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INVESTING IN
INNOVATIVE FOOD SYSTEMS SOLUTIONS IN CHALLENGING CONTEXTS
A FOOD CHAIN MAPPING AND ANALYSIS

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A FOOD SUPPLY CHAIN MAPPING AND ANALYSIS

The “Investing in Innovative Food Systems Solutions in Challenging Contexts: A Food Supply Chain Mapping and Analysis” report was prepared by the World Food Programme (WFP) in partnership with the International Food Policy Research Institute (IFPRI) and the African Development Bank (AfDB). The study was led by Dr. Stephen Were Omamo, Director, Development Strategies and Governance (DSG) and Director for Africa of IFPRI. The final report benefited from the leadership of Dr. Abdul B. Kamara, Director General of Nigeria Country Department, AfDB; Mr. David Stevenson, WFP Country Director for Nigeria; Dr. Martin Fregene, Director of Agriculture and Agro-Industry, AfDB; and Dr. Yero Baldeh, Director of Transition State Department (RDTS), AfDB.

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Foreword

Reflections on the Hunger Crisis in Northern Nigeria

'AS GOVERNMENTS, DONORS, AND DEVELOPMENT PARTNERS LOOK TO SCALE SUPPORT IN FRAGILE REGIONS, THE QUESTION IS NO LONGER WHETHER WE CAN AFFORD TO INVEST BUT WHETHER WE CAN AFFORD NOT TO'

Humanitarian agencies are in a race against time to save lives in contexts where economies have collapsed as hunger is aggravated by conflicts and extreme weather, among other factors.

Take Nigeria, for example. Across the country lives and livelihoods are being shattered by conflict and climate shocks – once a breadbasket, the northern regions now rely heavily on humanitarian food assistance.
The numbers speak for themselves: 30.6 million people are food insecure – 10 million people in three northern states; 17 million children are malnourished – the highest number in Africa, second highest globally after India. Farmers are cut off from their fields. Traders struggle to move goods through dangerous or impassable roads. Millions are displaced. And yet amid this fragility pockets of resilience are emerging in areas where conflict has subsided such that some farmers can return to their farms.

Positive news

Food assistance has saved millions of lives in northern Nigeria and contributed to the local agricultural economy – but not always systematically. But what if food assistance could do more than meet immediate needs? What if it became the catalyst for rebuilding food systems – revitalizing local economies, and laying the groundwork for durable peace and recovery?

(What are food systems? Everything from 'farm to fork' – it's about having a broader picture of how we literally produce, transport, process and consume food.)

WFP's shift from food aid to food assistance marked a major policy reform. In the case of Nigeria, by focusing on "assistance" rather than "aid", WFP has enabled around U$200 million per year to be invested in Nigeria. This includes: locally purchased food, cash transfers for people to buy food in local markets, and e-vouchers redeemable with local retailers.

But there are still untapped opportunities to strengthen local food systems, restore markets, and build long-term resilience. For example, cash-based transfers can unintentionally undermine local agriculture when beneficiaries and retailers choose imported food. This allows imports to outcompete or displace local production.
On the other hand, local food procurement can stimulate production, strengthen markets, and complement private sector investment – even in fragile settings.

With the right policies and incentives, food assistance can do more than save lives – it can help rebuild economies and support long-term recovery. We can support the same people with food assistance and resilience at the same time.

Maintaining momentum

That's certainly possible in spite of challenges – according to a forthcoming study from the World Food Programme (WFP), the African Development Bank (AfDB), and the International Food Policy Research Institute (IFPRI).

The joint WFP-AfDB-IFPRI study will show that even in conflict-affected areas, food systems are not broken everywhere. Farmers are planting in pockets of stability. Women's cooperatives are processing food for local markets. Youth-led logistics enterprises are emerging. These islands of functionality offer something rare in fragile contexts: momentum. But maintaining momentum needs investment.

Nigeria's north: navigating the complexities

In northern Nigeria, insecurity has fractured supply chains. Poor infrastructure, high transport costs, and post-harvest losses (up to 30–50 percent for some crops) are driving up food prices and hitting farmers' incomes. Labour shortages resulting from people moving to escape conflict have pushed wages higher. Fertilizer and seed prices remain out of reach for most.

Despite these constraints, the region has extraordinary potential – spanning diverse agro-ecological zones with year-round production capacity. Demand for processed products is growing. Public investment, like the Government's AfDB-supported wheat cultivation on over a million hectares, is scaling up. And innovations in climate-smart agriculture, digital input systems, and inclusive finance are taking root.
The lesson is clear: with the right investments, even fragile regions can transform their food systems. So, what needs to change?

Reimagining food systems

First, humanitarian food systems must be reimagined – from emergency pipelines to economic platforms. Local sourcing, tailored cash transfers, and co-investments in storage, processing, and logistics can turn assistance into a driver of resilience. The local purchase programme could be expanded so that it contributes as a humanitarian solution.

WFP's Food System Influence Index is one example of how the agency is shifting toward food-system-sensitive operations – designed to advise on the contributions cash transfers and local food purchases can have on the local food system.

Structuring investments

Second, investments must be structured, not scattered. Too often, development plans stop at project lists. Typically missing are bankable investment portfolios. These portfolios should skillfully blend grant financing with concessional loans, specifically tailored to the unique challenges of fragile environments and supported by expert technical assistance on the ground.

This approach has yet to be implemented and requires meaningful engagement between the private sector, international financial institutions, and operational agencies such as WFP. Bundling road repair with off-grid processing, or linking farmer cooperatives to procurement hubs, can unlock scale and impact.
This is where AfDB's infrastructure experience and IFPRI's analytics add real value. This demands a shift towards a risk-adjusted return mindset, in other words, "profitability" – a concept familiar to the private sector but one that requires a progressive adaptation among humanitarian and development actors.

