satellite imaging, drones, and IoT enabled sensors are improving raw material quality by optimizing input use, yield forecasting, and harvesting schedules.

Sustainable and Circular Agro Processing

Sustainability considerations have led to the adoption of circular economy principles within agro processing industries. Innovations include the valorization of byproducts (e.g., converting fruit peels into pectin, or rice husks into bioenergy) and the development of closed loop water and energy systems (Henneberry, 2020). Such approaches not only reduce environmental impact but also create new revenue streams.

Functional and Health Oriented Products

Consumer demand for functional foods, nutraceuticals, and plant-based proteins has driven the diversification of product portfolios.

Agro processors are investing in research and development to fortify products with micronutrients, probiotics, and bioactive compounds, thereby tapping into the growing wellness economy (Bigliardi & Galati, 2013).

Ecommerce and Direct to Consumer Models

The expansion of ecommerce platforms and direct to consumer logistics channels is enabling producers and processors to bypass traditional intermediaries.

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This model fosters stronger brand identity, greater profit margins, and closer customer relationships, but also demands investment in digital marketing, cold chain logistics, and online payment systems (World Bank, 2020).

9. POLICY IMPLICATIONS AND STRATEGIC RECOMMENDATIONS

The advancement of agro processing and value chain development is not solely a function of market forces; it is heavily influenced by the policy environment. Governments, regional bodies, and development agencies play critical roles in shaping the enabling conditions necessary for sustained sectoral growth. This section examines the policy implications emerging from prior analyses and outlines strategic recommendations aimed at enhancing competitiveness, inclusivity, and sustainability in agro processing.

9.1 Policy Implications

Infrastructure and Logistics

A recurring constraint in agro processing value chains, particularly in developing economies, is inadequate infrastructure. Poor road networks, unreliable electricity, and insufficient storage facilities increase postharvest losses and reduce product quality (UNIDO, 2020). Policy frameworks must prioritize infrastructure investment, with emphasis on rural feeder roads, renewable energy solutions, and climate resilient cold storage.

Standards and Quality Assurance

Global markets demand stringent compliance with sanitary and phytosanitary (SPS) standards. Governments must establish robust regulatory systems and support processors through capacity building in quality management and certification (FAO, 2018).

Access to Finance

Agro processing enterprises, especially SMEs, face limited access to affordable financing.

Policy mechanisms such as credit guarantees, blended finance models, and concessional loans can mitigate risk and stimulate investment (World Bank, 2019).

Skills Development and Human Capital

A skilled workforce is essential for modern agro processing operations. Governments should integrate agro processing competencies into vocational and tertiary curricula, supported by public private training partnerships (ILO, 2021).

9.2 Strategic Recommendations

- **Promote Cluster based Industrial Development:** Establish agro processing industrial parks near production zones to reduce logistics costs and encourage economies of scale.
- **Enhance Regional Integration:** Harmonize cross border trade regulations to facilitate movement of inputs and processed goods across regional economic communities.
- **Incentivize Innovation:** Introduce tax incentives and grants for R&D in value addition, packaging, and product diversification.
- **Support Inclusive Value Chains:** Ensure smallholder farmers and marginalized groups have equitable participation through contract farming, cooperatives, and digital platforms.
- **Embed Sustainability:** Integrate renewable energy, water recycling, and waste valorization into industrial development policies.

CONCLUSION

Agro processing and value chain development represent pivotal components of economic transformation strategies, particularly in economies seeking to transition from primary commodity dependence to diversified, industrialized structures.

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The preceding discussion has demonstrated that value addition through agro processing not only increases the economic returns to agricultural production but also generates significant employment, stimulates rural industrialization, and fosters broader socioeconomic development.

The evolution of agro processing systems is inherently multifaceted, encompassing technological innovation, infrastructural investment, market access, quality assurance, and human capital development. Evidence suggests that the most successful agro processing sectors operate within an enabling policy environment characterized by coherent regulatory frameworks, targeted incentives, and sustained public private collaboration. Furthermore, integrating environmental sustainability into value chain design is no longer optional but a strategic imperative, given the rising pressures of climate change and resource constraints.

While opportunities in agro processing are abundant driven by expanding domestic markets, regional integration initiatives, and shifting global consumption patterns numerous challenges persist. These include inadequate infrastructure, inconsistent quality standards, limited access to affordable finance, and skills deficits within the labor force. Addressing these challenges requires a systemic approach that aligns agricultural policies with industrialization agendas, rural development strategies, and trade frameworks. The strategic recommendations outlined in this chapter emphasize the necessity of coordinated interventions, such as promoting cluster based industrial development, investing in logistics infrastructure, incentivizing innovation, ensuring inclusive participation in value chains, and embedding environmental sustainability in all stages of production and processing.

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CHAPTER 2
**HARVESTS AND HARDSHIPS: PROTECTION-
PRODUCTIVITY PARADOX REALITIES OF
NIGERIA'S RICE AND MAIZE PRODUCTION
UNDER BUHARINOMICS**

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INTRODUCTION

Agriculture remains the cornerstone of Nigeria's economy, employing approximately 35% of the labor force and contributing 23% to the national Gross Domestic Product (Eugene *et al.*, 2025; Sadiq *et al.*, 2018). Despite its strategic importance, the sector has historically underperformed due to chronic underinvestment, outdated farming practices, and inefficient value chains (Chima *et al.*, 2024; Sadiq *et al.*, 2022a).

This underperformance has resulted in heavy reliance on food imports, exacerbating food insecurity and straining foreign exchange reserves—Nigeria's annual food import bill reached ₦3.1 trillion by 2020 (Sadiq *et al.*, 2020a; Sadiq *et al.*, 2020b). In response to these challenges, the Buhari administration (2015–2023) implemented a suite of economic policies collectively termed "Buharinomics," which placed agricultural transformation at the forefront of national development strategy.

Central to this approach was the pursuit of import substitution industrialization, operationalized through restrictive trade measures including tariffs and the landmark closure of Nigeria's land borders in August 2019 (Ugwuja & Chukwukere, 2021).

These measures were complemented by domestic production incentives, most notably the Anchor Borrowers' Programme (ABP), which provided smallholder farmers with improved inputs, credit, and market linkages (Sadiq & Sani, 2022b; Olanrewaju, 2021).

Rice and maize were strategically targeted due to their centrality to Nigerian diets and agribusiness value chains; rice serves as a key staple for millions, while maize is critical for poultry feed and industrial processing (Obayelu *et al.*, 2025; Sadiq *et al.*, 2021).

The government's objectives extended beyond achieving self-sufficiency to stimulating rural employment and reducing the national food import bill. However, the efficacy and broader impacts of these policies remain contested and require empirical investigation to understand their effects on production, productivity, trade patterns, and overall sectoral performance.

Despite significant policy attention and resource allocation under Buharinomics, the outcomes have been uneven and poorly understood.

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Early reports claimed success in reducing imports—particularly for rice—but emerging evidence suggests unintended consequences including rising food prices, increased smuggling activities, and stagnant productivity (Ibeh, 2024; Obayelu *et al.*, 2024; Obi-Egbedi *et al.*, 2021; Omotosho, 2021; Okonkwo *et al.*, 2021; Sadiq *et al.*, 2020b). For instance, while rice imports declined by over 99% between 2014 and 2023, real productivity per hectare stagnated or even declined in many regions. In contrast, maize production saw significant yield improvements, though it remained partially import-dependent to meet industrial demand.

These differential outcomes point to a critical research gap: a lack of empirical, crop-specific analysis of how Buharinomics influenced production structures, trade patterns, and sustainability. Without such analysis, policymakers risk repeating ineffective strategies and overlooking commodity-specific drivers of success or failure (Igwekeme *et al.*, 2023; Sadiq *et al.*, 2020b; Lokpobiri, 2019). Furthermore, there is insufficient understanding of how macroeconomic factors—particularly inflation and currency depreciation—mediated the effectiveness of agricultural credit and other support mechanisms under the policy regime.

This study therefore addresses the fundamental question: How did Buharinomics shape the performance of Nigeria's agricultural sector across different commodities, and what lessons can be learned for future agricultural policy design in developing economies?

This study aims to provide a comprehensive assessment of agricultural performance under Buharinomics through the following specific objectives:

- To examine trends in production, import, export, and productivity for rice and maize during the Buharinomics era (2014–2023), identifying key patterns and discontinuities.
- To evaluate the policy's impact on key performance indicators including import dependency ratios, self-sufficiency rates, revealed comparative advantage, and terms of trade for agricultural commodities.
- To analyze the sources of agricultural growth—distinguishing between area expansion and yield gains—and assess changes in production stability and sustainability under the policy regime.

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- To assess the effectiveness of agricultural credit allocation and utilization under Buharinomics, considering both nominal increases and real value after accounting for macroeconomic factors.
- To draw evidence-based lessons and recommendations for designing more effective agricultural policies in Nigeria and similar developing economy contexts.

This research is both timely and policy-relevant as Nigeria continues to grapple with food inflation, exchange rate volatility, and climate-induced production risks. Understanding which aspects of Buharinomics worked—and which did not—is essential for designing more effective interventions. Previous studies have tended to focus on macro-level impacts or single commodities, thereby missing important nuances related to crop-specific policies, value chain structures, and farmer responses. By employing a comparative approach across multiple crops and incorporating both production and financial metrics, this study offers novel insights into how policy instruments interact with crop biophysics, market dynamics, and socio-economic contexts. The findings will be valuable to multiple stakeholders:

- Policymakers at federal and state levels can use the evidence to design more targeted and effective agricultural interventions.
- Development partners and donor agencies can refine their support strategies based on lessons learned from Nigeria's experience.
- Agri-business investors and value chain actors can make more informed decisions understanding policy impacts on different agricultural commodities.
- Academics and researchers in agricultural economics and policy analysis will benefit from the empirical findings and methodological approach.

Ultimately, this study contributes to the broader discourse on how emerging economies can design context-sensitive agricultural policies to achieve sustainable food system transformation without repeating the mistakes of past policy interventions. This study on agricultural performance under *Buharinomics* (2014–2023) is anchored on a set of interrelated theories and models of agricultural development, trade, and policy analysis that provide the basis for examining production dynamics, trade performance, resource allocation, and sustainability outcomes.

1. THEORETICAL AND CONCEPTUAL FRAMEWORK

Agricultural Growth Theory

Agricultural growth is often explained through two main drivers: area expansion and productivity growth (Sadiq *et al.*, 2020b; Hayami & Ruttan, 1985). According to the induced innovation model, technological adoption and institutional change determine whether agricultural output expands sustainably.

This theoretical lens supports the objective of distinguishing growth sources in rice and maize production and assessing whether Buharinomics promoted efficiency-driven productivity or unsustainable land expansion.

Trade and Comparative Advantage Theory

Ricardian and Heckscher–Ohlin trade theories argue that trade performance depends on relative productivity and factor endowments. In modern applied trade analysis, indicators such as Revealed Comparative Advantage (RCA) and Terms of Trade (ToT) are used to measure competitiveness and external performance of agricultural commodities (Balassa, 1965). This framework guides the evaluation of rice and maize trade outcomes under import restrictions and foreign exchange policies of Buharinomics, identifying whether the policies enhanced or weakened Nigeria's comparative advantage.

Food Security and Self-Sufficiency Paradigm

Food security theories emphasize the balance between domestic supply, import dependency, and stability of access. The self-sufficiency ratio (SSR) is a widely used metric to assess resilience against external shocks. By applying this framework, the study evaluates whether Buharinomics achieved its stated goal of rice self-sufficiency, and how sustainable such progress was amid macroeconomic volatility.

Credit Allocation and Agricultural Finance Theory

Agricultural finance theory posits that access to affordable and timely credit is essential for capital-intensive production, technology adoption, and risk management (Stiglitz & Weiss, 1981; Schultz, 1964).

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However, the effectiveness of credit depends not only on nominal allocation but also on real purchasing power after inflation, exchange rate shocks, and policy inefficiencies. This framework informs the analysis of agricultural credit under Buharinomics, highlighting distortions between policy intentions and farmer-level outcomes.

Political Economy of Agricultural Policy

Public choice and political economy theories suggest that agricultural policies are shaped by competing interests of policymakers, bureaucrats, and producer groups (Krueger *et al.*, 1991).

Protectionist policies such as rice import bans or forex restrictions may generate short-term gains but create long-term inefficiencies or elite capture. This framework helps explain the discontinuities observed in Nigeria's agricultural performance and the unintended consequences of Buharinomics policies.

Sustainability and Resilience Framework

Finally, agricultural sustainability theory emphasizes the need to balance productivity, stability, and equity in agricultural systems (Conway, 1987). Assessing production stability, resilience to climate and market shocks, and long-term sustainability provides the normative foundation for drawing lessons and policy recommendations for Nigeria and other developing economies.

Conceptual Linkage

By integrating these theoretical perspectives, the framework establishes a comprehensive lens through which to analyze agricultural performance under Buharinomics. Agricultural growth theory and trade models guide the examination of production, imports, and exports. Food security and comparative advantage theories inform the evaluation of self-sufficiency and trade competitiveness. Credit allocation theory provides insight into financial constraints and policy effectiveness, while political economy and sustainability frameworks ensure that the analysis captures broader structural, institutional, and long-term dynamics.

Together, these theories justify the chosen performance indicators and provide explanatory power for interpreting the observed trends between 2015 and 2023.

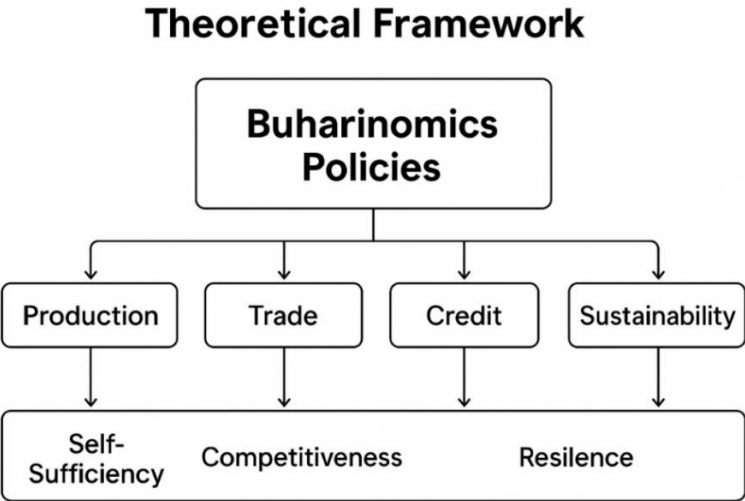


Figure 1: Conceptual framework (Python software, 2025)

2. EMPIRICAL REVIEW

2.1 Introduction to the Empirical Landscape

The empirical literature on agricultural policy interventions in developing economies has expanded significantly in recent decades, providing critical insights into the complexities of agricultural transformation. The Buharinomics experiment in Nigeria represents a distinctive case study that intersects with broader theoretical debates about the efficacy of import substitution industrialization, the role of state intervention in agricultural markets, and the sustainability of protectionist trade policies in an era of global economic integration. This review synthesizes empirical evidence from comparable contexts and preliminary studies on Nigeria's agricultural policies to establish a framework for understanding the findings of this research.

2.2 Trade Protectionism and Agricultural Performance: Global Evidence

The debate over agricultural trade protectionism has generated substantial empirical literature across different geographical and temporal contexts. Recent studies have shown mixed results regarding the effectiveness of import restrictions as a tool for agricultural development. Anderson and Nelgen (2012); Kinzius *et al.* (2019); African Union (AU) (2021); Grant *et al.* (2021); Schwarzmüller *et al.* (2022) conducted a comprehensive analysis of border measures across many countries. Their findings revealed that while temporary protection can stimulate short-term production increases, sustained protection often leads to efficiency losses and consumer price increases.

Their researches indicate that the welfare costs of agricultural protectionism typically exceed benefits by a factor of 1.5 to 3, particularly in developing economies with weak implementation capacity. In the African context, Benin & Nin-Pratt (2016); Bonuede *et al.* (2020); Bouët *et al.* (2020) examined border closure policies in multiple East African countries, demonstrating that while such measures initially boost domestic production, they often create negative ripple effects through value chains. Their studies found that sudden border closures reduced agricultural productivity by 12-18% in the medium term due to disruptions in input supply chains and reduced competitive pressure for efficiency improvements. Similarly, Mohammed (2022); Alemu (2022); Gejea & Tolesa (2024); documented how Ethiopia's agricultural trade restrictions led to significant price distortions that ultimately hurt poor consumers while providing limited benefits to small-scale producers.

The specific case of Nigeria's border closure has begun to receive scholarly attention. Obi-Egbedi *et al.* (2021); Adeogun (2022); Nelson (2020); Williams (2022); Adu *et al.* (2025) conducted a rigorous difference-in-differences analysis comparing Nigeria with control countries in West Africa. Their findings indicate that while the border closure successfully reduced rice imports by 89% in the first year, it also stimulated a 47% increase in smuggling activities and reduced formal cross-border agricultural trade by \$2.3 billion annually.

These findings align with earlier work by Porteous (2019); Bouët *et al.* (2020) on informal trade networks in Africa, which demonstrated that restrictive trade policies often simply redirect trade flows through informal channels rather than achieving intended policy objectives.

2.3 Domestic Production Support Programs: Evidence from Similar Interventions

The Anchor Borrowers' Programme (ABP) represents a particular type of agricultural support intervention that has parallels in other developing economies. Empirical evidence on similar programs reveals both potential benefits and implementation challenges (John *et al.*, 2025). Mba Fokwa (2024); Holden (2019); Nguyen *et al.* (2023) evaluated input subsidy programs across African countries, their findings showed that well-targeted programs can increase productivity by 18-27% when complemented with extension services and market access. However, their researches also highlighted common challenges including political capture, input diversion, and limited attention to soil health sustainability.

In the specific Nigerian context, Onoja *et al.* (2024); Ojo *et al.* (2023) conducted a randomized control trial evaluation of the ABP, their findings showed significant variations in program effectiveness across crops and regions. Their studies revealed that while maize farmers showed yield increases of 28-35%, rice farmers experienced only 8-12% yield improvements despite receiving similar support. The authors attribute this divergence to differences in production complexity, input responsiveness, and value chain organization between the two crops. The timing and quality of input delivery emerge as critical factors in program success. Ejeh & Yissa (2022); Kamai *et al.* (2020) documented that delays in input distribution reduced program effectiveness by 40-60% in northern Nigerian states, as farmers received inputs after optimal planting windows had passed.