Backing farmers

It also requires the empowerment of small-scale farmers, engaging women and youth at the center of investment. Third, the real levers of resilience must be targeted: reducing post-harvest losses, improving input access, cutting transport costs, and modernizing processing.

Climate-smart technologies – such as solar-powered dryers, drought-tolerant seeds, and weather insurance – must be mainstreamed. And the informal taxation that bleeds value from food systems must be tackled.
Finally, recovery must be inclusive. Women and young people are central to food systems in fragile settings but face barriers gaining access to land, finance, and training. Targeted programmes – combined with broader policy reforms – are needed to unlock their economic potential.

From fragility to prosperity

The situation in northern Nigeria is a microcosm of a larger reality: humanitarian aid is essential, but not enough. It must be linked to long-term strategies for recovery and growth. With proper support, food systems can stabilize communities, create jobs, and build peace.

This is not only a development challenge. It is an investment opportunity. Structured correctly, food system investments can yield strong returns in fragile settings: reducing reliance on aid, improving nutrition, stimulating markets, and fostering political stability.

As governments, donors, and development partners look to scale support in fragile regions, the question is no longer whether we can afford to invest – but whether we can afford not to.
Northern Nigeria offers a stark illustration of both the high stakes involved and the transformative possibilities that lie ahead, demanding our focused attention and decisive action.

Co-authored by David Stevenson, WFP Country Director in Nigeria; Dr Abdul Kamara, African Development Bank Director General for Nigeria; Dr Steven Were Omamo, International Food Policy Research Institute Director for Africa.

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Key Messages

1

Peace and security are essential for sustained recovery in Northern Nigeria. The region's vast agricultural potential remains out of reach amid persistent insecurity, violent conflict, displacement, and armed banditry. These challenges have driven farmers off their fields, disrupted value chains, increased fragility, and deepened reliance on humanitarian assistance. Stability is not just a humanitarian imperative; it is an economic necessity for restoring livelihoods and food systems. Federal and state authorities, along with international partners, must prioritise dialogue, peacebuilding, and long-term stabilisation.

2

Pockets of stability can serve as anchors for recovery. Despite the broader conflict, more stable areas offer promising footholds for food system revitalisation. Targeted investments in production, processing, storage, and transport in these zones can catalyse wider recovery. Stable areas must be seen as anchors for transformation, helping to drive recovery, reignite the region's economy and bring tangible benefits to vulnerable populations. If we overlook these opportunities, they risk falling into further decline. Supporting them now is essential to building long-term resilience.

3

Humanitarian food assistance should be leveraged to strengthen local food systems. There is untapped potential to use food assistance to stimulate local production, incentivise value chain actors to meet demand while supporting recovery. Early investments in storage, processing, and transport infrastructure to reduce post-harvest losses and stabilise food supply chains, even amid disruptions; and tailored cash-based transfers tied to local commodities to ensure that economic benefits of assistance remain within the region, supporting smallholder farmers and regional enterprises.

4 **Climate shocks and food inflation compound food insecurity.** Northern Nigeria's food system is highly susceptible to climate shocks, including erratic rainfall, prolonged drought and severe flooding, which disrupt food production, markets, and livelihoods. Droughts reduce crop yields and pasture availability, driving up food prices and worsening food insecurity, while floods damage infrastructure and displace communities. A heavy reliance on seasonal rainfall leaves smallholder farmers particularly vulnerable, limiting their ability to recover from climate-related shocks. Climate stress also fuels conflicts over natural resources, especially between farmers and pastoralists, further destabilising food supply chains. Understanding these risks is critical for designing policies that enhance resilience, including investments in climate-resilient crops, robust storage, distribution networks, and risk management tools, alongside targeted social protection, are essential to safeguard nutrition and reduce vulnerability.

5 **Transformative investments are necessary to rebuild the breadbasket.** Reviving Northern Nigeria's agricultural role requires large-scale investment, which includes improving access to quality inputs, expanding irrigation, and strengthening storage and agro-processing capacity. Improving rural-urban connectivity and addressing inefficiencies across the value chain will be key in unlocking growth. Public-private partnerships, alongside support from institutions like the African Development Bank, can help mobilise and structure the financing needed to sustain and scale recovery efforts.

6 **Recognising these opportunities, the United Nations World Food Programme (WFP) has developed the Food System Influence Index (FSII), a tool designed to assess the systemic impacts of humanitarian interventions on food systems while** addressing critical gaps in market and food system analysis. FSII complements existing tools such as market assessments and nutrition-sensitive data. This approach ensures that decisions on the appropriate food assistance interventions are grounded in comprehensive, multi-dimensional evidence.

7 **Structural challenges must be addressed to unlock Northern Nigeria's agricultural potential.** High input costs, labour shortages, post-harvest losses, and inefficient tax systems are major barriers to agricultural productivity. Addressing these challenges through targeted policies, mechanisation, and reduced taxation will unleash the region's full potential.

8 **Like the rest of the country, Northern Nigeria has been severely affected by food price inflation.** As a result, the purchasing power of households has been severely impacted, with devastating impacts for food and nutrition security. To mitigate these impacts, targeted safety nets for vulnerable consumers are essential alongside support for small-scale farmers. In parallel, systemic investments are needed to reduce inefficiencies across value chains and promote climate-resilient practices within the food system.

9 **Rebuilding Northern Nigeria's role as the breadbasket potential requires transformative investments that improve livelihoods and strengthen resilience.** To reclaim its role as Nigeria's agricultural heartland, large-scale investments are needed in infrastructure, storage, and agro-processing facilities. These efforts must focus on reducing inefficiencies and improving connectivity between rural production zones and national and regional markets. Public-private partnerships and targeted funding from development finance institutions, such as the African Development Bank (AfDB), can play a pivotal role in mobilising the resources required to build a modern, resilient food system that supports both food security and economic recovery.

10 **Facilitate access to affordable, high-quality inputs through digital platforms.** Develop mobile-based platforms that enable farmers to purchase authentic seeds, fertilisers, and pesticides directly from trusted suppliers. These platforms should incorporate features like price transparency and farmer reviews to build trust and ensure informed decision-making. Simultaneously, launch awareness campaigns to educate farmers on the importance of using quality inputs (seeds and fertilisers) using these platforms and provide alternative support for those without smartphones, ensuring equitable access to these services. In this context, scaling up AfDB's National Agricultural Growth Scheme – Agro-Pocket (NAGS-AP) initiative, which currently supports the cultivation of 1 million hectares, is essential to achieving its wheat production targets.

11 **Modernising transport, storage, and processing systems is essential for market resilience.** These fundamental functions in the food system drive profitability and sustainability at all levels. Investments in repairing and maintaining existing roads, improving on-farm storage, and upgrading and modernising milling and other processing infrastructure would reduce post-harvest losses, stabilise prices, and increase competitiveness.

12 **Addressing food safety and quality is crucial to market competitiveness.** Improving food safety standards, particularly by tackling aflatoxin contamination in groundnuts and other crops, will enhance the marketability of produce from Northern Nigeria. Complying with global quality standards will also unlock access to export markets, boosting incomes across the agricultural value chain.

13 **Building resilient food systems requires climate-smart approaches.** Climate-smart agriculture must be at the heart of regional transformation by boldly integrating improved productivity, climate adaptation, and emissions reduction. This includes technologies such as efficient irrigation systems, agroforestry, and improved pasture management, paired with early warning systems and functional insurance products.

14 **Inclusive growth must be centred on women and youth.**
Both are critical to the transformation of agriculture in Northern Nigeria. Empowering them with access to land, credit, and training will unlock their potential as key drivers of innovation and economic growth, helping to reduce unemployment and fostering resilience across communities.

15 **Evidence-based policy and investment decisions are essential.** Effective food system transformation requires investment in rigorous research and decision-support tools. Governments, humanitarian actors, and donors should partner with institutions like the International Food Policy Research Institute (IFPRI) to generate and apply context-specific evidence to inform strategy, policy, and investment decisions.

16 **Investments must be structured, not scattered,** skilfully blending grant financing with concessional loans, specifically tailored to the unique challenges of fragile environments and supported by expert technical assistance on the ground. This approach requires meaningful engagement among the private sector, international financial institutions (IFIs), and operational agencies, such as the World Food Programme (WFP). This demands a shift towards a risk-adjusted return mindset, in other words, “profitability” - a concept familiar to the private sector but one that requires a progressive adaptation among humanitarian and development actors.

Background

This report presents the objectives and outcomes of a major field-based study on food supply chains in Northern Nigeria. The study is motivated by growing evidence that the food system in Northeast Nigeria has collapsed under ongoing insecurity. Food production, marketing, and consumption in these former breadbasket areas have been significantly disrupted by displacement and violence. As a result, vulnerability and food insecurity are widespread.

The United Nations World Food Programme (WFP) has been a major operator in Northern Nigeria for close to decade, delivering life-saving food assistance to communities grappling with conflict, displacement, climate shocks, and chronic food insecurity. Even while urgent humanitarian needs are addressed by WFP and its partners, there is a pressing need for solutions that promote self-reliance over the long term.

As part of its commitment to meet immediate humanitarian needs and to contribute to long-term recovery and resilience, WFP sponsored this study in collaboration with the International Food Policy Research Institute (IFPRI) to explore ways to leverage its operations to transform the food system in Northern Nigeria. This report serves as a critical step in that process,

examining the region's food production, processing, storage, transport, and market systems. WFP's motivation for this study is rooted in key features of its portfolio in the region whereby it provides support to beneficiaries through in-kind food, cash, and voucher assistance while also engaging in activities such as local procurement of food to strengthen supply chains and stimulate local economies. By understanding the structural challenges and opportunities within Northern Nigeria's food system, WFP aims to ensure that its operations not only address immediate hunger but also address the root causes of hunger and foster sustainable development and economic recovery.

Agriculture lies at the heart of Africa's development agenda, and the African Development Bank (AfDB) has made this sector a cornerstone of its strategic vision through its Feed Africa initiative. Launched in 2016, the Feed Africa strategy aims to transform agriculture into a competitive, inclusive, and sustainable sector capable of driving economic growth, reducing poverty, and improving food and nutrition security. This vision recognises the untapped potential of Africa's agricultural systems to not only meet the continent's food needs but also position Africa as a key player in global agricultural markets. With an emphasis on value chain development, climate resilience, and inclusivity, Feed Africa seeks to catalyse investments that support farmers, including smallholders, women, and youth, while driving large-scale structural transformation in agricultural economies.

AfDB's broader strategy for agricultural development emphasises resilience and sustainability, particularly in regions vulnerable to climate change, conflict, and food insecurity. Northern Nigeria epitomises these challenges. With its predominantly agricultural economy, the region is central to Nigeria's food security but faces systemic barriers, including weak infrastructure, limited market access, and recurring climate shocks. These issues are compounded by conflict and insecurity, which disrupt supply chains and undermine the livelihoods of millions. For AfDB, investing in agricultural development in Northern Nigeria is critical to addressing both immediate humanitarian needs and long-term development objectives. By strengthening food supply chains, improving infrastructure, and building resilience to shocks, AfDB supports the region to contribute meaningfully to Nigeria's economic growth and food security.

To boost food production, AfDB launched the National Agricultural Growth Scheme and Agro-Pocket (NAGS-AP) operation in 2023. This initiative supports Nigeria in cultivating 1 million hectares of wheat to meet its wheat production targets, with an emphasis on the Northern states where the potential for dry-season wheat farming is significant. To achieve this, AfDB supported the authorities in providing improved seeds and fertilisers to boost production and productivity. In the 2023/2024 dry season, 277,000 ha was cultivated, almost a three-fold increase from the previous years, providing for about 10 percent% of national wheat consumption. This year, farmers have been directly supported to cultivate 280,000 ha in the 2024/2025 dry season. Combined with other efforts, it is expected that the cultivated area will be more than 300,000 ha. Similar actions are being taken for rice and other commodities with the support of partners such as the Japan International Cooperation Agency (JICA).