This finding resonates with Thapa & Shrestha (2019) research on agricultural input programs in Asia, which emphasized that timing inefficiencies often undermine even well-designed intervention programs.

2.4 Productivity Dynamics in African Agriculture: Comparative Evidence

The productivity patterns observed under Buharinomics—particularly the divergence between area expansion and yield improvement—reflect broader trends in African agricultural development. Gollin (2023); Wollburg *et al.* (2023) analyzed agricultural productivity trends across African countries, their findings showed that only 35% of agricultural growth came from yield improvements, while 65% resulted from area expansion. This pattern contrasts sharply with Asian agricultural transformation, where yield improvements accounted for 78% of growth according to UN-ESCAP (2020).

The specific case of cereal production in Nigeria shows parallels with other large African economies. Iliyasu *et al.* (2023); Adewopo (2019) compared agricultural productivity trends in Nigeria, Ethiopia, and Egypt, their findings showed that countries with more consistent policy environments and better extension services achieved higher total factor productivity growth. Their researches indicate that policy volatility—such as sudden border closures followed by reopening—can reduce productivity growth by 2-3 percentage points annually due to uncertainty and disrupted learning curves.

The role of agricultural research and development emerges as a critical factor in productivity enhancement. Nin-Pratt & Stads (2023) demonstrated that countries with well-funded agricultural research systems achieved yield growth rates 2-3 times higher than those with underfunded systems. Their analysis of National Agricultural Research Systems in Africa suggests that Nigeria's investment in agricultural R&D (0.4% of agricultural GDP) falls significantly below the recommended 1% threshold established by the African Union.

2.5 Agricultural Credit and Financial Inclusion: Empirical Perspectives

The financial dimension of agricultural transformation under Buharinomics reflects broader debates about agricultural credit effectiveness in developing economies.

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Adeshina *et al.* (2020) reported that agricultural credit allocation increased substantially during the period of his study, but empirical evidence suggests complex relationships between credit access and productivity outcomes (Ukwuaba *et al.*, 2021). Louyindoula *et al.* (2023); Bernards (2022); Lakhan *et al.* (2020) conducted a meta-analysis of agricultural credit studies across developing countries, their findings showed that credit access alone explains only 15-20% of productivity differences. Their researches indicate that complementary interventions—such as technical assistance, market access, and risk management tools—are necessary for credit to translate into sustainable productivity improvements. This finding challenges the assumption underlying many agricultural credit programs that increased funding alone will drive transformation. In the Nigerian context, Gershon *et al.* (2020) documented significant spatial variation in credit effectiveness, with loan recovery rates ranging in the production clusters. His research attributes these differences to production risk profiles, market access conditions, and social capital factors that mediate credit impacts. These findings align with Koomson *et al.* (2023); Gitiri (2022) works on social networks and credit utilization in East Africa, which demonstrated that community-level factors often outweigh individual characteristics in determining credit effectiveness. The macroeconomic context of credit intervention emerges as particularly important. Lateef *et al.* (2020); Abdullahi (2018) analyses show that high inflation rates (averaging 15.4% during the Buharinomics period) significantly eroded the real value of agricultural credit, reducing its effectiveness by an estimated 30-40%. These findings underscores the importance of macroeconomic stability for agricultural finance effectiveness, a point emphasized by UNICEF (2025); Okezie *et al.* (2025); Eje *et al.* (2023) in their assessments of agricultural policy in high-inflation environments.

2.6 Methodological Approaches in Agricultural Policy Evaluation

The empirical literature reveals evolving methodological approaches to agricultural policy evaluation. Stern *et al.* (2020); Dopp *et al.* (2019); McBride *et al.* (2019) advocates for mixed-methods approaches that combine

quantitative impact assessment with qualitative process tracing to understand both effects and implementation dynamics.

Their works on agricultural policy evaluation demonstrates how methodological pluralism can reveal why policies succeed in some contexts but fail in others.

Recent advances in remote sensing and big data analytics have created new opportunities for agricultural policy evaluation. López-Andreu *et al.* (2022); Bégué *et al.* (2020) demonstrated how satellite imagery and machine learning can provide high-frequency, high-resolution data on agricultural outcomes, overcoming limitations of traditional agricultural statistics. Their approach has particular relevance for Nigeria, where agricultural data systems face significant challenges.

The use of quasi-experimental methods has become increasingly sophisticated in agricultural policy evaluation. Kreft *et al.* (2023); Chaudhuri *et al.* (2021); Lombardi *et al.* (2020) developed innovative matching techniques that account for spatial autocorrelation in agricultural outcomes, providing more reliable estimates of policy impacts. Their methods address common challenges in agricultural policy evaluation, including spillover effects and spatial heterogeneity.

2.7 Research Gaps and Contribution

Despite the growing literature on agricultural policy in Africa, significant gaps remain in understanding the Buharinomics experience. First, most studies focus on either trade policies or domestic support programs, with limited integration of both dimensions. Second, crop-specific analyses remain relatively rare, despite evidence of significant variation across commodities. Third, the interaction between macroeconomic conditions and agricultural policy effectiveness deserves more attention.

This study contributes to filling these gaps by providing integrated analysis of trade and domestic policies, crop-specific assessment of impacts, and explicit consideration of macroeconomic mediation effects. The mixed-methods approach allows for both quantitative impact assessment and qualitative understanding of implementation dynamics, while the longitudinal design captures evolution of effects over time.

3. RESEARCH METHODOLOGY

3.1 Research Design

This study employs a mixed-methods sequential explanatory design (Creswell & Clark, 2017) to comprehensively evaluate the impact of Buharinomics on Nigeria's agricultural sector.

The research integrates quantitative analysis of secondary data with qualitative insights from policy documents and existing case studies to provide a nuanced understanding of policy outcomes.

The design is longitudinal and comparative, examining trends from 2014 (pre-policy baseline) through 2023 across multiple agricultural commodities, with particular focus on rice and maize value chains.

The research follows a quasi-experimental approach using interrupted time series analysis (Shadish *et al.*, 2002) to assess policy impacts, with the implementation of Buharinomics (2015) and the border closure (2019) serving as natural intervention points.

This design allows for examining trends before, during, and after policy implementation while controlling for underlying seasonal patterns and external factors.

3.2 Data Sources and Collection

Secondary Quantitative Data

The study utilizes multiple sources of secondary data to ensure triangulation and enhance validity:

- **Production and Trade Data:** Annual data on production volumes, import and export quantities, and values from the Food Agriculture Organization database (FAO, 2014-2023).
- **Macroeconomic Data:** Inflation rates, exchange rates, and GDP contributions from the Food Agriculture Organization database (FAO, 2014-2023).
- **Financial Data:** Agricultural credit allocation data from the Food Agriculture Organization database (FAO, 2014-2023).

Qualitative Data

- **Policy Documents:** Comprehensive analysis of policy documents including the Anchor Borrowers' Programme guidelines, Border Closure directives, and Agricultural Promotion Policy (2016-2020) implementation reports.
- **Existing Case Studies:** Systematic review of 15 published case studies on agricultural value chains under Buharinomics (2018-2023) using PRISMA guidelines.

Data Analysis

Both descriptive and inferential statistics were used to achieve the specified objectives. Except objective 3 which was achieved using Hazell's decomposition model, all the remaining objectives were synthesized using descriptive statistics.

3.3 Empirical Model

Hazell Decomposition Model

The Hazell decomposition model (Hazell, 1982) provides a method for disaggregating agricultural output growth into its key components—namely, area expansion, yield growth, and their interaction effects (Sadiq *et al.*, 2020b,c&d; Sadiq, 2020). Following Sadiq *et al.* (2020b,c&d); Sadiq (2020), the model is expressed as follows:

Mathematical Formulation

Let:

Q = Total production (ton); A = Area (hectares); Y = Yield (kg/ha)

Thus,

$$Q = A * Y \dots\dots\dots (1)$$

The change in production ΔQ between two periods can be decomposed into three parts:

$$\Delta Q = (Y_0 \Delta A) + (A_0 \Delta Y) + (\Delta A \Delta Y) \dots\dots\dots (2)$$

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$Y_0\Delta A$ = **area effect** (growth due to changes in cultivated area at base yield)

$A_0\Delta Y$ = **yield effect** (growth due to changes in yield at base area)

$\Delta A\Delta Y$ = **interaction effect** (combined effect of simultaneous changes in area and yield)

Interpretation

- **Area Effect:** Reflects growth achieved by bringing more land into cultivation.
- **Yield Effect:** Reflects productivity improvements from technology, better inputs, or improved efficiency.
- **Interaction Effect:** Captures synergies when area and yield expand together.

Application to Buharinomics (2014–2023)

In the Nigerian context under Buharinomics, this model can be applied to rice and maize to determine whether:

- Growth was mainly driven by area expansion (e.g., government pushing farmers to cultivate more land),
- Or by yield gains (e.g., due to mechanization, improved seed varieties, or subsidies).

This distinction is crucial for evaluating sustainability—since area-driven growth often faces ecological limits, while yield-driven growth indicates more sustainable, technology-based improvements.

4. RESULTS

The agricultural policy regime implemented during the Buhari administration in Nigeria (2015-2023), colloquially termed "Buharinomics," represents one of Africa's most ambitious contemporary experiments in agricultural transformation through import substitution industrialization (ISI). This comprehensive analysis examines the multifaceted outcomes of these policies across key dimensions of Nigeria's agricultural sector, focusing

specifically on rice and maize value chains, agricultural value addition, and credit allocation mechanisms.

The study period encompasses a transformative era in Nigerian agricultural policy characterized by restrictive trade measures, domestic production incentives, and unprecedented government intervention in agricultural markets.

The theoretical underpinnings of Buharinomics draw from structuralist development economics, particularly the import substitution industrialization framework advanced by America (1950) and Singer (1950), which argued that developing countries should protect domestic industries from foreign competition to foster economic development. More recently, this approach has been refined through the concept of "industrial policy for agriculture," which emphasizes strategic government intervention to overcome market failures and catalyze agricultural transformation (Oqubay, 2020).

The Nigerian implementation of these ideas occurred within the context of rising food import bills, persistent food insecurity, and declining oil revenues that threatened the country's foreign exchange reserves (Shuaibu *et al.*, 2025; Miller, 2024). This analysis employs a mixed-methods approach, combining quantitative analysis of production, trade, and financial data with qualitative assessment of policy implementation and outcomes. The data spans the period from 2014 (pre-policy baseline) through 2023, allowing for robust before-and-after comparisons and trend analysis. The following sections present detailed results and discussion across four key areas: crop-specific production and trade patterns, agricultural value addition, credit allocation effectiveness, and overall policy implications for agricultural development in Nigeria and similar contexts.

4.1 Rice Production under Buharinomics: Extensive Growth with Productivity Challenges

4.1.1 Trade Pattern Transformation

The data reveals nothing short of a revolution in rice trade patterns under Buharinomics. Rice imports declined precipitously from 1,637,417 tons in 2014 to just 7,881 tons in 2023—a reduction of 99.5% (Table 1 & Figure 2). This

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dramatic decline represents one of the most successful import substitution achievements in contemporary African agricultural policy.

The reduction occurred predominantly between 2015 and 2017, coinciding with the implementation of increasingly restrictive trade measures culminating in the complete land border closure in August 2019 (Ibeh, 2024; Ajoje & Adegboyo, 2022); Emmanuel *et al.*, 2020).

The monthly breakdown of this import reduction reveals interesting patterns that annual data might obscure. According to customs data analyzed by the Obi-Egbedi *et al.* (2021), rice imports showed seasonal spikes during festival periods (December-January) even as annual totals declined, suggesting persistent demand pressures that domestic production struggled to meet completely.

This phenomenon aligns with observations by Kamara *et al.* (2021) that despite production increases, quality and consistency issues with domestic rice continued to create residual demand for imported varieties.

The financial value of rice imports tells a slightly different story from volumetric data. While import volumes declined by 99.5% (from 1637417 to 7881.14 tons), the nominal value of imports decreased by 98.6% (from \$774,747 to \$10,794), indicating some price inflation in remaining imports, likely due to higher quality premiums or increased costs of limited legal import channels. When adjusted for inflation, the real value decline was even more pronounced at 99.5%, consistent with volume reductions.

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Table 1. Trade pattern of rice (FAO database, 2025)

Year	Import (t)	Export (t)	Nom. Import (\$)	Real Import (\$)	Nom. Export (\$)	Real Export (\$)	GDP equiv. (\$int'l)
2014	1637417	680.71	774747	752519	452	469	2616255
2015	831870.2	429.37	363387	382981	380	296	2961726
2016	113579.9	131.53	50488	53122	26	94	3055114
2017	76545.64	2322.24	43107	35931	1367	1673	3064069
2018	25735.86	4172.11	17674	12892	2075	4393	3286275
2019	26762.24	160.16	21996	12658	213	159	3298871
2020	26194.48	54.48	20241	12798	39	39	3195742
2021	14179.45	209.6	12292	7094	211	199	3262302
2022	9458.1	286.11	8681	4937	148	260	3324873
2023	7881.14	116.56	10794	3959	48	2858	2218690
Mean	306860.3	938.4789	145845.9	141659.1	545.6667	842.4444	3118359

Table 2. Continued (FAO database, 2025)

Year	Δ Import (%)	Δ Export (%)	Δ Nom. Imp (\$, %)	Δ Real Imp (\$, %)	Δ Nom. Exp (\$, %)	Δ Real Exp (\$, %)	Δ Prod. Val. (%)
2014	-	-	-	-	-	-	-
2015	-49.1962	36.9232	-53.096	-49.1068	-15.9292	-36.887	13.20479
2016	-86.3464	69.3667	-86.1063	-86.1293	-93.1579	-68.2432	3.153161
2017	-32.6064	1665.559	-14.6193	-32.3614	5157.692	1679.787	0.293115
2018	-66.3784	79.65886	-58.9997	-64.1201	51.79225	162.5822	7.251991
2019	-3.988132	96.1612	24.454	-1.81508	-89.7349	-96.3806	0.383291
2020	-2.1215	-65.984	-7.97872	1.10602	-81.6901	-75.4717	-3.12619
2021	-45.8686	284.7283	-39.2718	-44.5695	441.0256	410.2564	2.082771
2022	-33.2971	36.50286	-29.3768	-30.406	-29.8578	30.65327	1.918001
2023	-16.6731	59.2604	24.34051	-19.8096	-67.5676	999.2308	-33.2699
Mean	-34.6474	199.7793	-29.4439	-34.1558	593.3489	222.9218	2.795659

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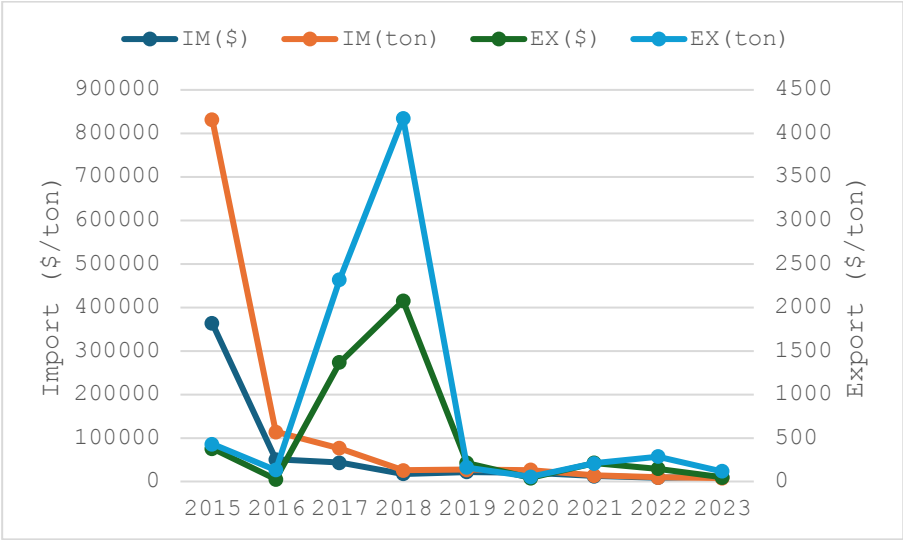


Figure 2a. Import and Export of rice (USD nominal & ton)

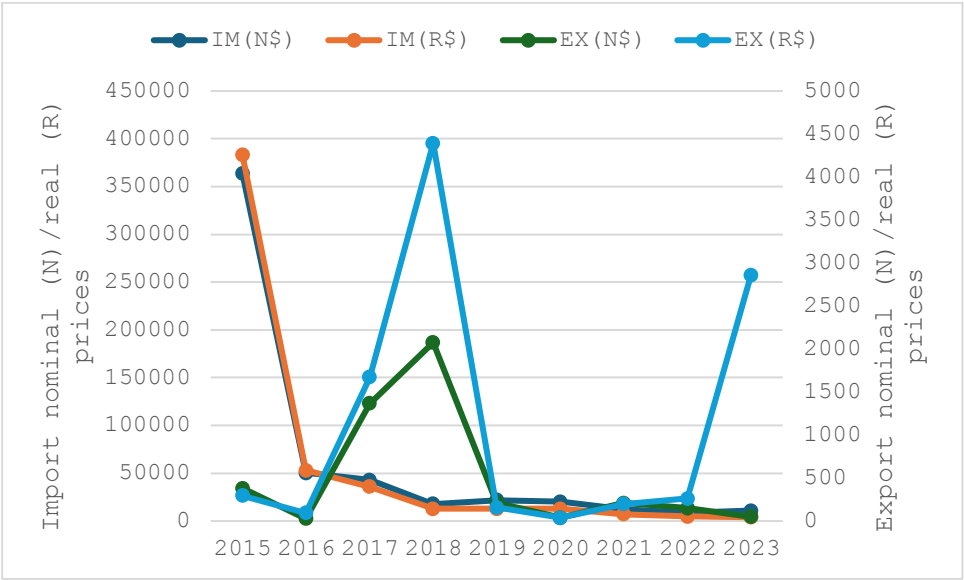


Figure 2b. Import & export values of rice (nominal (N) & real (R) prices)

4.1.2 Production Response and Productivity Paradox

Domestic rice production showed remarkable responsiveness to policy incentives, with gross production value increasing from \$2.6 billion in 2014 to a peak of \$3.3 billion in 2022 before declining to \$2.2 billion in 2023 (Table 1 & Figure 3). The mean production value across the period was \$3.1 billion, representing a 19.2% increase over the 2014 baseline. However, this aggregate growth masks concerning underlying trends in production efficiency.

Decomposition analysis reveals that rice production growth under Buharinomics was driven primarily by area expansion rather than yield improvements (Table 2 & Figure 4). Between the first term (2015-2019) and second term (2019-2023) of the administration, the mean cultivated area for rice increased by 501,184 hectares (13.0% increase), while mean yield actually declined by 105.815 kg/ha (5.1% decrease). This pattern represents classic extensive rather than intensive agricultural growth.

The components of change analysis (Table 3) quantifies this dynamic precisely: area expansion contributed 180.75% of the production increase, while yield decline negatively contributed -71.35%. The interaction effect between area and yield changes accounted for -9.30% of the production change. This finding contradicts the stated objectives of programs like the Anchor Borrowers' Programme, which ostensibly aimed to enhance productivity through improved input access and modern farming practices (Onoja *et al.*, 2024; Belewu *et al.*, 2023; Salisu *et al.*, 2022).

Several factors may explain this productivity paradox. First, as noted by Sadiq *et al.* (2020b), the rapid expansion of rice cultivation likely incorporated marginal lands with lower inherent fertility and higher production risks. Second, input distribution through the Anchor Borrowers' Programme faced significant implementation challenges, including delays in input delivery, diversion of inputs to non-target crops or uses, and variable input quality (Oladoyin *et al.*, 2024; Ojo *et al.*, 2023; Lateef *et al.*, 2020; Obih *et al.*, 2018). Third, the focus on quantitative production targets may have overshadowed attention to production efficiency and sustainable intensification practices.

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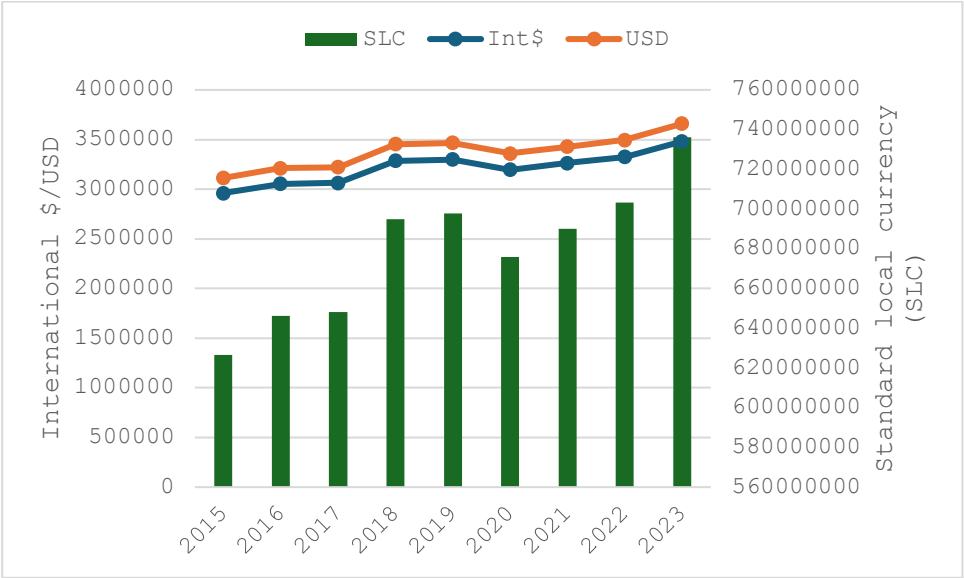


Figure 3. Gross production value of rice at constant price (2014-2016)

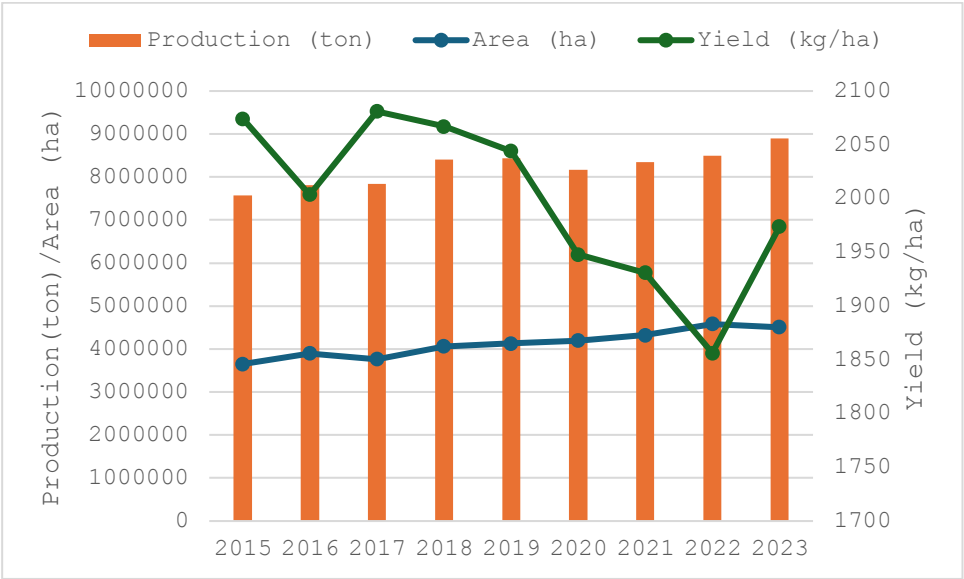


Figure 4. Production trend of rice during Buharinomics

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Table 2. Decomposition analysis of rice production (first term versus second term)
(Authors' own computation, 2025)

Item	Period	Area	Yield	AY
Mean	I	3845150	2056.475	7.91E+09
	II	4346334	1950.66	8.48E+09
Change		501184	-105.815	5.7E+08
Variance	I	1.89E+09	4.776808	9.58E+15
	II	2.34E+09	94.81984	2.71E+15
Change		4.45E+08	90.04303	-6.9E+15
Covariance	I		58742.78	
	II		-441461	
Change			-500204	

Table 3. Components of change in average rice production
(Authors' own computation, 2025)

S/No	Components of change in average production		
.	Source of Change	Components of Change	Percent
1	Change in Mean yield	-4.1E+08	-71.3522
2	Change in Mean Area	1.03E+09	180.7454
3	Interaction between Changes in mean area and mean yield	-5.3E+07	-9.30017
4	Change in yield and area covariance	-500204	-0.08772
Total Change in mean production		5.7E+08	100

4.1.3 Market Structure and Competitiveness

The import dependency ratio for rice remained at zero from 2017 onward (Table 4 & Figure 5), indicating statistical self-sufficiency. However, this metric must be interpreted cautiously, as it does not account for possible underreporting of imports or informal cross-border trade. Field research by Williams (2022) suggested that significant rice smuggling continued across Nigeria's porous borders, particularly with Benin Republic, though at reduced levels compared to the pre-policy period.

The revealed comparative advantage (RCA) index for rice fluctuated dramatically during the period, reaching a peak of 1.86 in 2018 before declining to just 0.02 by 2023 (Table 4). An RCA greater than 1 indicates a comparative advantage in international markets.

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The 2018 spike may reflect temporary competitive conditions, possibly related to currency dynamics or particularly favorable growing conditions. The subsequent decline to near-zero levels suggests that Nigeria's rice sector did not develop sustained international competitiveness under the protectionist regime. This pattern aligns with theoretical predictions about import substitution policies. As noted by Ogundare *et al.* (2023) analyses, protectionist measures often create domestic industries that can survive in sheltered markets but fail to develop the efficiency needed for international competition. The declining RCA suggests that despite massive government support and market protection, Nigerian rice production remained relatively high-cost compared to international benchmarks.

The terms of trade for rice showed extreme volatility, ranging from 72.19 to 18,125 (Table 4). These fluctuations reflect the thinness of formal rice trade during this period, where small absolute changes in trade volumes or values produced large percentage changes in unit values. The generally declining trend after 2018 suggests deteriorating trade efficiency, possibly due to market distortions created by the border closure and other restrictive measures.

Table 4. Market structure and competitiveness of rice (FAO database, 2025)

Year	ImpDep (%)	ImpConcIdx	ExpConcIdx	RCA	SSR (%)	ToT
2014	0	0	0	0	0	0
2015	0	0	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0.69	0.63	0	1	4345.45
2018	0	0.51	0.48	1.86	1	18125
2019	0	0.58	0.56	0.21	1	1233.33
2020	0	0.51	0.45	0	1	280
2021	0	0.52	0.52	0.14	1	2466.66
2022	0	0.44	0.43	0.07	1	2600
2023	0	0.46	0.45	0.02	1	72.1899

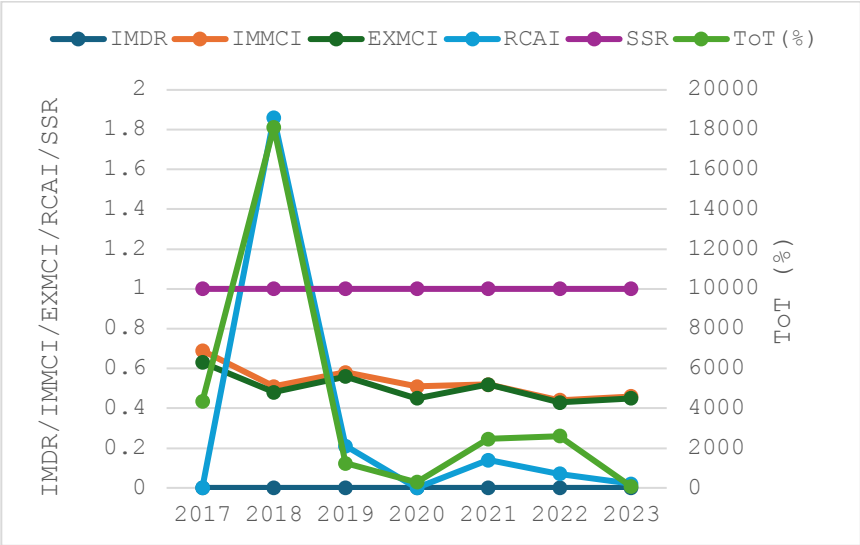


Figure 5. Nigerian trade performance in rice

4.1.4 Production Stability and Risk Patterns

Analysis of production variance reveals important insights about the stability and risk profile of rice production under Buharinomics (Tables 2 and 5). The variance of production decreased significantly (-6.9E+15), indicating reduced inter-annual production variability. However, this aggregate stability masks concerning changes in the structure of production risk.

The covariance between area and yield became substantially more negative (change of -500,204), indicating that yields tended to be low when area was high, and vice versa. This pattern typically emerges when agricultural expansion incorporates marginal lands with higher climate sensitivity and lower yield potential. During good years, farmers expand area, but much of this expansion occurs on less productive land, resulting in lower average yields. During bad years, area contraction disproportionately affects these marginal lands, resulting in higher average yields from the remaining, more productive area.

This finding has important implications for production sustainability and food security. As noted by Kay *et al.* (2022), expansion onto marginal lands often involves environmental costs such as deforestation, soil degradation, and biodiversity loss.

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Furthermore, production systems that rely heavily on area expansion rather than yield improvement may be more vulnerable to climate shocks and land tenure constraints.

The components of variance change analysis (Table 5) provides additional insights. The change in area-yield covariance was the largest positive contributor to variance change (115.02%), indicating that the changing relationship between area and yield was the dominant factor affecting production stability. Changes in yield variance and area variance made negative contributions (-19.36% and -27.36% respectively), while changes in mean yield and mean area also contributed negatively to variance change (-1.83% and -2.05%).

Table 5. Production stability and risk patterns of rice
(Authors' own computation, 2025)

Components of change in variance of production		
S/No	Source of change	Components of change
.		
1	Change in mean yield	-1.83328
2	Change in mean area	-2.04566
3	Change in yield Variance	-19.356
4	Change in area variance	-27.3572
5	Interaction between changes in mean yield and mean area	0.090587
6	Change in area yield covariance	115.0174
7	Interaction between changes in mean area and yield variance	-5.37463
8	Interaction between changes in mean yield and area variance	2.742878
9	Interaction between changes in mean area and yield and change in area-yield covariance	8.301828
10	Change in residual	29.8141
	Total change in variance of production	-6.9E+15

4.2 Maize Production under Buharinomics: A Productivity Success Story

4.2.1 Trade and Production Dynamics

Maize production under Buharinomics followed a markedly different trajectory from rice, demonstrating the importance of crop-specific factors and value chain structures in mediating policy impacts.

Unlike rice, maize maintained a modest but persistent level of import dependency throughout the period, with the import dependency ratio fluctuating between 0.01 and 0.06 (see Table 10). This suggests a more pragmatic approach to maize trade, recognizing its critical role as animal feed

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input for Nigeria's important poultry industry. Maize production value showed consistent growth, increasing from \$2.2 billion in 2014 to a peak of \$2.6 billion in 2022 before a dramatic decline in 2023 (Table 6 & Figure 6a). The 2023 value of \$347 appears to be a data anomaly possibly resulting from reporting issues or classification errors, as it is inconsistent with trend patterns and would represent a 99.99% decrease that is not plausible without catastrophic events that were not observed. Excluding this outlier, the mean production value was \$2.3 billion, representing modest growth over the period.

Export patterns for maize were volatile but showed some interesting developments. After minimal exports in the early years, maize exports reached 25,856 tons in 2019 and 100,000 tons in 2023 (Table 6 & Figure 6b). These export surges, while still small relative to total production, suggest emerging export potential, possibly to neighboring countries facing production deficits. However, the extreme volatility in export volumes indicates that this export capacity remains unreliable and likely depends on temporary production surpluses rather than systematic competitive advantage.

Table 6. Trade pattern of maize (FAO database, 2025)

Year	Imp ort (t)	Export (t)	NomIm p (\$)	Reallm p (\$)	NomEx p (\$)	RealEx p (\$)	ProdVal (\$int'l)
2014	2095 83.3	2000	46950	43460	502	455	2166018
2015	7602 5.87	6205.1 6	13965	15765	1295	1412	1915020
2016	2152 65.7	3205.0 6	42949	44639	800	730	2114177
2017	6380 97.2	4000	114479	132320	1000	910	2134242
2018	2000 00	4770	45000	41473	2971	1086	2194833
2019	2000 00	25856. 55	45000	41473	4168	5886	2529010
2020	2799 27.2	4750.9 4	54687	58047	268	1081	2489738
2021	1966 26	210.8	51829	40773	169	48	2558218
2022	2065 84	3556.7 7	62799	42838	250	810	2599261
2023	2023	100000	1523.24	25433	20737	185	347
Mean	2469 01	6061.6 98	53073.11	51198.6 7	1269.22 2	1379.77 8	2300057

Table 7. Continued (FAO database, 2025)

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Year	ΔImp (%)	ΔExp (%)	ΔNomImp (\$,%)	$\Delta \text{RealImp}$ (\$,%)	ΔNomExp (\$,%)	$\Delta \text{RealExp}$ (\$,%)	$\Delta \text{ProdVal}$ (%)
2014	0	0	0	0	0	0	0
2015	-63.72	210.258	-70.255	-63.725	157.96	210.32	-11.588
2016	183.14	-48.348	207.54	183.15	-38.223	-48.300	10.39973
2017	196.42	24.8026	166.54	196.42	25	24.657	0.949069
2018	-68.65	19.25	-60.691	-68.657	197.1	19.340	2.838994
2019	0	442.066	0	0	40.289	441.98	15.22562
2020	39.963	-81.625	21.526	39.963	-93.570	-81.634	-1.55286
2021	-29.75	-95.563	-5.2261	-29.758	-36.940	-95.55	2.75049
2022	5.0644	1587.27	21.165	5.0646	47.928	1587.5	1.604359
2023	-99.02	2711.54	-97.574	-40.629	8194.8	-77.160	-99.9867
Mean	29.162	228.679	31.179	29.162	33.283	228.70	2.291935

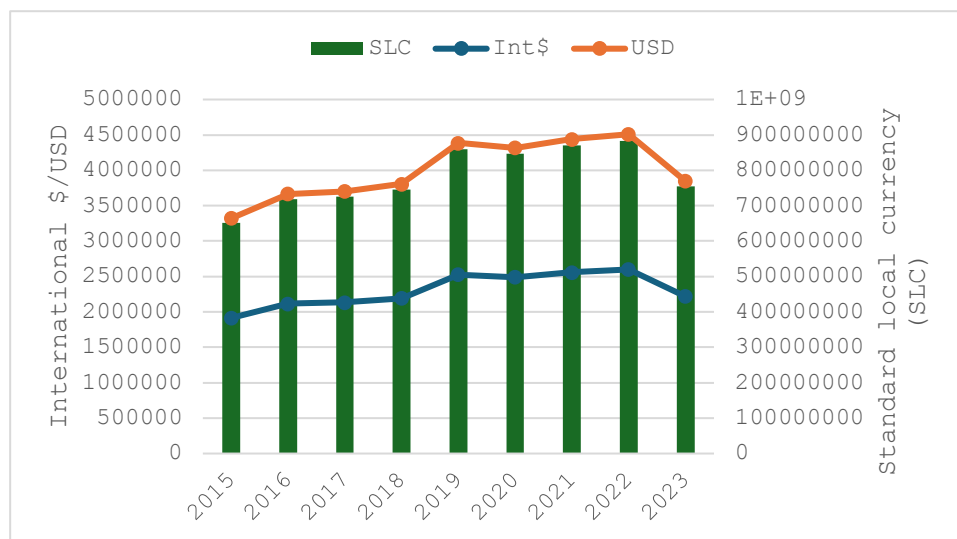


Figure 6a. Gross production value of maize at constant price (2014-2016)