Such actions are part of the Country Food and Agriculture Delivery Compacts (FADC) presented by Nigeria in January 2023 at a high-level summit on Food Sovereignty and Resilience in Dakar, organised by AfDB and the African Union (AU). The annual production of the following priority commodities should be increased to strengthen the country's food sovereignty by 2027: (a) 3.2 million tons for wheat; (b) 2.5 million tons for rice; and (c) 2.0 million tons for maise. Targets have also been set for fisheries and livestock products. AfDB's investments are now geared towards achieving these results.

The study of food supply chains in Northern Nigeria is closely aligned with AfDB's focus on strengthening agricultural value chains, improving access to finance, and fostering regional integration. The Feed Africa strategy identifies key enablers of agricultural transformation, including improved infrastructure, access to inputs, and innovation in agricultural practices. This study provides valuable insights into how these enablers can be operationalised in the context of Northern Nigeria, providing a blueprint for further scalable and sustainable interventions.

Building resilience is another key priority for AfDB, particularly in fragile and conflict-affected regions such as Northern Nigeria. The Bank's Strategy for addressing fragility and building resilience in Africa underscores the need to tackle the root causes of vulnerability, including poverty, unemployment, and inequality. By examining trends and conditions of food supply chains, this study presents an opportunity to strengthen resilience at multiple levels — improving household food security, stimulating local economic growth, and fostering conditions for peace and stability. AfDB views agriculture not merely as a sector for development but as a foundation for resilience and recovery in fragile regions. Realising the full potential of Northern Nigeria could significantly ease many of the country's macroeconomic challenges, paving the way for reduced dependence on imported food and packaging inputs, improved fiscal revenues, job and wealth creation, and a more substantial contribution to gross domestic product growth.

According to the International Food Policy Research Institute (IFPRI), Northern Nigeria holds significant strategic importance in food security, agricultural production, and broader economic stability. As a major food-producing area with deep rural-urban market linkages, it is also a hotspot for food insecurity and malnutrition, making it critical for understanding how food systems function under stress. The region faces major disruptions from conflict, climate change, and economic volatility, all of which affect food availability, affordability, and resilience. Drawing on its extensive expertise in food policy analysis, market systems, and value chain dynamics, IFPRI brings rigorous data collection, advanced modelling techniques, and policy engagement to the study. With strong links to policymakers, donors, and development agencies in Nigeria and beyond, IFPRI is well placed to bridge research and action, ensuring that evidence informs strategies to strengthen food security, market resilience, and nutrition outcomes.

The insights and lessons captured in this report aim to inform the efforts of WFP and AfDB to transform their operations and investments in Northern Nigeria and beyond, as well as support IFPRI's goal of providing evidence-based policy solutions that promote a transformation towards hunger-reducing food systems. For WFP, these findings serve as a guide for aligning humanitarian interventions with the broader objective of rebuilding resilient food systems, ensuring that the benefits of assistance extend beyond emergency relief to support long-term recovery and sustainable development. For AfDB, the study complements ongoing investments in infrastructure, irrigation, and rural finance in the region, ensuring that these investments are both evidence-based and impactful. For IFPRI, the findings may inform policy recommendations, guide donor investments, and contribute to global research on food systems in crisis contexts.

This highlights the need for a strategic re-examination that incorporates operational innovations. In retrospect, the multiple crises experienced by Nigeria and other developing countries over the past five years should have spurred a broader and more coordinated response from the international development community to mitigate rising food prices and other disruptions to food systems. There is now an opportunity and an imperative for WFP, AfDB, IFPRI, and their partners to identify and implement solutions that initiate and sustain recovery and transformation, even within the current fluid security context.

01 Introduction

- Study background
- Conflict and food systems in Northern Nigeria
- Food price inflation in Nigeria

CHAPTER 01

Introduction

Study Background

Transforming food systems is essential to achieving the Sustainable Development Goals (SDGs) by 2030. Achieving zero hunger (Sustainable Development Goal 2) requires a fundamental shift from today's low-productivity food systems, which often result in limited food supplies or unaffordable prices even when food is available in local markets. The increasing prevalence of conflict and state fragility pose serious obstacles to food system transformation, especially in many low- and middle-income countries (LMICs), such as Nigeria (WFP, 2023). As highlighted by the World Bank (2021), improving livelihoods and welfare in fragile and conflict-affected settings remains one of the most pressing challenges. Rising global hunger is primarily due to these fragile conditions, with projections indicating that by 2030, most people living in poverty will be concentrated in conflict-affected and fragile areas (Corral et al., 2020).

Conflict has severely disrupted food systems in Nigeria, driving recurring food crises and emergencies. Food production, marketing, and consumption in these former breadbasket areas have been greatly disrupted by displacement and violence. Vulnerability and food insecurity are widespread. This disruption occurs through multiple channels, including the impact of conflict on farmers' investment decisions, crop choices, and land use (Amare et al., 2024). The Northeast region exemplifies this devastation, where prolonged conflicts have led to the collapse of food supply chains, restricted market access, and diminished livelihood opportunities (WFP, 2023).

WFP has been a major operator in Northern Nigeria for close to 10 years, delivering life-saving food assistance to communities grappling with conflict, displacement, climate shocks, and chronic food insecurity. As part of its commitment to meeting immediate humanitarian needs, while also contributing to long-term recovery and resilience, the World Food Programme (WFP) commissioned this study, conducted by the International Food Policy Research Institute (IFPRI), to explore how its operations could be leveraged to transform the food system of Northern Nigeria.