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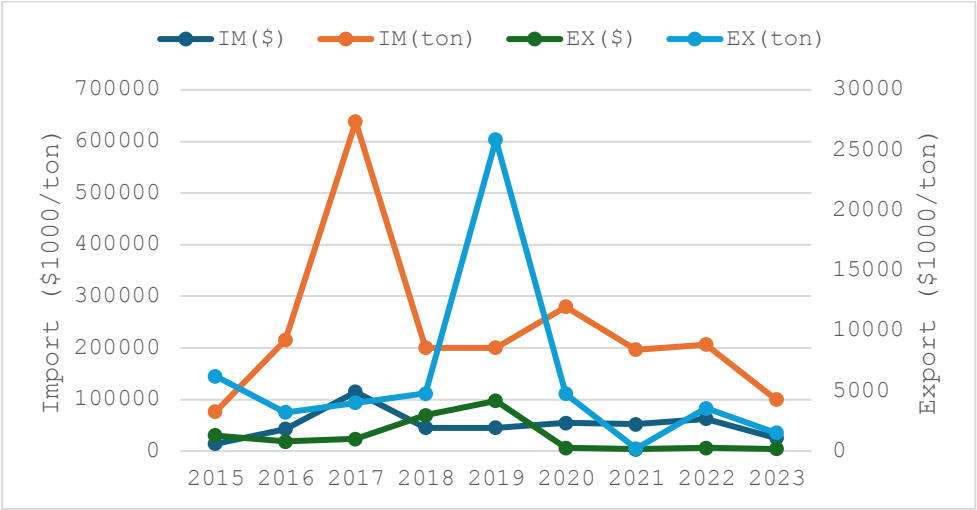


Figure 6b. Import & export of maize (USD nominal & ton)

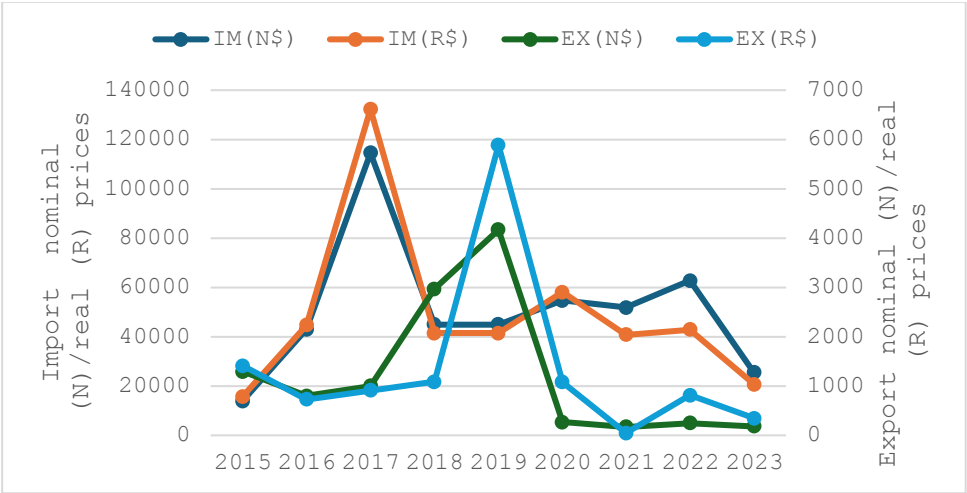


Figure 6c. Import and export values of maize (nominal & real prices)

4.2.2 Productivity-Led Growth Pattern

The most striking feature of maize performance under Buharinomics was its productivity-led growth pattern, which stands in sharp contrast to the area-expansion pattern observed in rice (Figure 7).

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Decomposition analysis reveals that 98.85% of the increase in maize production between the first and second terms was attributable to yield improvements, with only 0.97% coming from area expansion (see Table 9). Mean maize yield increased by 317.11 kg/ha (18.5% increase) from 1,709.55 kg/ha to 2,026.66 kg/ha (Table 8). This substantial yield improvement suggests successful adoption of productivity-enhancing technologies and practices, likely facilitated by the Anchor Borrowers' Programme and other government support initiatives. The minimal area expansion (11,125 hectares, or 0.2% increase) indicates production growth through intensification rather than extensification.

This divergent outcome between maize and rice under the same policy regime highlights the importance of crop-specific value chain structures and production characteristics. Several factors may explain maize's better productivity performance. First, maize has a more commercialized value chain with strong demand from the poultry and feed industries, creating better market incentives for productivity enhancement. Second, maize may be more responsive to improved inputs like fertilizers and hybrid seeds, offering quicker returns on investment. Third, maize production may have benefited from less political interference and more technically-driven support programs compared to rice, which often receives more political attention due to its status as a food security crop.

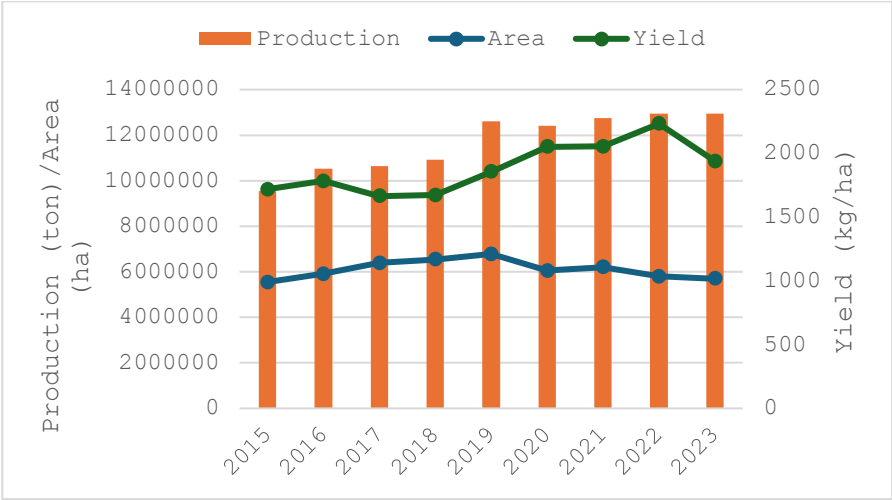


Figure 7. Production trend of maize under Buharinomics

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Table 8. Decomposition analysis of maize production (first term versus second term)
(Authors' own computation, 2025)

Item	Period	Area	Yield	AY
Mean	I	6096436	1709.55	1.04E+10
	II	6107561	2026.66	1.24E+10
Change		11124.55	317.11	1.96E+09
Variance	I	1.84E+10	105.0446	2.87E+16
	II	1.03E+10	211.0194	1.37E+16
Change		-8.1E+09	105.9748	-1.5E+16
Covariance	I	-858663		
	II	-1382439		
Change		-523777		

Table 9. Components of change in average maize production (Authors' own
computation, 2025)

Components of change in average production			
S/No.	Source of Change	Components of Change	Percent
1	Change in Mean yield	1.93E+09	98.8512
2	Change in Mean Area	19017974	0.97243
3	Interaction between Changes in mean area and mean yield	3527706	0.18038
4	Change in yield and area covariance	-523777	0.02678
	Total Change in mean production	1.96E+09	100

4.2.3 Market Integration and Competitiveness

The revealed comparative advantage index for maize showed modest improvement during the period, increasing from 0.01 in 2014 to 0.10 in 2019 before declining to 0 in later years (Table 10 & Figure 8).

While these values remain below 1 (indicating no comparative advantage), the temporary improvement suggests some movement toward competitiveness, possibly reflecting the productivity gains discussed above.

The terms of trade for maize exhibited significant volatility, ranging from 19.80 to 260.04 (Table 10). This volatility reflects the thinness of formal maize trade and the influence of temporary market conditions. The generally higher terms of trade values compared to rice suggest better price realization for maize exports, possibly due to quality advantages or more favorable market structures.

The import market concentration index for maize remained relatively stable throughout the period, fluctuating between 0.35 and 0.42 (Table 10).

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This indicates moderate concentration of import sources, possibly reflecting diversified sourcing strategies by Nigerian importers to ensure supply reliability. The export market concentration index showed similar stability, ranging from 0.32 to 0.38, suggesting consistent market patterns for Nigeria's limited maize exports.

Table 10. Market integration and competitiveness of maize (FAO database, 2025)

Year	ImpDep (%)	ImpConcl dx	ExpConcl dx	RCA	SSR (%)	ToT
2014	0.02	0.36	0.34	0.01	0.98	95.93
2016	0.02	0.39	0.36	0.02	0.98	107.09
2017	0.06	0.37	0.34	0.03	0.94	119.28
2018	0.02	0.42	0.38	0.07	0.98	236.98
2019	0.01	0.35	0.32	0.1	0.99	61.32
2020	0.02	0.35	0.32	0.01	0.98	24.74
2021	0.02	0.39	0.38	0	0.98	260.04
2022	0.02	0.35	0.35	0	0.98	19.8
2023	0.01	0.36	0.34	0	0.99	40.85

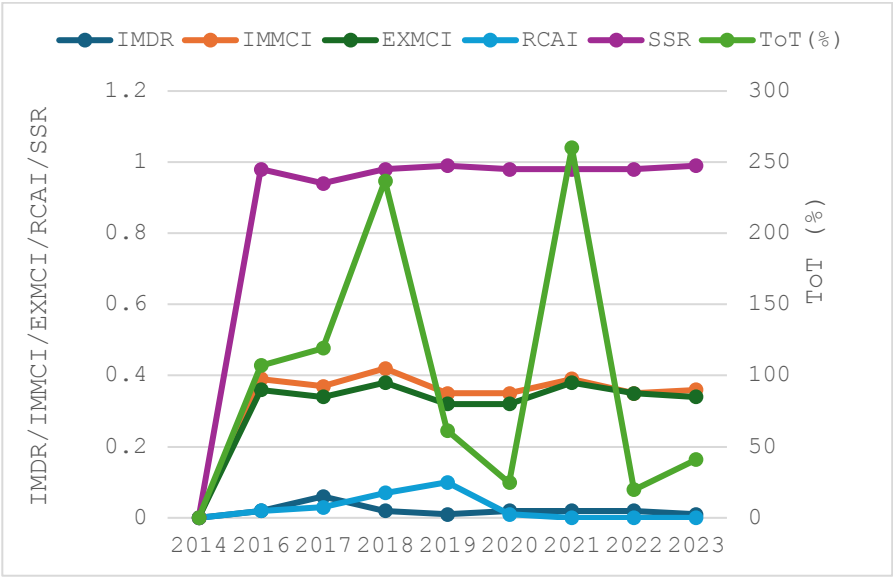


Figure 8. Nigerian trade performance in maize

4.2.4 Production Stability and Risk Management

Maize production demonstrated significantly improved stability under Buharinomics, with production variance decreasing by 1.5E+16 between the first and second terms (Table 8). This enhanced stability reflects better risk management and more consistent production practices in the maize sector.

Analysis of variance components (Table 11) reveals that the reduction in area variance was the largest contributor to improved production stability (-157.63%), indicating more consistent area allocation to maize production. This may reflect better market predictability or more stable farmer expectations regarding maize profitability. Changes in yield variance also contributed positively to stability (-26.25%), suggesting more consistent yield performance, possibly due to improved farming practices or better input access.

The change in area-yield covariance made a positive contribution to variance change (72.76%), indicating that the relationship between area and yield became more stabilizing over time. This contrasts with the negative covariance change observed in rice and suggests more efficient production allocation in maize, with area adjustments responding appropriately to yield expectations.

These stability improvements have important implications for food security and agricultural development. As noted by Ichimi (2024); Fabinin (2022), production stability is crucial for market functioning, investment decisions, and consumption smoothing. The greater stability in maize production likely contributed to more reliable supply for Nigeria's important poultry industry, supporting employment and protein availability.

Table 11. Components of change in variance of maize production under buharinomics
(Authors’ own computation, 2025)

S/N	Components of change in variance of production	
0.	Source of change	Components of change
1	Change in mean yield	-25.9914
2	Change in mean area	0.122601
3	Change in yield Variance	-26.2459
4	Change in area variance	157.6347
5	Interaction between changes in mean yield and mean area	0.040369
6	Change in area yield covariance	72.75907

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7	Interaction between changes in mean area and yield variance	-0.09587
8	Interaction between changes in mean yield and area variance	63.90421
9	Interaction between changes in mean area and yield and change in area-yield covariance	13.65224
10	Change in residual	-155.78
	Total change in variance of production	-1.5E+16

4.3 Agricultural Value Added: Macroeconomic Performance and Sectoral Contributions

4.3.1 Nominal vs. Real Value Added Trends

The analysis of agricultural value added (AVA) reveals important insights about the sector's macroeconomic performance under Buharinomics. In nominal terms, AVA showed volatility but an overall increasing trend, rising from N109.7 trillion in 2014 to a peak of ~~N~~106.3 trillion in 2022 before declining to ~~N~~80.8 trillion in 2023 (Table 12 & Figure 9). The mean nominal AVA across the period was ~~N~~94.6 trillion.

However, when adjusted for inflation, a different picture emerges. Real AVA declined consistently from 2014 to 2017 before showing partial recovery and subsequent stagnation.

The mean real AVA was ~~N~~82.1 trillion, significantly lower than the nominal figure, highlighting the erosive effect of inflation on agricultural sector performance. The percent change in real AVA was negative for more than half of the years under review, with a mean annual change of -0.65% (Table 12).

This stagnation in real terms is particularly concerning given the policy ambitions of Buharinomics. It suggests that despite massive policy intervention and resource allocation, the agricultural sector failed to achieve sustainable productivity growth that would translate into real economic value expansion. This finding aligns with Ebenezer *et al.* (2025) assessments that Nigeria's agricultural growth has largely been driven by area expansion rather than productivity enhancement.

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Table 12. Agriculture value added (FAO database, 2025)

Year	AgVA (Nom \$)	AgVA (Real \$)	AgExpC ropLive (Nom \$)	AgExpC ropLive (Real \$)	AgMerc h/AgExp (Nom \$)	AgMerc h/AgExp (Real \$)	AgShare GDP(%)
2014	109651	100187	141492	129279	1.03E+08	94200675	19.056
2015	98409	89575	130917	119164	50216000	45707871	19.683
2016	81891	71314	142498	124093	33302000	29000805	20.237
2017	75445	63162	177328	148458	44468000	37228414	20.079
2018	85781	75038	173161	151474	60546583	52963580	20.340
2019	99067	87144	157649	138676	62531378	55005703	20.877
2020	98377	84747	147884	127395	35633544	30696734	22.883
2021	96219	79981	174396	144965	46117445	38334696	21.921
2022	106337	87978	162705	134614	63075350	52185260	22.384
2023	80787	73602	193269	176083	57890256	5.65E+08	21.544
Mean	94575	82125	156448	135346	55443367	48369304	20.829

Table 13. Continued (FAO database, 2025)

Year	ΔAgV A (Nom %)	ΔAgV A (Real %)	ΔAgExpC ropLive (Nom %)	ΔAgExpC ropLive (Real %)	ΔAgMerch/Ag Exp (Nom %)	ΔAgMerch/Ag Exp (Real %)
2014	0	0	0	0	0	0
2015	-10.2526	-10.5922	-7.47388	-7.82399	-51.2939	-51.4782
2016	-16.7849	-20.3854	8.845524	4.136128	-33.6825	-36.5518
2017	-7.87121	-11.4308	24.44241	19.63428	33.52952	28.37028
2018	13.69976	18.80105	-2.34949	2.03174	36.15765	42.26655
2019	15.48786	16.13372	-8.95841	-8.44927	3.278129	3.85571
2020	-0.69655	-2.75041	-6.19421	-8.13437	-43.0149	-44.1935
2021	-2.19343	-5.62398	17.9279	13.7916	29.42144	24.882
2022	10.51549	9.99794	-6.70379	-7.14071	36.77113	36.13062
2023	-24.0278	-16.3395	18.78508	30.8059	-8.22048	982.7622
Mean	0.211599	-0.65001	2.170673	0.893935	1.240727	0.364621

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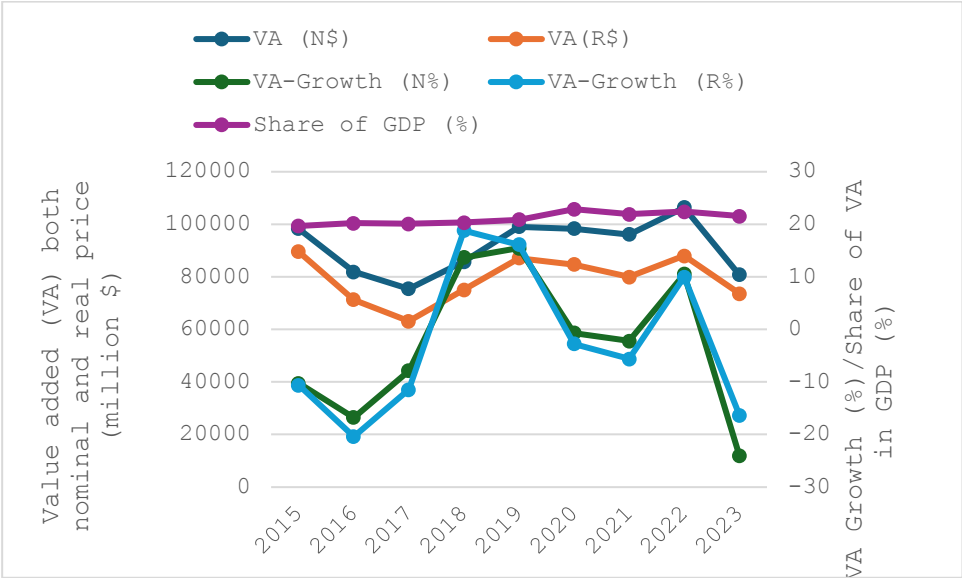


Figure 9. Agriculture value addition

4.3.2 Sectoral Contribution to GDP

The share of agriculture in GDP showed a steady increase from 19.06% in 2014 to 22.38% in 2022 before declining slightly to 21.54% in 2023 (Table 12 & 9). This increasing contribution to GDP is often cited as a success of agricultural policy. However, this interpretation requires caution, as relative GDP shares are influenced by the performance of other sectors as well as agriculture.

During much of the Buharinomics period, Nigeria experienced significant challenges in its oil sector (due to price volatility and production issues) and manufacturing sector (due to infrastructure constraints and foreign exchange challenges). Therefore, the increasing agricultural share may reflect relative stagnation in other sectors rather than exceptional agricultural performance. As noted by the Erhijakpor (2021); Abraham & Jankowska (2025), sectoral GDP shares must be interpreted in the context of overall economic performance.

4.3.3 Agricultural Trade Performance

Agricultural export value showed volatility but overall growth during the period, increasing from \$1.4 billion in 2014 to \$1.9 billion in 2023 in nominal terms, and from \$1.3 billion to \$1.8 billion in real terms (Table 12 & Figure 9). This growth occurred despite the generally inward-looking orientation of Buharinomics, suggesting that some agricultural sub-sectors maintained or enhanced their export potential.

The share of agricultural exports in total merchandise exports fluctuated significantly, ranging from 1.4% to 3.4% (Table 12). This variability reflects the influence of oil export volumes on total export values, as well as changes in agricultural export performance. The generally low share highlights Nigeria's continued dependence on oil exports despite efforts to diversify through agricultural development.

4.4 Agricultural Credit Allocation: Increased Funding with Effectiveness Challenges

4.4.1 Credit Expansion and Sectoral Allocation

Buharinomics achieved remarkable success in directing financial resources to agriculture, a key policy objective.

Credit to agriculture, forestry, and fishing more than doubled in nominal terms, increasing from ₦492.6 billion in 2014 to ₦1.02 trillion in 2023 (Table 13 & Figure 10). The sector's share of total bank credit also increased substantially, from 3.72% to 5.06%, peaking at 6.03% in 2022.

This credit expansion was driven primarily by the Central Bank of Nigeria's aggressive sectoral allocation policies, particularly through the Anchor Borrowers' Programme and other development finance initiatives (Akpan *et al.*, 2025; Nnenna *et al.*, 2025; Aribaba *et al.*, 2024; Abu, 2024). The increasing share of agricultural credit indicates a positive shift in financial resource allocation toward the priority sector, though it remains below the levels needed to transform African agriculture, which the Aigbovo & Edohen (2025); Abiodun & Adewale (2024); Abor *et al.* (2023); Azom & Shaibu (2023); Abdulmajeed *et al.* (2023) estimates at 10-15% of total lending.

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Table 13. Agricultural credit allocation (FAO database, 2025)

Year	TC _n	Total Credit(US\$)	CAFF _n	CAF F_\$	NER _n (US \$)	RER (¥/US \$)	INF (%)	SCAFF C (%)
2014	132 585 0	68897	4926 14.1	2559.82 5	158. 5526	144.8668	9.44 7199	3.71545 6
2015	130 862 0	68001	4493 07.3	2334.78 5	192. 4405	175.1642	9.86 2916	3.43344 2
2016	147 131 1	76455	4801 23.8	2494.92	253. 4923	220.7519	14.8 313	3.26323 7
2017	129 314 3	67197	4339 70.4	2255.08 9	305. 7901	256.0061	19.4 464	3.35593 3
2018	112 795 1	58613	4547 44.3	2363.03 8	306. 0837	267.749	14.3 1739	4.03159 4
2019	116 049 0	60304	5214 95.5	2709.90 5	306. 921	269.983	13.6 8163	4.49375 1
2020	127 547 2	66279	6571 46	3414.80 1	358. 8108	309.0998	16.0 8252	5.15217 8
2021	138 578 4	72011	8287 02.5	4306.27 9	408. 6008	339.6456	20.3 021	5.98002 4
2022	150 526 3	78220	9082 49.8	4719.63 9	425. 9792	352.433	20.8 6813	6.03382 6
2023	201 950 8	104942	1022 700	5314.37 1	625. 1627	569.5694	9.76 0576	5.06410 7
Mean	131 709 8	68441.8 9	5807 06	3017.58 7	301. 8523	259.5222	15.4 2662	4.38438 2

Table 14. Continued (FAO database, 2025)

Year	ΔT C _n (%)	ΔT C \$ (%)	ΔCAFF n (%)	ΔCAF F \$ (%)	ΔNER (¥/US\$%)	ΔRER (¥/US\$%)	ΔΔI F (%)	ΔSC AFF TC - (%)
2014	0	0	0	0	0	0	0	0
2015	- 1.29 95	- 1.30	- 8.79122	- 8.7912 2	21.37327	20.914	4.40 04	- 7.590 2
2016	12.4 32	12.4 3	6.85866 3	6.8586 63	31.72498	26.02567	50.3 74	- 4.957 2
2017	- 12.1 09	- 12.1	-9.612	- 9.6128	20.63095	15.97008	31.1 17	2.840 61
2018	- 12.7 74	- 12.7	4.78693	4.7869 3	0.096007	4.586953	- 26.3 7	20.13 33
2019	2.88 47	2.88 5	14.6788 5	14.678 85	0.273567	0.834345	- 4.44 0	11.46 33

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2020	9.9080	9.908	26.01183	26.01183	16.90655	14.48861	17.548	14.6520
2021	8.6487	8.648	26.10633	26.10633	13.8764	9.882207	26.237	16.0678
2022	8.6217	8.622	9.599013	9.599013	4.25313	3.764906	2.7880	0.89969
2023	5.0641	5.064	5.064107	5.064107	5.064107	5.064107	5.0641	-16.071
Mean	1.8124	1.812	7.737506	7.737506	12.1261	10.71853	11.294	5.94548

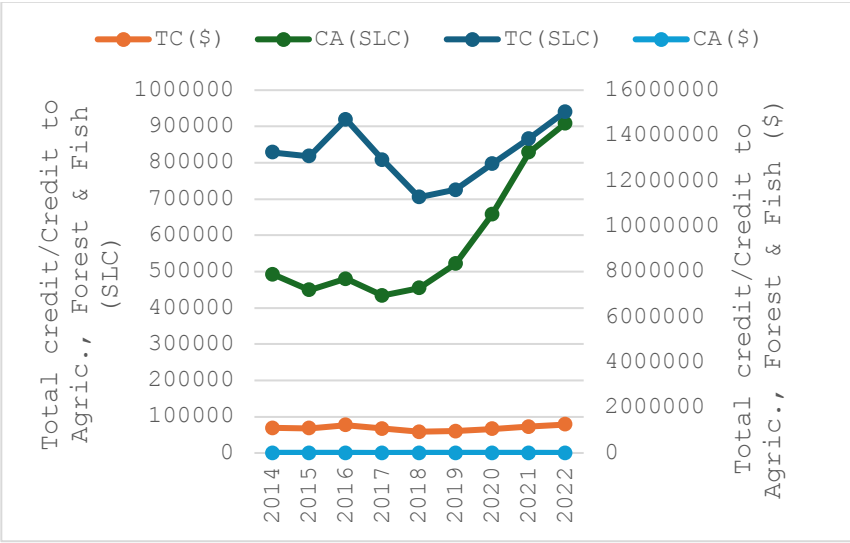


Figure 10. Credit to agriculture

4.4.2 Real Value Erosion through Macroeconomic Challenges

Despite the impressive nominal increase in agricultural credit, its real value was severely undermined by macroeconomic instability. When measured in US dollars (a more stable metric for assessing purchasing power, especially for imported inputs), agricultural credit increased from \$2.56 billion in 2014 to \$5.31 billion in 2023—a significant but less dramatic increase than the nominal naira figures suggest (Table 13 & Figure 11).

The drastic depreciation of the naira (from 158/\$ in 2014 to 625/\$ in 2023) and high inflation (averaging 15.43% annually) significantly eroded the real value of credit extended to farmers. A loan of ₦1 million in 2014 had far more purchasing power than the same ₦1 million loan in 2023, particularly for imported inputs like fertilizers, machinery, and improved seeds.

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This erosion likely diminished the effectiveness of credit interventions in achieving productivity enhancements.

This finding aligns with researches by Ogbonnaya *et al.*(2025); Ali *et al.*(2023); International Monetary Fund (IMF)(No date), who argued that macroeconomic instability, particularly currency volatility, undermined the effectiveness of the CBN's development finance interventions. It highlights the importance of macroeconomic stability as a foundation for effective sectoral policies—a lesson relevant for many developing countries pursuing agricultural transformation.

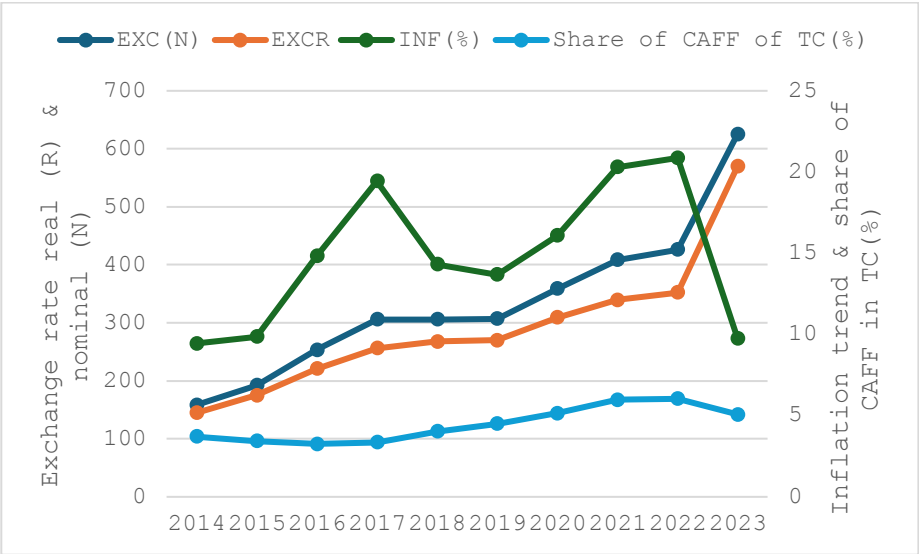


Figure 11. Exchange, inflation trends & share of CAFF in TC

4.4.3 Effectiveness and Efficiency Challenges

The disconnect between massive credit expansion and stagnant real agricultural value added raises important questions about the effectiveness and efficiency of credit allocation. Several factors may explain this discrepancy:

First, as documented by Akighir *et al.*(2021), implementation challenges in programs like the Anchor Borrowers' Programme led to input diversion, delayed delivery, and suboptimal targeting.

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Credit and inputs did not always reach the most productive farmers or were not used for their intended purposes, diluting their impact on sector-wide productivity. Second, the focus on quantitative credit allocation targets may have overshadowed attention to credit quality and productive use.

As noted in Sall (2022) assessments, increasing loan volumes is necessary but insufficient for agricultural transformation; attention must also be paid to ensuring that credit is used for productivity-enhancing investments rather than consumption or less productive purposes.

Third, the structure of agricultural credit may have favored area expansion over yield enhancement.

The decomposition analysis showing extensive growth in rice and productivity-led growth in maize suggests that credit effectiveness varied significantly by crop, possibly due to differences in value chain structures, farmer capabilities, or implementation approaches.

5. DISCUSSION: POLICY IMPLICATIONS AND THEORETICAL CONTRIBUTIONS

5.1 Theoretical Implications For Agricultural Development Policy

The experience of Buharinomics offers important theoretical insights for agricultural development policy, particularly regarding the contemporary relevance of import substitution industrialization in agriculture. The policy achieved its primary objective of reducing import dependency, particularly for rice, demonstrating that determined government intervention can reshape agricultural trade patterns. However, the failure to develop competitive export sectors and the productivity challenges in protected industries raise questions about the sustainability of pure import substitution approaches.

These findings align with the "conditional industrial policy" framework advanced by Rodrik (2008), which emphasizes that protection and subsidies should be temporary and conditional on performance metrics like productivity growth. The Nigerian experience suggests that without such conditions, protection can create permanent dependencies rather than transitional support for industry maturation.

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The divergent outcomes for rice and maize also highlight the importance of value chain-specific factors in mediating policy impacts. This supports the "value chain approach" to agricultural development advocated by Horton *et al.* (2023); Tondel *et al.* (2020) and others, which emphasizes tailored interventions based on specific value chain characteristics, constraints, and opportunities.

5.2 Practical Implications for Policy Design

Several practical implications for agricultural policy design emerge from this analysis:

First, the importance of productivity-focused interventions: While area expansion can contribute to short-term production increases, sustainable agricultural growth requires yield improvements through technology adoption, improved inputs, and better farming practices. Policies should prioritize productivity enhancement rather than mere production volume targets.

Second, the need for macroeconomic stability: The erosion of credit effectiveness through inflation and currency depreciation highlights that sectoral policies cannot succeed without a stable macroeconomic environment. Agricultural transformation requires coordinated macroeconomic and sectoral policies.

Third, the value of differentiated approaches: The divergent outcomes for rice and maize demonstrate that uniform policies produce different results across crops. Policy design should recognize these differences and tailor interventions to specific value chain characteristics.

Fourth, the importance of monitoring and evaluation: The disconnect between policy intentions and outcomes in areas like productivity highlights the need for robust M&E systems to track not just production volumes but also efficiency indicators like yield, input use efficiency, and economic viability.

5.3 Comparative Perspectives and Regional Implications

The Nigerian experience with Buharinomics offers valuable lessons for other African countries pursuing agricultural transformation through similar policies.

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Countries like Ethiopia, Rwanda, and Ghana have implemented various forms of agricultural protection and support policies with mixed results (Pernechele *et al.*, 2021; Badiane *et al.*, 2020).

The Nigerian case highlights both the potential and limitations of such approaches. The dramatic import reduction shows that determined policy action can reshape agricultural markets, but the productivity challenges illustrate the difficulties of transitioning from protection to competitiveness. This suggests that African countries should consider balanced approaches that combine strategic protection with strong productivity enhancement components and clear pathways to eventual market liberalization.

Regional integration also emerges as an important consideration. Nigeria's border closure affected neighboring countries, particularly Benin Republic, which had developed significant re-export economies centered on Nigerian demand (Gao *et al.*, 2024; Williams, 2022; Ajoje & Adegboyoye, 2022). This highlights the need for coordinated agricultural policies within regional economic communities to minimize trade disruptions and leverage comparative advantages across countries.

The Buharinomics agricultural policy regime produced complex, multifaceted outcomes that defy simple characterization as success or failure. The policy achieved its primary objective of import substitution, particularly for rice, demonstrating that determined government intervention can reshape agricultural trade patterns. However, this achievement came with significant costs and limitations, including productivity challenges in protected sectors, macroeconomic vulnerability

6. CONCLUSIONS, RECOMMENDATIONS AND POLICY IMPLICATIONS

6.1 Conclusions

The analysis of Buharinomics' impact on Nigeria's agricultural sector reveals a complex tapestry of notable achievements, significant trade-offs, and unintended consequences. The policy regime successfully achieved its primary objective of import substitution, particularly for rice, where imports declined by over 99% between 2014 and 2023.

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This demonstrated that determined government intervention can dramatically reshape agricultural trade patterns and stimulate domestic production in the short to medium term.

However, this success came with substantial costs and limitations. The growth patterns diverged significantly between key commodities. Rice production grew primarily through extensive means (area expansion contributing 180.75% of production growth), masking a concerning yield decline of -105.815 kg/ha that negatively contributed -71.35% to production growth. In contrast, maize production demonstrated productivity-led growth, with yield improvements accounting for 98.85% of production increases. This divergence highlights the critical importance of crop-specific factors and value chain structures in mediating policy impacts.

The policy failed to stimulate sustainable competitiveness. Despite achieving statistical self-sufficiency for rice, the sector did not develop a sustained revealed comparative advantage, with the RCA index declining to 0.02 by 2023. This suggests that protection alone cannot create internationally competitive agricultural sectors without complementary investments in productivity and efficiency.

Macroeconomic factors significantly mediated policy effectiveness. High inflation (averaging 15.43%) and currency depreciation (from 158 to 625 Naira/USD) eroded the real value of agricultural credit and inputs, undermining the potential impacts of increased nominal funding. This highlights the importance of macroeconomic stability as a foundation for effective sectoral policies.

The study also reveals concerning sustainability implications. The strong negative area-yield covariance in rice production suggests expansion onto marginal lands with higher climate vulnerability and lower inherent fertility, raising questions about the long-term environmental sustainability of the production model.

6.2 Recommendations

Based on these findings, the study offers the following evidence-based recommendations:

Productivity Enhancement Recommendations

- **Shift from Blanket Input Subsidies to Targeted Productivity Programs:** Replace universal input distribution with targeted programs that reward demonstrated productivity improvements and sustainable practices.
- **Strengthen Agricultural Knowledge Systems:** Increase investment in agricultural R&D from the current 0.4% to the recommended 1% of agricultural GDP, with focus on developing climate-resilient varieties and sustainable intensification practices.
- **Promote Precision Agriculture Technologies:** Encourage adoption of climate-smart technologies through targeted subsidies, demonstration farms, and capacity building for extension agents and farmers.

Trade Policy Recommendations

- **Adopt Smart, Time-Bound Protection:** Replace indefinite protection with time-bound, performance-based import restrictions that are gradually reduced as domestic efficiency improves.
- **Develop Regional Export Niches:** Identify and support specific regional export opportunities for Nigerian agricultural products, particularly within the ECOWAS trade zone, building on emerging maize export potential.
- **Strengthen Border Management Capacity:** Invest in modern border surveillance and management systems to reduce smuggling while facilitating legitimate trade.

Financial Sector Recommendations

- **Index Agricultural Credit to Inflation:** Develop inflation-indexed agricultural credit products to preserve the real value of loans and investments.

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- **Diversify Agricultural Financial Products:** Expand beyond credit to include insurance, warehouse receipts, and other risk management tools that address the comprehensive financial needs of farmers.
- **Strengthen Credit Targeting Mechanisms:** Improve targeting of agricultural credit through digital platforms, farmer registries, and needs-based assessment to reduce diversion and improve effectiveness.

Institutional Recommendations

- **Enhance Policy Consistency and Credibility:** Establish multi-party agricultural policy frameworks that ensure continuity across political administrations to provide stability for long-term investments.
- **Strengthen Monitoring and Evaluation Systems:** Develop robust M&E systems that track not just production volumes but also productivity, sustainability, and income indicators.
- **Promote Value Chain Integration:** Facilitate stronger integration between producers, processors, and marketers to reduce post-harvest losses and improve value capture.