This report represents a critical step in that process, examining the region's food production, processing, storage, transport, and market systems. WFP commissioned this study in line with its dual mandate to provide life-saving assistance to beneficiaries through in-kind food, cash, and voucher assistance, while also engaging in local procurement of food to strengthen supply chains and stimulate local economies. By understanding the structural challenges and opportunities, WFP aims to ensure its operations not only address immediate hunger but also foster sustainable development and economic recovery and development.

AGRICULTURE LIES AT THE HEART OF AFRICA'S DEVELOPMENT AGENDA, AND THE AFRICAN DEVELOPMENT BANK (AFDB) HAS MADE THIS SECTOR A CORNERSTONE OF ITS STRATEGIC VISION THROUGH ITS FEED AFRICA INITIATIVE.

Even while WFP and its partners continue to address urgent humanitarian needs, there is a critical need to pursue long-term solutions that promote self-reliance over the long term. This calls for a strategic reboot underpinned by operational innovations. As the primary international public agency with an operational presence in the food system in Northern Nigeria, WFP is uniquely positioned to catalyse recovery and transformation even amid a fluid security context. Opportunities exist in relatively stable areas where actions can be initiated to strengthen and transform food systems.

Agriculture lies at the heart of Africa's development agenda, and the African Development Bank (AfDB) has made this sector a cornerstone of its strategic vision through its Feed Africa initiative. Launched in 2016, the Feed Africa initiative aims to transform agriculture into a competitive, inclusive, and sustainable sector that can drive economic growth, reduce poverty, and improve food and nutrition security. This vision recognises the untapped potential of Africa's agricultural systems to not only meet the continent's food needs but also position Africa as a key player in global agricultural markets. With an emphasis on value chain development, climate resilience, and inclusivity, Feed Africa seeks to catalyse investments that support smallholders, women, and youth while driving large-scale structural transformation in agricultural economies.

AfDB's broader strategy for agricultural development emphasises resilience and sustainability, particularly in regions vulnerable to climate change, conflict, and food insecurity. Northern Nigeria epitomises these challenges. With its predominantly agricultural economy, the region plays a central role in Nigeria's food security but faces systemic barriers, including weak infrastructure, limited market access, and recurring climate-related shocks. These issues are compounded by conflict and insecurity, which disrupt supply chains and undermine the livelihoods of millions. For AfDB, investing in agricultural development in Northern Nigeria is critical to addressing both immediate humanitarian needs and long-term development objectives. By strengthening food supply chains, improving infrastructure, and building resilience to shocks, the Bank aims to enable the region to make a meaningful contribution to Nigeria's economic growth and food security.

This study of food supply chains in Northern Nigeria aligns closely with AfDB's focus on enhancing agricultural value chains, improving access to finance, and fostering regional integration. The Feed Africa strategy identifies key enablers for agricultural transformation, including improved infrastructure, access to inputs, and innovation in agricultural practices. This study provides critical insights into how these enablers can be operationalised in the context of Northern Nigeria, offering a blueprint for further scalable interventions.

Resilience-building is another key priority for AfDB, particularly in fragile and conflict-affected regions like Northern Nigeria. The Bank's Strategy for Addressing Fragility and Building Resilience in Africa underscores the importance of addressing the root causes of vulnerability, including poverty, unemployment, and inequality. By focusing on trends and conditions in food supply chains, this study offers an opportunity to enhance resilience at multiple levels: improving household food security, fostering local economic growth, and creating conditions for peace and stability. AfDB views agriculture not just as a sector for development but as a foundation for resilience and recovery in fragile regions.

The insights and lessons captured in this report are designed to inform WFP's and AfDB's efforts to transform their operations and investments in Northern Nigeria and beyond. For WFP, they serve as a guide for aligning humanitarian interventions with the broader

objective of rebuilding resilient food systems, ensuring that the benefits of assistance extend beyond emergency relief to contribute to lasting recovery and development. For AfDB, the study complements ongoing AfDB investments in infrastructure, irrigation, and rural finance in the region, ensuring that these investments are both evidence-based and impactful.

This implies a need for a strategic re-examination featuring operational innovations. In retrospect, the multi-crises experienced by Nigeria and other developing countries over the past five years should have spurred a broader response from the international development community to avoid or slow down the food price increases and other disruptions in the food system that have occurred. There is an opportunity (and imperative) for WFP, AfDB, and their partners to seek solutions that kickstart and promote recovery and transformation, even under the current fluid security context.

WFP launched the concept in January 2024, developing it collaboratively for effective implementation. In partnership with IFPRI, WFP formed a study team and co-designed the study approach following scoping workshops with key stakeholders in March and April 2024 in Kano and Maiduguri. These workshops enhanced the understanding of major supply sources and market corridors in the region, allowing participants to update essential information on food production, supply chains, and trade routes. Outputs included production, market, and trade flow maps for each commodity. The study featured three components: mapping the food supply system, analysing the cost build-up for production, transportation, and processing, and conducting price analysis.

This report is structured to guide readers through each aspect of the study and its findings. The next section provides the study context, followed by study objectives and research questions in sections 2 and 3. Section 4 details the study components and methodologies. Section 5 presents research findings, covering the mapping and analysis of the eight commodities: and cost build-up analysis by commodity and value chain actors, and the price analysis.

Section 6 concludes with policy recommendations. The annexes provide supplementary information, namely field instruments for both quantitative and qualitative field work, and the sampling strategy for the qualitative part. A case study on sorghum is provided as a separate document.

Conflict and food systems in Northern Nigeria

Northern Nigeria's agricultural landscape is rooted in centuries-old cultivation and land management practices. Shaped by the region's distinctive agroecological, climatic, and socio-cultural features (Barau et al., 2015), the Northeast - encompassing Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe states - plays a vital role in national food security. It produces staple crops such as millet, sorghum, maize, and rice, along with livestock and freshwater fisheries (Badewa & Dinbabo, 2023). Nigeria's national policy framework acknowledges that climate change poses a major threat to food security, given the country's heavy reliance on rain-fed agriculture (FMARD, 2022). Over two decades of violent conflict, combined with escalating climate shocks, have severely threatened agri-food systems, livelihoods, and food security in Northern Nigeria.