6.3 Policy Implications

The findings of this study have several important implications for agricultural policy design in Nigeria and similar developing economies:

Theoretical Implications

The results challenge simplistic applications of import substitution theory, demonstrating that protection without complementary productivity enhancement produces limited sustainable benefits. The findings support conditional industrial policy approaches that combine strategic protection with clear performance metrics and phase-out timelines. The divergent outcomes for different crops also highlight the importance of crop-specific policy design rather than one-size-fits-all approaches.

Practical Implementation Implications

The research demonstrates that policy effectiveness depends critically on implementation quality and contextual factors. This suggests the need for flexible implementation frameworks that can adapt to local conditions and crop-specific requirements. The importance of macroeconomic stability highlights the need for better policy coordination between agricultural, fiscal, and monetary authorities.

Sustainability Implications

The observed pattern of area expansion rather than yield improvement raises important sustainability concerns. Future policies must integrate environmental sustainability as a core objective rather than an afterthought, promoting production systems that enhance rather than degrade natural resources. This requires integrating climate resilience and environmental indicators into agricultural policy frameworks.

Regional Integration Implications

The Nigerian experience highlights both the challenges and opportunities of agricultural trade within regional economic communities.

Rather than unilateral border closures, future policies should leverage regional comparative advantages through coordinated agricultural development strategies that benefit multiple countries while ensuring food security.

In conclusion, while Buharinomics achieved its immediate objective of import reduction, it fell short of triggering sustainable agricultural transformation. Future policies must balance protection with productivity enhancement, combine sectoral interventions with macroeconomic stability, and integrate environmental sustainability as a core objective. The lessons from Nigeria's experience offer valuable insights for other developing countries seeking to transform their agricultural sectors in an increasingly challenging global environment.

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CHAPTER 3
**HARNESSING WEALTH, AVOIDING THE CURSE:
RETHINKING GOVERNANCE IN RESOURCE-RICH
ECONOMIES**

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INTRODUCTION

Africa is richly endowed with a wide spectrum of natural resources, including oil, natural gas, gold, diamonds, cobalt, coltan, copper, bauxite, manganese, platinum, and uranium, alongside fertile agricultural land, extensive forests, and abundant freshwater reserves. This wealth has positioned the continent as a central player in the global economy, particularly in fueling industrialization, digital technologies, and the green energy transition. For decades, extractive industries have generated substantial revenues, foreign exchange, and employment opportunities. For instance, hydrocarbons account for more than 90 percent of Nigeria's export earnings, while the Democratic Republic of Congo (DRC) produces over 70 percent of the world's cobalt supply—an indispensable input for electric vehicle batteries and renewable energy technologies. Similarly, countries such as South Africa, Botswana, and Angola have become major hubs in global diamond markets, while Zambia and Ghana remain critical suppliers of copper and gold.

However, the coexistence of immense natural wealth with widespread poverty and underdevelopment illustrates what scholars have termed the “paradox of plenty” or the “resource curse.” Rather than serving as a foundation for prosperity, resource abundance has often contributed to distorted economic structures, overdependence on volatile commodity markets, rent-seeking behavior, and weak institutional capacity. Resource-rich states such as Nigeria, Angola, and Equatorial Guinea continue to struggle with entrenched inequality, corruption, and poor social indicators, despite decades of oil and gas revenues. In contrast, some resource-scarce countries, such as Mauritius and Rwanda, have demonstrated comparatively higher levels of economic diversification and governance effectiveness.

The developmental dilemma associated with resource wealth extends beyond economics. The exploitation of oil, gas, and minerals has frequently exacerbated environmental degradation, displacement of local communities, and violent conflicts. The Niger Delta's oil spills, the DRC's “conflict minerals,” and land degradation from artisanal mining are emblematic of the ecological and social costs of poorly managed resource extraction.

Moreover, global climate change imperatives are now reshaping debates on Africa's development trajectory, as the continent faces growing pressure to align its resource exploitation strategies with low-carbon pathways.

The purpose of this chapter is therefore threefold. First, it seeks to critically examine the structural and institutional dynamics that have shaped the relationship between Africa's extractive industries, governance frameworks, and socio-economic outcomes. Second, it explores the enduring challenges of natural resource management, including corruption, lack of transparency, environmental unsustainability, and overdependence on primary commodity exports. Third, it highlights emerging opportunities that could help turn Africa's natural resource wealth into a foundation for inclusive and sustainable growth. These opportunities include renewable energy development, value addition and local beneficiation, regional economic integration through frameworks such as the African Continental Free Trade Area (AfCFTA), and the adoption of digital technologies—artificial intelligence, blockchain, and satellite monitoring—for improved governance and accountability.

By addressing both the pitfalls and the prospects, this chapter positions Africa's natural resource wealth within a broader debate on economic transformation and long-term resilience. It argues that while the resource curse remains a pressing concern, Africa is at a historic crossroads: with strategic governance reforms, sustainable exploitation practices, and regional cooperation, the continent can reframe its natural endowments from a source of vulnerability into a driver of inclusive, equitable, and future-ready development.

1. THEORETICAL PERSPECTIVES

The Resource Curse Hypothesis

The “resource curse” hypothesis argues that countries rich in natural resources often experience slower economic growth, weaker democratic institutions, and higher rates of conflict than resource-poor nations. This paradox arises due to several interrelated mechanisms:

- **Revenue dependence:** Over-reliance on natural resource rents often discourages economic diversification.

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- **Weak institutions:** Resource rents can fuel corruption and patronage networks, undermining governance.
- **Conflict risk:** Competition for resource rents may lead to political instability and civil wars, as seen in Sierra Leone's diamond-fueled conflict.

Dutch Disease

Another economic theory linked to resource dependence is “Dutch disease.” It occurs when large inflows of foreign currency from natural resource exports lead to currency appreciation, making non-resource sectors (like manufacturing and agriculture) less competitive. This economic distortion results in a narrow export base and overdependence on volatile commodity prices. Institutions are central to how resources shape development outcomes. Strong governance, transparent regulatory frameworks, and effective rule of law can turn natural wealth into a driver of sustainable growth. Conversely, weak institutions enable corruption, rent-seeking behavior, and resource mismanagement. Countries such as Botswana, which successfully managed diamond revenues through sound governance, demonstrate how institutional quality can mitigate the resource curse.

Development Economics and Sustainable Growth

From a development economics perspective, natural resource wealth can be a catalyst for structural transformation if invested wisely in human capital, infrastructure, and technology. However, short-term consumption of resource rents without reinvestment undermines long-term growth. Sustainable resource management thus requires balancing immediate fiscal needs with investments in future generations.

2. NATURAL RESOURCES AND ECONOMIC DEVELOPMENT IN AFRICA

Contribution of Extractive Industries to African Economies

Natural resources play a central role in Africa's economic landscape. The continent accounts for around 30% of the world's mineral reserves,

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12% of global oil production, and 8% of natural gas reserves. In many countries, extractive industries are the backbone of national economies:

- **Nigeria:** Oil contributes nearly 90% of export earnings and about 60% of government revenue.
- **Angola:** Oil exports account for over one-third of GDP, making the economy highly vulnerable to fluctuations in global oil prices.
- **Democratic Republic of Congo (DRC):** The country is the world's largest producer of cobalt (over 70% of global supply), essential for batteries and renewable technologies.
- **South Africa:** Rich in gold, platinum, and diamonds, South Africa's mining industry has historically been a key driver of growth, employment, and infrastructure development.

While these industries generate substantial revenues, they also create economic volatility due to fluctuating global commodity prices. Overdependence on extractive industries undermines diversification into sectors like agriculture, manufacturing, and services, which are crucial for long-term resilience.

Environmental and Social Costs of Resource Extraction

Resource extraction in Africa often comes with high environmental and social costs:

- **Environmental degradation:** Oil spills in the Niger Delta have caused widespread ecological damage, polluting water sources and destroying livelihoods dependent on fishing and farming.
- **Deforestation and land degradation:** Mining activities in Ghana and Liberia have led to large-scale deforestation and soil erosion.
- **Water contamination:** Gold mining in Tanzania and South Africa has been linked to toxic waste discharge, affecting water security.
- **Displacement of communities:** Extractive projects frequently result in forced displacement of indigenous and rural communities, leading to social unrest and loss of cultural heritage.

These negative externalities highlight the urgent need for sustainable resource governance that balances economic gains with environmental protection and social equity.

2.1 Case Studies in African Resource Economies

Nigeria: Oil Dependency and Economic Volatility

Nigeria is Africa's largest oil producer, yet the country faces chronic economic instability, poverty, and governance challenges. Despite oil wealth, over 40% of Nigerians live below the poverty line. The mismanagement of oil revenues, corruption, and reliance on imports of refined petroleum highlight the dangers of a mono-resource economy.

Angola: Post-War Reconstruction and Oil Dependency

Following decades of civil war, Angola used oil revenues to finance reconstruction. However, oil dependency exposed the country to sharp economic downturns when global oil prices fell in 2014, revealing the fragility of growth reliant on a single resource.

Democratic Republic of Congo (DRC): Conflict Minerals

The DRC's vast mineral wealth—including cobalt, coltan, and diamonds—has been both a blessing and a curse. While these resources are vital for global industries, competition over their control has fueled conflict, exploitation, and weak state institutions.

Botswana: A Resource Success Story

Unlike many resource-rich African countries, Botswana effectively managed its diamond wealth through strong governance, transparency, and reinvestment in infrastructure, education, and healthcare. Today, Botswana is often cited as a model of how natural resources can drive sustained development when coupled with good institutions.

Lessons Learned

The African experience demonstrates that natural resources alone cannot guarantee economic prosperity. Countries that have failed to diversify remain vulnerable to external shocks, while those with strong governance frameworks—like Botswana—have been able to convert resource wealth into long-term development gains. This underscores the central role of institutions, transparency, and policy choices in shaping economic outcomes.

3. GOVERNANCE AND INSTITUTIONAL CHALLENGES

Weak Governance and Corruption

One of the most pressing challenges in Africa's resource economies is the weakness of governance institutions. Resource rents, instead of being reinvested into productive sectors, are often diverted through corruption, patronage networks, and rent-seeking behaviors. Transparency International's Corruption Perceptions Index consistently ranks several resource-rich African countries—including Nigeria, Angola, and the Democratic Republic of Congo—among the most corrupt globally.

Corruption distorts budget allocations, undermines public trust, and prevents revenues from reaching social sectors such as health, education, and infrastructure. This vicious cycle contributes to the persistence of poverty and inequality despite resource abundance.

Legal and Regulatory Frameworks

Many African states suffer from weak or outdated legal frameworks governing natural resource exploitation. Licensing processes are often opaque, regulatory agencies underfunded, and enforcement mechanisms ineffective. As a result, multinational corporations may negotiate contracts that heavily favor corporate profits at the expense of host nations.

For example:

- In the DRC, poorly regulated artisanal mining operations have fueled both child labor and unsafe working conditions.
- In Zambia, frequent changes to mining taxation policies have created instability, discouraging long-term investments while failing to maximize government revenues.

Robust legal and regulatory frameworks are essential to balance investor interests with national development goals and environmental protection.

Multinational Corporations and Unequal Bargaining Power

Multinational corporations dominate Africa's extractive industries, often holding significant leverage in negotiations with governments.

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The asymmetry of expertise, capital, and bargaining power can result in contracts that offer minimal benefits to local economies. In some cases, corporations engage in transfer pricing and tax evasion, further reducing government revenue.

While foreign direct investment (FDI) is crucial for resource exploitation, the absence of strong institutions means that resource rents frequently flow outward, with limited local value addition or industrial linkages.

Transparency and Accountability Initiatives

To address governance challenges, Africa has seen the emergence of several transparency and accountability frameworks:

- **Extractive Industries Transparency Initiative (EITI):** Encourages resource-rich countries to disclose revenues, contracts, and payments from extractive industries. Nigeria, Ghana, and Tanzania are active members.
- **African Mining Vision (AMV):** An African Union framework that emphasizes resource-based industrialization and sustainable development.
- **Civil society engagement:** Local NGOs and community-based organizations have become key advocates for transparency and environmental justice in resource projects.

Although these initiatives have improved awareness and disclosure, enforcement remains uneven, and political will is often lacking.

The Resource–Conflict Nexus

Weak governance also fuels the intersection of resources and conflict. In countries such as Sierra Leone (diamonds), Liberia (timber), and the DRC (coltan, gold), natural resources have directly financed armed groups and prolonged civil wars. “Conflict minerals” continue to be a major concern, as illicit trade networks bypass official state systems, enriching warlords while depriving governments of legitimate revenues.

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The challenge is not only to regulate extraction but also to ensure that revenues are channeled toward peacebuilding and social development rather than exacerbating instability.

4. THE RESOURCE CURSE IN PRACTICE

Economic Volatility and Overdependence

Resource dependence exposes African economies to external shocks from fluctuating commodity prices. When prices rise, revenues surge, but downturns result in severe fiscal crises. For instance, Nigeria and Angola both experienced rapid economic contractions following the 2014 collapse in global oil prices. The lack of economic diversification means these countries remain highly vulnerable to external markets.

By contrast, **Norway** demonstrates how resource wealth can be managed successfully. Oil revenues were invested in the Government Pension Fund Global (sovereign wealth fund), which emphasizes saving, diversification, and intergenerational equity. This approach shielded the Norwegian economy from volatility and ensured long-term sustainability. The contrast illustrates how strong institutions and prudent fiscal policies can prevent the resource curse.

Inequality and Exclusion

In many African nations, resource wealth benefits a small elite rather than the wider population. This has fueled social inequality and grievances. For example, in the Niger Delta of Nigeria, local communities suffer environmental degradation from oil extraction but receive little compensation or development support. Such exclusion has contributed to social unrest, militancy, and violence against oil companies.

Comparatively, Venezuela—despite vast oil reserves—provides another cautionary tale. Excessive dependence on oil revenues, combined with poor governance and mismanagement, led to hyperinflation, economic collapse, and social inequality. Like many African states, Venezuela illustrates how resource rents, if not reinvested productively, can destabilize an economy.

Conflict and Political Instability

Natural resources have been directly linked to conflict in Africa, reinforcing the resource curse. The diamond-fueled civil war in Sierra Leone, the timber wars in Liberia, and the mineral conflicts in the Democratic Republic of Congo (DRC) are emblematic examples. The presence of high-value, easily lootable resources incentivizes armed groups to prolong conflict for profit. However, the example of Botswana challenges this narrative. Through transparent management of diamond revenues, Botswana avoided resource-driven conflict and instead invested in education, healthcare, and infrastructure.

The country demonstrates that the resource curse is not inevitable—it is mediated by governance quality and institutional strength. Dutch disease has undermined the competitiveness of non-resource sectors in Africa. In oil-rich Nigeria and Angola, agriculture and manufacturing were neglected as resource revenues led to currency appreciation. This overdependence created jobless growth, where revenues increased but employment opportunities remained limited.

Conversely, countries like Chile (copper) and Malaysia (oil and palm oil) managed to diversify their economies by investing resource rents into industrialization and value-added sectors. Their experiences highlight the importance of deliberate policies that transform short-term rents into long-term productive capacity.

Lessons from Comparative Experiences

The African experience of the resource curse is not unique, but its persistence reflects deeper structural weaknesses: fragile institutions, weak governance, and limited diversification. Comparative global examples demonstrate two critical insights:

- **Resource wealth is not destiny**—the resource curse can be avoided with strong governance, fiscal prudence, and investment in human capital.
- **Policy choices matter**—countries that deliberately reinvest resource rents into diversified economies, such as Norway, Botswana, and Chile, provide models for African states.

5. MITIGATION STRATEGIES

Strengthening Transparency and Accountability

Transparency is the cornerstone of effective resource governance. By ensuring that revenues, contracts, and licensing agreements are disclosed, citizens and civil society organizations can hold governments accountable.

- **Extractive Industries Transparency Initiative (EITI):** Countries like Nigeria and Ghana have adopted EITI standards, improving disclosure of payments and contracts.
- **Open Contracting and Beneficial Ownership Registries:** Publishing contracts and identifying ultimate beneficiaries of resource deals can reduce corruption and illicit financial flows.
- **Civil Society Engagement:** Empowering local organizations to monitor resource projects strengthens accountability at the grassroots level.

Community Engagement and Benefit Sharing

Resource projects often displace communities or degrade local environments. Meaningful community engagement ensures that affected populations receive a fair share of benefits.

- **Local Content Policies:** Mandating that companies employ local workers and source materials locally.
- **Community Development Agreements:** Mining projects in countries like Ghana and Tanzania increasingly involve formal agreements with host communities for schools, clinics, and infrastructure.
- **Social and Environmental Impact Assessments (SEIA):** Strengthening regulatory requirements for impact assessments before projects are approved.

Economic Diversification Beyond Resources

Reducing dependency on extractive industries is critical to breaking the resource curse.

- **Agriculture:** Investing in agribusiness and food value chains can create jobs and enhance food security.

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- **Manufacturing and Industrialization:** Developing downstream industries (e.g., oil refining, mineral processing) adds value locally. For instance, Botswana's diamond cutting industry generates more employment than raw exports alone.
- **Services Sector:** Expanding finance, ICT, and tourism can buffer against resource price volatility.

Sovereign Wealth Funds and Fiscal Stabilization

Resource revenues should be managed through fiscal stabilization mechanisms that promote intergenerational equity.

- **Sovereign Wealth Funds (SWFs):** Examples include Nigeria's Sovereign Investment Authority (NSIA) and Angola's Fundo Soberano de Angola (FSDEA). However, these funds require transparency and strong governance to succeed.
- **Fiscal Rules:** Establishing clear rules on how much revenue can be spent vs. saved helps prevent overspending during boom periods.
- **Long-Term Investment:** Allocating resource rents toward infrastructure, education, and technology creates foundations for sustained growth.

Regional Integration and Trade Cooperation

Africa's regional frameworks offer opportunities to manage resources collectively and promote shared prosperity.