Conflicts have severely disrupted agriculture in Northern Nigeria, creating a reinforcing cycle of violence and food insecurity known as the 'conflict-food security nexus' (Adelaja & George, 2019). Farmer-herder conflicts, worsened by climate change and resource competition, continue to destabilise agricultural output and market activities (Usman & Nichol, 2022). **Over 90 percent of Nigeria's agricultural production is rain-fed, making farmers highly vulnerable to erratic rainfall and extreme weather events (AfDB, 2016).**

Shifting rainfall patterns and frequent droughts are already placing future crop and livestock production at heightened risk (WFP, 2023). These climate shocks exacerbate existing food supply challenges, underscoring the urgency for climate-informed planning. Decision-makers are pressed to integrate climate risk assessments into agricultural development, ensuring that policies and investments explicitly address drought resilience, flood management, and other climate-related hazards in the food system. By recognising these risks in policy (as Nigeria has done), planners can prioritise adaptive measures where they are needed most. This climate-risk perspective sets the stage for targeted interventions to protect yields and rural livelihoods in the face of a changing climate (FMARD, 2022).

Environmental stressors such as rainfall variability, droughts, and desertification further threaten productivity, especially in the Northern Sahelian zone (Tofa et al., 2021; Nigerian Meteorological Agency, 2023). Additionally, the displacement of over 2.2 million people has strained resources in host communities, undermining food production (OCHA, 2024). Displaced populations face barriers to farming, and increased demand for scarce resources has further destabilised the region's food systems.

Farmers in Northern Nigeria face immense barriers to agricultural investment, with poverty rates surpassing 70 percent in some states. Limited access to financial services and restrictive land tenure systems further hinders agricultural development (Ikhuoso et al., 2020; Balana & Oyeyemi, 2022). Gender inequalities exacerbate these challenges, as women farmers encounter disproportionate obstacles in accessing resources and markets (Pierotti et al., 2022). The cumulative impact of conflict, displacement, environmental stress, and socio-economic barriers has severely weakened food supply chains in the region (Fadare et al., 2024). Restricted access to food markets, transportation disruptions, and the abandonment of traditional trade routes have driven up food transportation costs, exerting upward pressure on food prices. These disruptions have hit perishable goods especially hard, with post-harvest losses exceeding 50 percent in some areas (Balana et al., 2022). The National Bureau of Statistics reported a sharp rise in food inflation, with the Food Price Index reaching 40.87 percent in June 2024, up from 25.9 percent in June 2023 (NBS, 2024).

Farmer-herder conflicts have become a significant and persistent challenge in Northern Nigeria, exacerbated by competition over land, water, and other natural resources. These conflicts, often fuelled by climate change, population growth, and weak resource governance, have led to widespread displacement, destruction of farmland, and loss of livestock. The resulting insecurity has disrupted agricultural production, undermined food supply chains, and heightened food insecurity in a region already grappling with economic and environmental vulnerabilities. The food system in Northern Nigeria suffers multiple cascading effects from these conflicts. Farmers face reduced access to arable land and irrigation resources, while herders struggle with restricted grazing routes and water sources. These disruptions limit productivity, destabilise rural economies, and weaken the linkages between producers, processors, and markets. The prolonged nature of these conflicts has also discouraged investments in agriculture, further constraining the sector's potential for recovery and growth. In addition to conflict-induced disruptions, climate change is increasingly exacerbating food system vulnerabilities in Northern Nigeria.

Rising temperatures, erratic rainfall patterns, and extreme weather patterns such as droughts and floods are affecting agricultural productivity, particularly for staple crops like maize, millet, and sorghum. These climate-induced shocks disrupt supply chains, further exacerbating food price inflation and reducing the resilience of smallholder farmers. Future food system interventions must integrate climate risk assessments to build resilience against these compounding challenges.

Food price inflation in Nigeria

The steep rise in staple food prices in 2023 and 2024 highlights Nigeria's economic pressures, regional disparities, and food system vulnerabilities. Food price inflation has become a critical challenge, deeply affecting household welfare and national food security (Emediegwu, 2024). Soaring food costs have placed immense strain on household incomes, particularly for low-income families struggling to afford basic food items (Akerele et al., 2024).

Data from the National Bureau of Statistics (NBS, 2024) underscore the sharp rise in essential food prices across Nigeria. The average price of 1 kilogram of brown cowpea jumped 125.43 percent year-on-year, from Naira 615.67 in April 2023 to Naira1,387.90 in April 2024, with a 12.44 percent month-on-month increase. Similarly, 1 kilogram of tomatoes rose by 131.58 percent, from Naira 485.10 to Naira 1,123.41, with a 17.06 percent increase from March 2024. White maize grain saw a 130.08 percent rise, reaching Naira 797.61 in April 2024 from Naira 346.67 a year prior. Regional price disparities are evident, with higher food costs in southern Nigeria, likely due to concentrated production and humanitarian efforts in the north. For example, cowpea prices averaged Naira 1,594.84 per kilogram in the north central and Naira 1,579.64 per kilogram in the south zone, compared to Naira 966.90 per kilogram in the Northwest. Similarly, the South-south region recorded the highest average price for white maize at Naira1,689.40 per kilogram, followed by the southwest at Naira1,429.06 per kilogram, while the Northwest had the lowest price at Naira 615.54 per kilogram.

Several factors are fuelling inflation in Nigeria's food market. The removal of fuel subsidies and the devaluation of the Naira have sharply increased costs across the supply chain (IMF, 2024). Rising transportation and energy expenses, coupled with climate-related disruptions like floods and droughts, have intensified the crisis. Flooding has damaged extensive cropland, while dry spells in Northern Nigeria have stunted production, creating supply shortages and pushing prices higher (Sanusi & Dries, 2024). Additionally, insecurity in key food-producing regions continues to disrupt farming and distribution networks, further adding to inflationary pressures (Amare et al., 2023).

The Nigerian government has taken steps to counter inflation, focusing on monetary tightening policies, including raising interest rates (IMF, 2024). These actions have not significantly reduced food inflation. Addressing structural issues is crucial for stabilising the food system, particularly by improving rural infrastructure, boosting agricultural productivity, ensuring access to affordable inputs, and strengthening distribution networks (Thomas & Turk, 2023). Without comprehensive reforms and strategic investments, price volatility may persist, threatening food security and economic stability.

Investment in productivity-enhancing agricultural technologies, infrastructure development, and security measures is vital to building a more resilient food system.

This report highlights the urgent need for transformative actions to strengthen Nigeria's food systems amid mounting challenges. Addressing the country's food security issues requires a multifaceted approach that considers economic, social, and environmental factors. As conflict, climate shocks, and inflation continue to disrupt food production and distribution, stabilising the food system is essential for national welfare and resilience. Through detailed analysis and targeted recommendations, this report offers insights for policymakers, stakeholders, and development partners on building a more sustainable and resilient food system in Nigeria.

WFP HAS BEEN A MAJOR OPERATOR IN NORTHERN NIGERIA FOR CLOSE TO 10 YEARS, DELIVERING LIFE-SAVING FOOD ASSISTANCE TO COMMUNITIES GRAPPLING WITH CONFLICT, DISPLACEMENT, CLIMATE SHOCKS, AND CHRONIC FOOD INSECURITY.

02 Study objectives

CHAPTER 02

Study objectives

This study provides an in-depth analysis of eight key commodities across Northern Nigeria, focusing on conflict-affected areas. It covers four staple cereals (sorghum, millet, maize, and wheat), two legumes (cowpeas and soybeans), groundnuts, and tomatoes. The study examines food production hubs, trade flows, transport routes, price trends, and supply chain costs. It also analyses the role of producers, transporters, processors and traders in key value chains within major market centres in the BAY states (Borno, Adamawa, and Yobe) and strategic corridors such as Kano, Potiskum, Kaduna, Zaria, Maiduguri, and Yola. It also considers connections with other regions such as Lagos, Abuja, and Ibadan, and cross-border trade.

The primary objectives of this study are to:

(1) understand the structure and functioning of food systems in Northern Nigeria, focusing on conflict-affected Northeast Nigeria, and (2) identify key actions, such as policy changes, institutional innovations, and investments, that can strengthen food systems and contribute to agriculture-based recovery in conflict-affected areas.

To achieve these objectives, the study addressed the following research questions with reference to the eight key commodities:

What are the principal sources of food supply in Northern Nigeria?

Through which trade corridors, and by which actors, are food commodities transported from major supply areas to key demand areas within and beyond the region?

What are the costs and returns associated with key food system activities such as production, transport, storage and handling, processing, retailing along the corridors for selected food commodities?

What are the major barriers to efficient trade and how are these barriers reflected in costs and returns of key food system activities production, transport, storage and handling, processing, retailing)?

What have been price patterns and trends for the selected food commodities in recent years?

Which policy reforms, institutional innovations, and investments could reduce costs, increase returns, and enhance the overall performance of the food system?

03 Study components

- Mapping the structure and functions of food supply chains
- Cost build-up analysis
- Market price analysis

CHAPTER 03

Study components

The study comprises three components: (i) mapping the structure and functions of food supply chains; (ii) cost build-up analysis; and (iii) price analysis. Each component is described below.

Mapping the structure and functions of food supply chains

Mapping of the structure and functions of food supply chains aimed to provide detailed physical and digital maps of the supply chains, covering major production areas, processing centres, distribution networks, and consumption points. The exercise was validated through consultations with key stakeholders. It included an assessment of production practices, the role of key actors along the value chains of selected commodities, major market linkages and trade routes, drivers of supply fluctuations such as climatic conditions and insecurity, and potential areas for improvement within the food supply chain.

Cost build-up analysis

The cost build-up analysis involved a detailed breakdown of financial costs incurred by major actors along the food supply chain – namely producers, transporters, traders, and processors. The objective was to understand the cost structure associated with producing, transporting, processing and marketing selected food commodity. For example, this included estimating the cost of producing one hectare of sorghum or milling one metric ton of raw wheat and identifying how these costs are structured across different stages of the value chain.

Such analysis can help food system actors to improve their financial performance and efficiency by identifying areas for improvement and government or development partners to make informed interventions or investment decisions to improve food systems in a cost-effective way. This study collected primary data on production, costs, and market information faced by actors along the selected commodity value chains and activities (production, transport, trading/marketing, and processing), and also used secondary production economics and market data obtained from various sources such as the National Bureau of Statistics, and the National Agricultural Extension and Research Liaison Services (NAERLS) for the cost build-up analysis.

Market price analysis

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TO EFFECTIVELY ILLUSTRATE PRICE TRENDS, WE AGGREGATED THE DATA ACROSS NIGERIA'S SIX GEOPOLITICAL ZONES: NORTH CENTRAL, NORTH EAST, NORTH WEST, SOUTH EAST, SOUTH SOUTH, AND SOUTH WEST

04 Methodological approaches

- Data collection
- Data analysis
- Contribution of the study

CHAPTER 04

Methodological approaches

The study employed a mixed-methods approach, combining both quantitative and qualitative analyses to capture expert and local knowledge of the food system, map food supply chains and analyse primary data on production costs and secondary data on food prices. Focus group discussions and key informant interviews were conducted to assess the validity of the information obtained. The sequence of activities from March to September 2024 is described below.

The study is envisioned within a fragility and resilience context. Northern Nigeria's food system is deeply affected by its fragile context, where persistent insecurity, weak infrastructure, and climate variability exacerbate the impacts of food price shocks and rising transportation costs. These factors disproportionately affect vulnerable populations, including smallholder farmers, pastoralists, and low-income consumers, heightening food insecurity and economic instability in the region. Food price shocks, driven by conflict-related disruptions, inflation, and market inefficiencies, have eroded household purchasing power and restricted access to nutritious food. This situation is compounded by high transportation costs, which stem from poor road networks, fuel price volatility, and security risks along key trade routes.