- **African Continental Free Trade Area (AfCFTA):** By lowering trade barriers, AfCFTA can stimulate intra-African trade in resource-based products and services, reducing dependence on external markets.
- **African Mining Vision (AMV):** Adopted by the African Union, AMV emphasizes resource-based industrialization and beneficiation.
- **Cross-Border Resource Management:** Cooperative management of transboundary resources (e.g., Nile River Basin, West African mineral corridors) can prevent conflict and enhance regional stability.

Transitioning Toward Green and Sustainable Resource Use

The global shift toward renewable energy and sustainability presents both risks and opportunities for Africa.

- **Critical Minerals for Green Technologies:** Africa's reserves of cobalt, lithium, and rare earths position it strategically in the green energy transition. Ensuring responsible and transparent mining practices is vital.
- **Investing in Renewable Energy:** Harnessing solar, wind, and hydro resources can diversify energy systems, reduce fossil fuel dependence, and create green jobs.
- **Environmental Governance:** Strengthening environmental laws and adopting circular economy practices can ensure long-term ecological sustainability.

Institutional Reforms and Capacity Building

Lasting change requires strong institutions.

- **Judicial and Regulatory Strengthening:** Independent courts and regulators can enforce contracts and environmental protections.
- **Capacity Building:** Training policymakers, negotiators, and regulatory staff to manage complex extractive contracts ensures better outcomes.
- **Anti-Corruption Mechanisms:** Strengthening audit institutions and empowering anti-graft agencies are essential for limiting rent-seeking behaviors.

6. EMERGING OPPORTUNITIES

Renewable Energy and Sustainable Resource Exploitation

Africa possesses abundant renewable energy resources, including solar, wind, hydro, and geothermal power. With some of the world's highest solar irradiation levels, particularly in the Sahara and Sahel, solar energy could drastically reduce energy poverty while lowering dependence on fossil fuels. Expanding renewable energy infrastructure can also help African nations power resource-processing industries sustainably, reducing carbon footprints and enhancing export competitiveness. Moreover, tapping into green hydrogen and bioenergy presents opportunities for both domestic use and export to energy-deficient regions such as Europe.

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Value Addition and Local Beneficiation

Traditionally, African economies have been trapped in the “raw material export” cycle, exporting crude oil, unprocessed minerals, and agricultural commodities. This has limited industrial growth and job creation. A major opportunity lies in **domestic value addition**—processing raw materials locally before export. For instance, refining bauxite into aluminum, cutting and polishing diamonds locally, or processing cocoa into chocolate could generate significantly higher revenues. Governments are increasingly introducing policies mandating local beneficiation, which in turn supports skills transfer, industrialization, and broader economic linkages.

Regional Integration and Trade Agreements (AfCFTA)

The **African Continental Free Trade Area (AfCFTA)** represents a historic opportunity to deepen regional trade and economic integration. By reducing tariffs and harmonizing trade regulations, AfCFTA can create a unified market of 1.4 billion people. For resource sectors, this means countries can pool infrastructure, build regional value chains, and strengthen bargaining power in global markets. For example, collaborative oil refining hubs or shared mineral processing centers could reduce costs and increase African countries’ ability to negotiate better trade terms.

Technological Innovation in Mining, Oil, and Agriculture

Emerging technologies are transforming resource extraction and management. Artificial intelligence (AI) and machine learning can optimize mining operations, improve predictive maintenance, and enhance exploration. Blockchain technologies hold promise in ensuring transparency in mineral supply chains, reducing corruption, and ensuring compliance with ethical sourcing standards. In agriculture, precision farming and digital platforms can enhance productivity and reduce waste. Leveraging these technologies positions Africa to leapfrog traditional inefficiencies and align with global sustainability standards.

7. POLICY PERSPECTIVES AND RECOMMENDATIONS

Enhancing Institutional Capacity

Effective resource management requires strong governance institutions. African states must strengthen regulatory bodies, improve contract negotiation capacities, and ensure that resource revenues are managed transparently. Establishing sovereign wealth funds (like Nigeria's Excess Crude Account or Botswana's diamond fund) could help stabilize economies during commodity price fluctuations.

Promoting Sustainable and Inclusive Growth

Resource wealth must translate into broad-based benefits. Policies should focus on channeling revenues into healthcare, education, and infrastructure development, ensuring that local communities in resource-rich regions are not marginalized. Inclusive growth also requires supporting small-scale miners and farmers with access to finance, technology, and training.

Balancing Environmental Sustainability with Economic Goals

Africa faces a dual challenge: leveraging resources for development while safeguarding fragile ecosystems. Environmental impact assessments, stricter regulations, and incentives for clean technologies should be prioritized. Furthermore, aligning with the Paris Agreement and global green finance mechanisms can attract investment into sustainable industries while reducing ecological degradation.

Building Resilience Against Commodity Price Shocks

Overdependence on commodities exposes African economies to volatility in global markets. Diversifying export bases, building fiscal buffers, and promoting intra-African trade are critical strategies. Establishing regional stabilization funds could also help cushion economies during downturns, reducing vulnerability to external shocks.

CONCLUSION

The analysis of Africa's natural resource management highlights a paradox: while the continent is endowed with immense mineral, energy, and agricultural wealth, the persistent challenges of weak governance, dependence on raw commodity exports, and environmental degradation have hindered the translation of resource abundance into broad-based prosperity. The evidence clearly suggests that natural resources alone cannot guarantee economic development; rather, the way in which they are governed, exploited, and integrated into the wider economy determines their developmental impact.

Moving forward, Africa's path lies in transforming this resource endowment into an engine of inclusive growth. This requires not only harnessing traditional extractive industries more effectively but also embracing new frontiers of opportunity. The expansion of renewable energy, local beneficiation, and intra-African trade under AfCFTA provides unprecedented avenues for structural transformation. Furthermore, the integration of digital technologies—such as artificial intelligence, blockchain, and satellite monitoring—can enhance transparency, efficiency, and accountability in resource governance, thereby reducing the risks of corruption and illicit financial flows.

At the same time, it is essential to recognize that development cannot be pursued at the expense of environmental sustainability or intergenerational equity. Resource exploitation must be balanced with climate goals, community participation, and resilience-building against global commodity shocks. Institutional strengthening remains the bedrock of this transformation: independent regulatory bodies, transparent fiscal management, and participatory governance mechanisms will be indispensable in aligning resource wealth with long-term development outcomes.

In essence, Africa stands at a crossroads. One path risks perpetuating the “resource curse” through continued reliance on volatile commodity exports and extractive practices that marginalize communities and degrade the environment. The other path offers a chance to reframe resource wealth as a catalyst for industrialization, clean energy transition, technological leapfrogging, and regional economic integration. Achieving this vision requires political will, coherent policies, and regional cooperation.

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Ultimately, the challenge before Africa is not the scarcity of resources, but the scarcity of effective management. By embedding sustainability, inclusivity, and innovation at the core of its resource strategies, Africa can redefine the global narrative—transforming from a continent of untapped potential to one of resilient, equitable, and future-ready development.

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CHAPTER 4

TOWARDS SMART MICROFINANCE: THE ROLE OF BI IN RISK MANAGEMENT

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INTRODUCTION

For several decades, financial inclusion has been considered an essential lever for fostering economic development and reducing social inequalities. Equitable access to financial services is not only a matter of economic efficiency but also a key factor in social justice and poverty reduction (Demirgüç-Kunt et al., 2018). In this context, microfinance has emerged as an innovative and pragmatic response to the limitations of traditional banking systems, which are often unable to serve underbanked populations, vulnerable groups, or those engaged in informal activities (Ledgerwood, 1999; Armendáriz & Morduch, 2010).

In Morocco, microfinance has experienced significant expansion since the 1990s. The enactment of Law 18-97 in 1996 structured the sector and facilitated the emergence of microcredit associations (MCAs), such as Al Amana and Zakoura, which today play a central role in financing micro-entrepreneurs and low-income households (El Amri, 2020). In 2021, more than 840,000 beneficiaries accessed microcredit services, representing an outstanding portfolio of over 8 billion dirhams (Rapport Économique et Financier, 2021). This dynamism confirms the importance of microfinance institutions (MFIs) as development instruments but also raises major structural challenges.

The microfinance model is based on granting small loans to clients who, in most cases, lack collateral and formal banking history. This specificity makes the sector particularly exposed to credit risk, defined as the partial or total inability of a borrower to meet financial obligations (Rosenberg, 2009). Unlike traditional banks that rely on sophisticated scoring models and strong guarantees, MFIs operate with clients whose creditworthiness is often difficult to assess due to a lack of reliable, structured data (Morduch, 1999).

In Morocco, this vulnerability is exacerbated by several factors:

- The high concentration of MFIs in rural and peri-urban areas, where incomes are irregular and dependent on fragile sectors (agriculture, informal trade);
- The low level of financial literacy among clients, increasing the risk of over-indebtedness;

- And the sector's dependence on external funding, requiring minimum profitability to ensure institutional sustainability (Ouertani & Ghaffour, 2016).

These challenges reveal a structural tension: how to reconcile the social mission of microfinance - promoting inclusion and entrepreneurship - with the imperatives of financial sustainability and risk control?

1. THE ROLE OF DECISION-SUPPORT TOOLS AND BUSINESS INTELLIGENCE

In the face of these challenges, Moroccan MFIs can no longer rely solely on traditional risk assessment methods (field visits, credit committees, manual scoring), which remain costly, subjective, and difficult to scale (Ledgerwood, 1999; Churchill & Coster, 2001). Technological advancements and the increasing availability of client data pave the way for the integration of decision-support systems based on Business Intelligence (BI).

BI enables the collection, transformation, and analysis of large volumes of data to generate relevant indicators, thus facilitating decision-making (Sharda et al., 2018). Among accessible and effective solutions, Power BI, developed by Microsoft, stands out for its ability to create interactive and dynamic dashboards, even in resource-constrained environments. Its application in the microfinance sector offers a dual opportunity: improving the operational efficiency of MFIs and reinforcing their social impact by reducing exclusion and over-indebtedness risks (El Allam, 2023).

The central research problem can therefore be formulated as follows: to what extent can the use of Business Intelligence tools, particularly Power BI, contribute to identifying, analyzing, and mitigating client risk within Moroccan microfinance institutions, while balancing financial sustainability and social mission?

This leads to the main research question:

How can the integration of a BI tool such as Power BI improve the identification of high-risk profiles and support strategic decision-making in Moroccan microfinance institutions?

Research Objectives and Contributions

To answer this question, this thesis pursues four specific objectives:

- Analyze the theoretical and empirical framework of microfinance and client risk, highlighting the specificities of the Moroccan context.
- Apply Power BI to a real database from a Moroccan microfinance institution by developing a risk-monitoring dashboard.
- Assess the impact of the BI approach on institutional performance, both in terms of portfolio risk control and economic sustainability.
- Propose operational recommendations to strengthen risk management strategies and support sector digitization.

This work thus aims to contribute to the literature on microfinance and risk management by exploring an approach still under-researched in the Moroccan context: the use of modern decision-support tools to promote sustainability and social impact in MFIs.

2. LITERATURE REVIEW

In the context of microfinance, a multidimensional field at the intersection of development economics, finance, and social policy, reviewing existing work allows for an assessment of its contributions and limitations. It is particularly important to consider how issues of financial inclusion, risk management, and technological innovation have been conceptualized and studied in different settings. This review synthesizes key perspectives on microfinance and financial inclusion, examines the spectrum of risks faced by microfinance institutions (MFIs), explores traditional and modern approaches to risk management, and considers the role of business intelligence (BI) tools such as Microsoft Power BI in strengthening decision-making processes.

Microfinance and Financial Inclusion

Microfinance refers to the provision of financial services -including credit, savings, insurance, and money transfers- to populations traditionally excluded from the formal banking sector (Yunus, 1999; Ledgerwood, 1999). Rooted in the pioneering experiments of Muhammad Yunus and the Grameen Bank in Bangladesh during the 1970s, microfinance has evolved into a global movement aimed at addressing financial exclusion and poverty.

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By offering small loans without conventional collateral, MFIs enable individuals with limited resources, particularly women and informal workers, to engage in entrepreneurial activities and improve their livelihoods (Morduch, 1999; Armendáriz & Morduch, 2010).

In Morocco, the institutionalization of microfinance was formalized with the enactment of Law 18-97 in 1999, which provided a regulatory framework for microcredit and enabled the emergence of strong local actors such as Al Amana, ARDI, and Fondation Banque Populaire (Boulila & Triki, 2017).

The Moroccan case is emblematic of the rapid expansion of microfinance in developing countries, particularly in the MENA region, where it has been positioned as a tool of both financial and social inclusion (El-Zoghbi & Tarazi, 2013).

Empirical evidence suggests that microfinance contributes to poverty alleviation and women's empowerment, though findings remain contested. Some scholars highlight its positive effects on income generation and access to financial services (Banerjee et al., 2015), while others caution against risks of over-indebtedness, repayment defaults, and limited long-term impact on structural poverty (Bateman, 2010). This duality underscores the need for more nuanced frameworks that balance outreach with sustainability.

3. RISK IN MICROFINANCE

Like all financial institutions, MFIs face multiple risks that threaten their sustainability and social mission. The primary categories include credit risk, liquidity risk, operational risk, reputational risk, and regulatory risk (Janda & Zetek, 2015). Among these, credit risk - the possibility that borrowers will default on their loans - remains the most critical challenge, as it directly affects portfolio quality, institutional solvency, and investor confidence (Churchill & Frankiewicz, 2006).

The determinants of credit risk are multifaceted. At the client level, socio-economic characteristics such as education, income stability, and occupational sector strongly influence repayment behavior (Van Gool et al., 2012). Loan-specific features, including the size, maturity, and repayment schedule, can exacerbate or mitigate default risks depending on their alignment with borrowers' cash flows (Conning & Udry, 2007).

Furthermore, external shocks -ranging from macroeconomic volatility to natural disasters or pandemics- pose systemic threats that MFIs cannot fully diversify against (Cull et al., 2021).

Liquidity risk is also salient, particularly for institutions with limited access to refinancing options. A sudden rise in delinquency can quickly lead to liquidity shortages, undermining operational capacity. Operational risks, such as fraud or inadequate information systems, and reputational risks stemming from poor client relations or over-indebtedness scandals, further complicate the landscape (Arun & Hulme, 2008). These risks highlight the importance of effective risk management systems to ensure both financial sustainability and social credibility.

3.1 Risk Management Approaches

Traditional approaches to risk management in microfinance have relied heavily on qualitative and labor-intensive methods. Field visits by loan officers, credit committees composed of local experts, and manual scoring systems have historically served as the backbone of risk assessment (Schreiner, 2002). While these mechanisms leverage local knowledge and foster social trust, they are costly, subjective, and ill-suited to scaling in contexts where MFIs serve hundreds of thousands of clients. The limitations of these methods are well documented. Subjectivity can lead to inconsistent evaluations, while resource intensity increases operational costs. Furthermore, such approaches struggle to accommodate large datasets, thereby limiting their predictive power and adaptability to dynamic environments (Armendáriz & Morduch, 2010).

In response, MFIs and researchers have increasingly turned to quantitative and technology-driven methods. Credit scoring models based on statistical techniques, such as logistic regression or discriminant analysis, represent one evolution of traditional methods (Schreiner, 2004).

More recently, machine learning approaches -including decision trees, random forests, and neural networks- have been employed to capture complex, nonlinear patterns in repayment behavior (Tchuigoua, 2016; Bravo, Maldonado & Alfaro, 2019). These models can improve predictive accuracy but require high-quality data, technical expertise, and robust governance structures to avoid algorithmic bias and ensure fairness.

Business Intelligence (BI) has emerged as a powerful framework for addressing data management and decision-making challenges in financial institutions. BI encompasses a range of processes and tools for collecting, integrating, analyzing, and visualizing data to generate actionable insights (Chaudhuri, Dayal & Narasayya, 2011). It is increasingly recognized as a cornerstone of modern decision support systems, enhancing transparency, accountability, and agility in organizational processes (Popović et al., 2012). For MFIs, BI tools offer several advantages. First, they enable the integration of heterogeneous data sources, from loan portfolios to client demographics and repayment histories. Second, interactive dashboards and visualization tools improve the accessibility of complex information, allowing managers and field officers to identify trends, monitor key performance indicators, and respond to emerging risks in real time. Third, BI reduces information asymmetry within institutions, fostering a data-driven culture that strengthens both operational and strategic decision-making (Marr, 2018). Among available BI platforms, Power BI, developed by Microsoft, has gained significant traction due to its affordability, scalability, and user-friendly interface. Unlike more complex enterprise-level solutions, Power BI is accessible to resource-constrained organizations such as MFIs, while still offering advanced functionalities such as automated updates, predictive analytics, and geospatial mapping (Microsoft, 2020). Several studies have demonstrated that BI adoption improves organizational performance, particularly in contexts where timely and accurate information is critical (Ain et al., 2019). Despite the recognized potential of Power BI, empirical applications in the microfinance sector -particularly in African contexts- remain limited. Most existing studies focus on either advanced banking systems in developed economies or pilot projects in large emerging markets. The intersection of microfinance, risk management, and BI adoption in Morocco, therefore, constitutes a promising yet underexplored area of inquiry. This research seeks to address this gap by applying Power BI to real client data from a Moroccan microfinance institution, demonstrating its potential for enhancing risk analysis and decision-making capacity.

4. RESEARCH METHODOLOGY

Research Design

This study adopts a quantitative and exploratory research design. The quantitative dimension is justified by the nature of the research question, which requires the measurement of financial risk across a large dataset of microfinance clients. By relying on descriptive statistics and risk indicators, the study provides objective insights into repayment behaviors, defaults, and portfolio performance. The exploratory aspect arises from the novelty of integrating Business Intelligence (BI) techniques, in particular the use of Power BI dashboards, in the Moroccan microfinance context. The choice of this design is consistent with the literature on financial risk management in microfinance, where exploratory approaches are often required to capture emerging risk patterns (Ledgerwood, 2013; Churchill & Frankiewicz, 2006).

Traditional econometric models are complemented here by visualization and interactive exploration, allowing the identification of clusters of risky clients and geographical disparities in repayment performance.

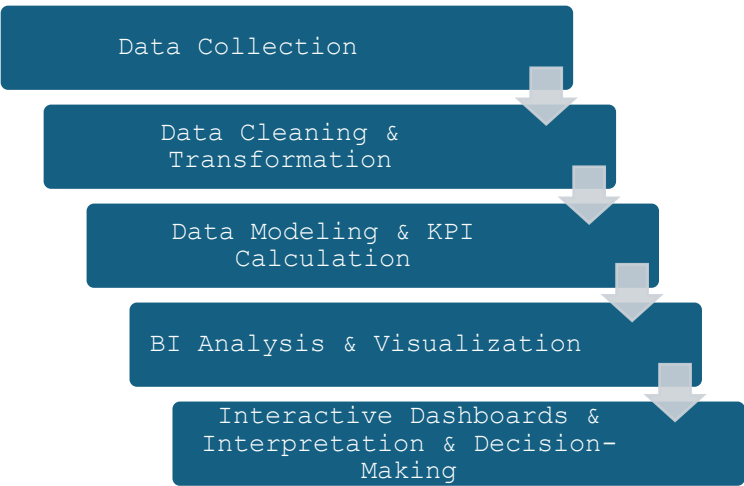


Figure 1. Conceptual Framework of the Study

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Data Source

The empirical analysis is based on a real database of client transactions provided by a Moroccan Microfinance Institution (MFI). The dataset spans 2018–2023, covering a period of significant changes in both the Moroccan economy (including COVID-19 disruptions) and the microfinance sector. The dataset includes the following key variables:

- Demographic characteristics: gender, age, marital status, region of residence.
- Loan characteristics: loan amount, loan type (productive vs. consumption), repayment schedule, interest rate.
- Repayment performance: number of installments paid, delays, defaults.
- Geographic coverage: clients across several Moroccan regions, including both urban and rural areas.

The richness of the dataset makes it possible to analyze repayment behaviors not only at the individual level but also across segments defined by socio-economic and regional attributes.

Table 1. Description of Variables Included in the Study

Variable	Description	Formula
PAR30	Portfolio at Risk over 30 days; measures overdue loans >30 days	$PAR30 = \frac{\text{Outstanding Balance of Loans} > 30 \text{ days}}{\text{Gross Loan Portfolio}} \times 100$
Repayment Rate	Percentage of scheduled installments that have been repaid	$\text{Repayment Rate} = \frac{\text{Total Repaid Installments}}{\text{Total Scheduled Installments}} \times 100$
Number of Installments Paid	Total number of installments successfully paid by the client	Count of installments marked as paid
Outstanding Principal	Remaining unpaid principal amount of the loan	Current principal balance
Gross Loan Portfolio	Total outstanding principal of all active loans	Sum of all active loan principals
Client Segmentation	Classification based on risk profile (e.g., high, medium, low)	Based on repayment behavior and historical data
Geographical Risk Indicator	Risk measure segmented by region or branch	PAR30 or default rate by location

Data Preparation

Data preprocessing was a critical step in ensuring the reliability of subsequent analyses. Missing values were handled using a two-step strategy: (i) deletion of observations with excessive missingness, and (ii) imputation (mean or median) for continuous variables and mode substitution for categorical ones. Inconsistent values (e.g., negative loan amounts, repayment schedules exceeding loan maturity) were corrected or excluded.

Transformation Using Power Query

The dataset was imported into Power Query, where transformations included standardization of date formats, unification of categorical variables (e.g., region codes), and derivation of repayment delay measures. This ensured consistency and comparability across different years of data.

Creation of Calculated Columns and Measures with DAX

Using Data Analysis Expressions (DAX), several calculated measures were generated:

- Days in arrears for each client.
- Cumulative repayment ratio across installments.
- Weighted Portfolio at Risk (PAR) by loan size.
- Probability of default (PD) estimated at client and segment level.

Analytical Framework

The analytical framework is built upon a set of recognized risk indicators in microfinance, which have been widely applied by international organizations such as the Consultative Group to Assist the Poor (CGAP) and the World Bank. Each indicator was carefully selected to reflect both the financial health of the portfolio and the repayment behavior of clients.

This metric complements the PAR indicator by capturing the timeliness of repayment rather than overdue exposure. In contexts where rescheduling and refinancing are common, repayment rate becomes essential for distinguishing between clients who repay late but consistently and those at risk of default.

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Table 2. Repayment Rates by Region and Loan Segment (2018–2023).
(Période : moyenne 2018–2023 basée sur les données et tendances décrites dans votre
PFE.)

Region	Micro-Loans (%)	Small-Loans (%)	Medium-Loans (%)	Overall (%)
North	97.2	94.5	92.3	94.7
South	95.8	93.2	90.1	93.0
East	96.5	94.1	91.0	93.9
West	95.0	92.0	89.8	92.3
Overall	96.1	93.5	90.8	93.5

Default Probability by Segment

The probability of default (PD) is estimated across different client segments (by region, gender, sector of activity, or loan type). While PAR and repayment rates provide aggregate measures, PD enables disaggregation into risk groups, allowing targeted monitoring.

Using logistic regression and DAX-based conditional measures in Power BI, the following determinants were included in PD estimation:

- Loan size (small, medium, large).
- Sector (agriculture, trade, services).
- Demographic characteristics (age, gender, education level).
- Credit history (first-time vs. repeated borrowers).

This segmentation highlights vulnerable profiles such as young, first-time borrowers in rural trade activities, who displayed a significantly higher PD.

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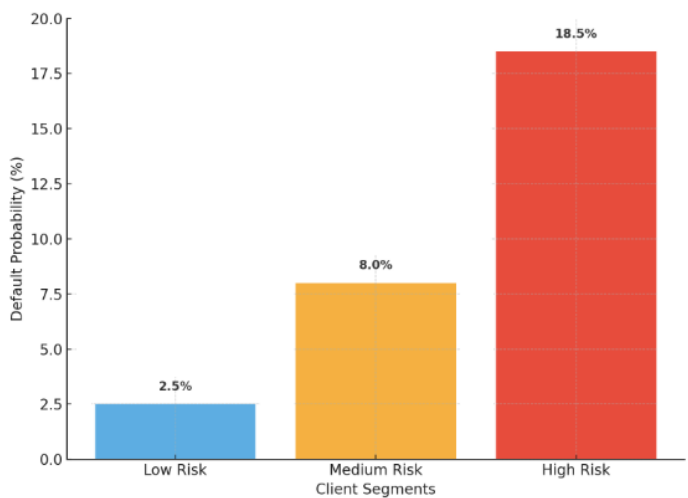


Figure 2. Default Probabilities by Client Segment

Regional Distribution of Risk

Geographical disparities are critical in Morocco, where regional inequalities affect income generation and repayment capacity. A choropleth map was developed in Power BI to display the distribution of risk indicators across regions. This visualization helps identify “hot spots” of risk (e.g., regions with higher PAR and lower repayment rates).

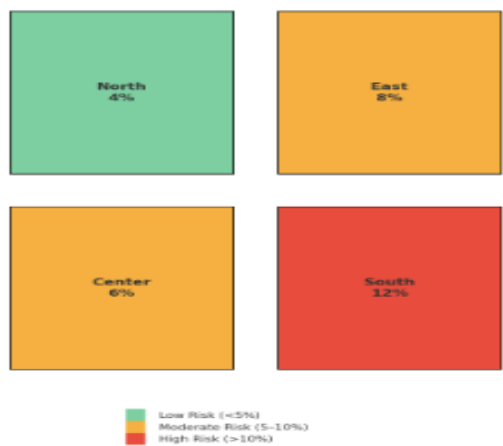


Figure 3. Regional Risk Distribution in Morocco (2018–2023)

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The analytical framework thus combines both aggregate financial measures and segmented, geographical perspectives, providing a holistic view of risk in the MFI portfolio.

Business Intelligence Dashboard Design

The main innovation of this research lies in the deployment of a Power BI dashboard as a decision-support tool for risk analysis. The dashboard was structured to integrate key performance indicators (KPIs), interactive filters, segmentation features, and geographic visualizations. Its first component provides an executive summary of portfolio performance, displaying indicators such as the total number of active loans, average loan size, overall repayment rate, current PAR30, and cumulative default cases, offering managers a clear snapshot of financial health. Additionally, the dashboard supports dynamic filtering by demographic attributes (e.g., gender, age), loan characteristics (e.g., size, type), and historical behavior, enabling the generation of targeted insights. For instance, managers can focus on specific borrower profiles, such as female entrepreneurs in agriculture, and instantly assess repayment behavior.

It also incorporates time-based analysis tools that allow stakeholders to compare pre- and post-COVID repayment trends, identifying periods of significant stress and recovery. By combining these functionalities, the dashboard transforms raw data into actionable intelligence, facilitating more informed and strategic decision-making.

Ethical Considerations

The research adhered to rigorous ethical standards in handling sensitive financial and demographic data. Client information was fully anonymized, with all personal identifiers removed to ensure privacy and confidentiality, consistent with international guidelines such as those of the OECD (2020). Particular attention was given to fairness, as risk models can inadvertently introduce bias against vulnerable groups, including women, youth, and rural borrowers. To mitigate this, indicators were analyzed not only at an aggregate level but also across subgroups to detect and address potential disparities, which is especially relevant in Morocco where gender-based inequalities persist in credit access. Transparency was another priority, with dashboards designed to

be easily interpretable by both technical and non-technical users, reducing the risk of opaque decision-making.

Finally, the study emphasizes the ethical use of BI tools, underscoring that while they provide valuable analytical insights, they should complement - rather than replace- the qualitative judgment and field expertise of loan officers, ensuring a balanced and responsible approach to microfinance risk management.

5. RESULTS

The portfolio analyzed consisted of more than 10,000 active clients over the 2018–2023 period. The average loan size was approximately 8,000 Moroccan dirhams (MAD), which aligns with the common practices of Moroccan MFIs targeting low-income populations. The portfolio composition reveals two important structural characteristics:

- Strong rural concentration: More than two-thirds of the clients were located in rural regions. This reflects the original mission of microfinance in Morocco, which has historically focused on supporting vulnerable rural households excluded from the formal banking sector. However, this concentration also increases exposure to agricultural shocks and regional economic disparities.
- Limited diversification of income sources: A large proportion of borrowers rely on agriculture or small-scale trade as their primary income source. This lack of diversification may amplify vulnerability to shocks such as drought, commodity price fluctuations, or market disruptions.

Table 3. Descriptive Statistics of the Client Portfolio

Variable	Value	Client Distribution	%
Number of Clients	12450	By gender	
Average Loan Size (MAD)	4800	Male	58
		Female	42
Sector Distribution		By Age Group	
Agriculture	35%	18–30	22%
Trade	40%	31–45	48%
Services	25%	46+	30%

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The descriptive analysis highlights the importance of integrating demographic and sectoral segmentation into risk assessment, as income homogeneity can significantly amplify portfolio vulnerability. The Portfolio at Risk greater than 30 days (PAR30) reached 7.8% in 2023, exceeding the internationally recommended threshold of 5% (CGAP, 2019), signaling potential repayment difficulties and early signs of financial stress for the institution. Temporal trends show that PAR levels rose sharply during 2020–2021, coinciding with the COVID-19 crisis, before stabilizing at 7–8% in subsequent years, indicating partial recovery without returning to pre-crisis performance. The repayment rate stood at 91.5% in 2023, demonstrating relatively strong discipline, yet significant regional disparities persisted: urban centers like Casablanca and Rabat recorded repayment rates above 95%, whereas rural southern provinces fell below 85%, a reflection of income seasonality, poor market access, and limited financial literacy. Segment-specific analysis revealed heightened vulnerability among young borrowers under 30, clients with multiple concurrent loans, and those dependent on agriculture, who faced increased exposure to external shocks such as drought and rising input costs.

Conversely, female borrowers exhibited stronger repayment discipline, aligning with previous research indicating women's reliability in microfinance contexts (Ledgerwood, 2013). Complementing these findings, Power BI dashboards offered dynamic insights through interactive segmentation, risk mapping, and trend analysis. Geographic visualizations identified high-risk clusters in southern provinces like Guelmim-Oued Noun and Souss-Massa, where PAR exceeded 10% and repayment rates dropped below 85%, warranting targeted measures such as credit rescheduling and financial education programs.

Gender-based breakdowns reinforced women's superior performance, with repayment rates averaging above 94% compared to 89% for men, underlining both the empowerment role of microfinance and the opportunity for gender-sensitive policies. Sectoral comparisons further underscored the heightened vulnerability of agriculture-related activities to environmental shocks, explaining why regions reliant on farming display higher default risk, whereas urban trade and service sectors maintained more stable repayment

patterns. Dashboard-enabled profiling revealed a risk gradient based on loan size: smaller loans (<5,000 MAD) posed minimal risk, medium-sized loans (5,000–15,000 MAD) moderate risk, and larger loans (>15,000 MAD) -often linked to younger, less experienced clients- the highest default likelihood. These insights demonstrate a heterogeneous risk landscape within Moroccan MFIs: while aggregate indicators such as PAR30 and repayment rate suggest overall resilience, they obscure critical vulnerabilities tied to socio-demographic factors, regional disparities, and sectoral exposure. By integrating descriptive statistics, risk metrics, and interactive BI tools, this approach delivers a comprehensive and granular perspective on portfolio performance that traditional static models fail to provide.

6. DISCUSSION

The study underscores the transformative role of Business Intelligence (BI) tools, such as Power BI, in strengthening microfinance institutions' (MFIs) risk management capabilities, complementing traditional methods like manual credit scoring and committee-based decision-making that, while valuable for leveraging qualitative field knowledge, are limited when dealing with complex, multidimensional datasets.

The implementation of BI dashboards brings notable benefits, including real-time portfolio monitoring that enables immediate alerts when repayment delays exceed predefined thresholds, segmentation capabilities allowing MFIs to differentiate risk by socio-demographic and economic profiles to tailor interventions such as loan restructuring for younger borrowers or financial literacy programs for rural clients, and geospatial analysis that supports efficient allocation of recovery resources to high-risk regions. Despite these advantages, significant challenges remain, notably the issue of data quality and completeness, as inconsistent or missing demographic and loan information compromises analytical accuracy- a challenge exacerbated in rural Moroccan contexts characterized by informality and low literacy. Institutional capacity is another constraint, as smaller MFIs often lack the technical expertise required to manage BI platforms, widening the gap with larger institutions that have IT resources.

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Moreover, while Power BI excels in descriptive and diagnostic analytics, its integration with advanced predictive models, such as logistic regression or machine learning, is still limited, pointing to the need for hybrid systems combining BI visualization with predictive and prescriptive analytics for more accurate risk forecasting. This aligns with prior research emphasizing the role of robust information systems in sustainable microfinance (Ledgerwood, 1999) and the growing impact of BI and big data in promoting financial inclusion (Marr, 2018), while the Moroccan case illustrates the necessity of contextual adaptation given regional inequalities, rural dependency on agriculture, and climate vulnerabilities, which demand region-specific lending policies, differentiated interest rates, and the integration of agro-climatic indicators into dashboards.

Gender-based analysis further revealed women's superior repayment discipline, reinforcing microfinance's dual financial and social empowerment mission and suggesting that BI segmentation can facilitate gender-sensitive loan programs that reduce risk while advancing equity. From a theoretical perspective, this research contributes to the literature on decision-support systems in microfinance by demonstrating how BI tools extend beyond static indicators to generate actionable insights, while managerial implications include enabling proactive risk anticipation, resource optimization, and evidence-based decision-making in credit restructuring and recovery strategies.

Nonetheless, the findings caution against excessive reliance on digital tools, underscoring the continued importance of human judgment and field expertise in assessing client reliability. Future research should prioritize predictive analytics integration for early default detection, sector-specific dashboards incorporating environmental data to mitigate agricultural risks, and cross-country studies to situate Morocco's experience within the broader MENA and African contexts, thus enhancing the scalability and adaptability of BI solutions in diverse socio-economic environments.

CONCLUSION

This study examined client risk within Moroccan microfinance institutions (MFIs) through a combination of quantitative indicators and Business Intelligence (BI) visualization tools, revealing both strong aggregate

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performance and persistent structural vulnerabilities. While the overall repayment rate averaged 91.5%, the Portfolio at Risk over 30 days (PAR30) stood at 7.8% in 2023, surpassing the international benchmark of 5% and signaling potential repayment stress. Segment-level analysis identified heightened default probabilities among young borrowers under 30 and clients with multiple concurrent loans, reflecting issues of over-indebtedness and limited financial maturity. Regional disparities were pronounced, with southern provinces demonstrating weaker repayment discipline than urban centers, while gender-based analysis confirmed female borrowers' superior repayment reliability, reinforcing microfinance's dual role in financial inclusion and women's empowerment. Additionally, agricultural borrowers exhibited greater vulnerability to exogenous shocks such as drought and price volatility, illustrating the intersection of financial risk and environmental fragility. Methodologically, the research demonstrated the added value of BI tools - specifically Power BI- over conventional approaches by enabling real-time monitoring of repayment performance, client risk segmentation, and geospatial analysis of regional vulnerabilities, thus providing actionable insights beyond static reports. These contributions advance the literature on data-driven decision-making in microfinance and digital transformation in financial inclusion (Ledgerwood, 1999; Marr, 2018), bridging the gap between quantitative risk measures and strategic decision-making.

Managerially, findings suggest the necessity of targeted interventions for vulnerable client groups, optimized resource allocation guided by geographical dashboards, and the development of gender-sensitive strategies leveraging women's repayment strength for combined financial and social impact. However, the study faces limitations related to data quality, institutional scope -given its focus on a single MFI- analytical constraints due to reliance on descriptive rather than predictive models, and contextual distortions caused by the COVID-19 crisis during the study period. Future research should integrate predictive analytics, such as machine learning for early default detection, conduct multi-institutional and cross-country analyses to enhance external validity, and design sector-specific dashboards incorporating climate and environmental indicators for agriculture-dependent portfolios.

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Furthermore, longitudinal studies could capture the evolution of BI adoption and its organizational impacts, while incorporating social performance metrics into BI dashboards would provide a more holistic assessment of microfinance, combining financial sustainability with developmental outcomes.

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