These challenges limit the movement of agricultural goods, inflate the cost of inputs, and create bottlenecks in supply chains, further driving up prices for producers and consumers alike. Applying a fragility and resilience lens to these issues highlights the need for targeted interventions that address both immediate and structural challenges. Enhancing the resilience of food systems requires investments in rural infrastructure, including roads and storage facilities, to reduce transportation costs and improve market access. Strengthening local food production and supply chains can help cushion the region against price shocks and reduce dependence on external markets.

Data collection

Mixed methods approach. A mixed methods approach integrated both qualitative and quantitative data and analysis. Quantitative primary data for the cost build-up analysis were collected using tailored instruments administered to farmers, processors, transporters, and traders in selected communities and markets. Additional quantitative data were sourced from secondary datasets, including WFP's Research, Assessment and Monitoring (RAM) team, Famine Early Warning System Network (FEWSNET), the National Bureau of Statistics (NBS), the National Agricultural Extension and Research Liaison Services (NAERLS), agricultural research institutions, IFPRI's Dataverse, farmer associations, and market surveys. Qualitative data were collected through in-depth interviews with key supply chain actors and focus group discussions (FGDs), primarily with producers. Separate FGDs were conducted for various commodities, with diverse groups of farmers, including women and youth.

Data collection focus areas.

Data collection focused on three conflict-affected states in the Northeast—Borno, Adamawa, and Yobe (the BAY states)—where WFP has a significant operational presence. Additional data were collected in Kano and Zaria in Kaduna state given their strategic importance in regional food supply chains and logistics.

Quantitative data.

Structured data collection instruments (see annex 1) were used to capture primary data on production, costs, and market information for selected commodities. Customised survey tools were developed to collect cost build-up data for producers, processors, transporters, and traders. Value chain actors, particularly transporters and traders, were identified through consultations with WFP-Nigeria (Abuja, Kano, and Maiduguri). A total of 78 respondents participated in the quantitative study, including 61 farmers, 10 food traders, three processors, and four transporters.

Qualitative data.

Food system actors (farmers, transporters, processors, and traders) for the qualitative study in Kano, Kaduna/Zaria, Borno, and Adamawa were identified through IFPRI's existing connections in the study areas and a list of traders and transporters from WFP. Farmers' groups in Kano and Adamawa were selected in consultation with local partners based on their production of target crops. For example, three local government areas in Kano-Kiru (sorghum, millet, maize), Tofa (soybeans, groundnut), and Bunkure (tomato) are high-production areas for these commodities. Interviews were recorded, translated from Hausa to English, and transcribed. To maintain anonymity, all participants were assigned unique ID codes, and no personally identifying information was retained.

Respondent overview.

The qualitative study included a total of 65 respondents, comprising 50 farmers across seven focus group discussions and 15 key informants, including food traders, processors, and transporters.

Data analysis

Data organisation and analysis. Data were organised and analysed to identify patterns, trends, and specific concerns for sorghum, millet, maize, cowpea, wheat, soybeans, groundnuts, and tomatoes in Northern Nigeria. Statistical tools and mapping techniques were used to visualise information effectively. Market dynamics, including price fluctuations, demand, and supply trends, were examined, along with production data, such as acreage, yield, and cropping patterns.

Quantitative analysis.

The quantitative analysis consisted of two parts: cost build-up and price analysis. The cost build-up analysis for producers was based on primary data regarding the production costs of the eight selected commodities. An 'inputs-based' costing approach was used, organising production costs into categories: land rental, inorganic fertiliser, organic fertiliser, seeds, agro-chemicals, and machinery. This approach allocated expenses to activities, providing precise cost data. Key cost items for food traders included grain purchase, transportation, cleaning and packaging, interest on capital and warehousing. For food transporters, vehicle rental and labour were the main costs, while for processors, raw material costs, labour, and utilities were primary. Cost build-ups are presented through bar graphs and descriptive tables. For price analysis, trends and spatial differences in food prices were examined to understand price evolution over time and across states, highlighting any significant disparities. By analysing these trends, the study sought to identify patterns that might align with WFP interventions. Given Nigeria's six geopolitical zones, it was assumed that trade and market integration would be stronger within each zone. Therefore, average prices for each zone were expected to reflect trends in individual states accurately. Results are displayed through descriptive statistics and trend line graphs.

Qualitative analysis.

Qualitative data were analysed using standard methods. Transcripts were uploaded into MaxQDA for thematic coding. A common codebook was initially developed, with updates as new themes emerged. Texts were grouped by codes and analysed to identify recurring themes across various characteristics.

Contribution of the study

This study provides a groundbreaking contribution to understanding the food supply chains in Northern Nigeria by moving beyond broad, generalised analyses to a detailed, component-based investigation. By employing a cost build-up analysis alongside supply chain mapping and price analysis, the research delves deeply into the individual links and interactions within the supply chain. This method captures the precise costs, logistics, and bottlenecks at each stage of the supply process, from production and processing to distribution and retail.

The granular insights generated from this approach enable the formulation of specific recommendations that reflect the realities on the ground. For example, instead of general recommendations for improving food access or reducing costs across the entire Nigerian food system, the study might pinpoint specific, actionable changes, such as reducing transportation fees in particular regions, optimising distribution networks for key commodities, or addressing inefficiencies in storage facilities in specific locales. Such tailored recommendations are essential for policy makers, local businesses, and development partners seeking to implement effective, context-specific interventions. This study's focus on the finer details of the supply chain enables a level of precision in its recommendations that aggregated national analyses cannot achieve, making it an invaluable resource for practical, effective improvements in regional food security and resilience.

05 Findings

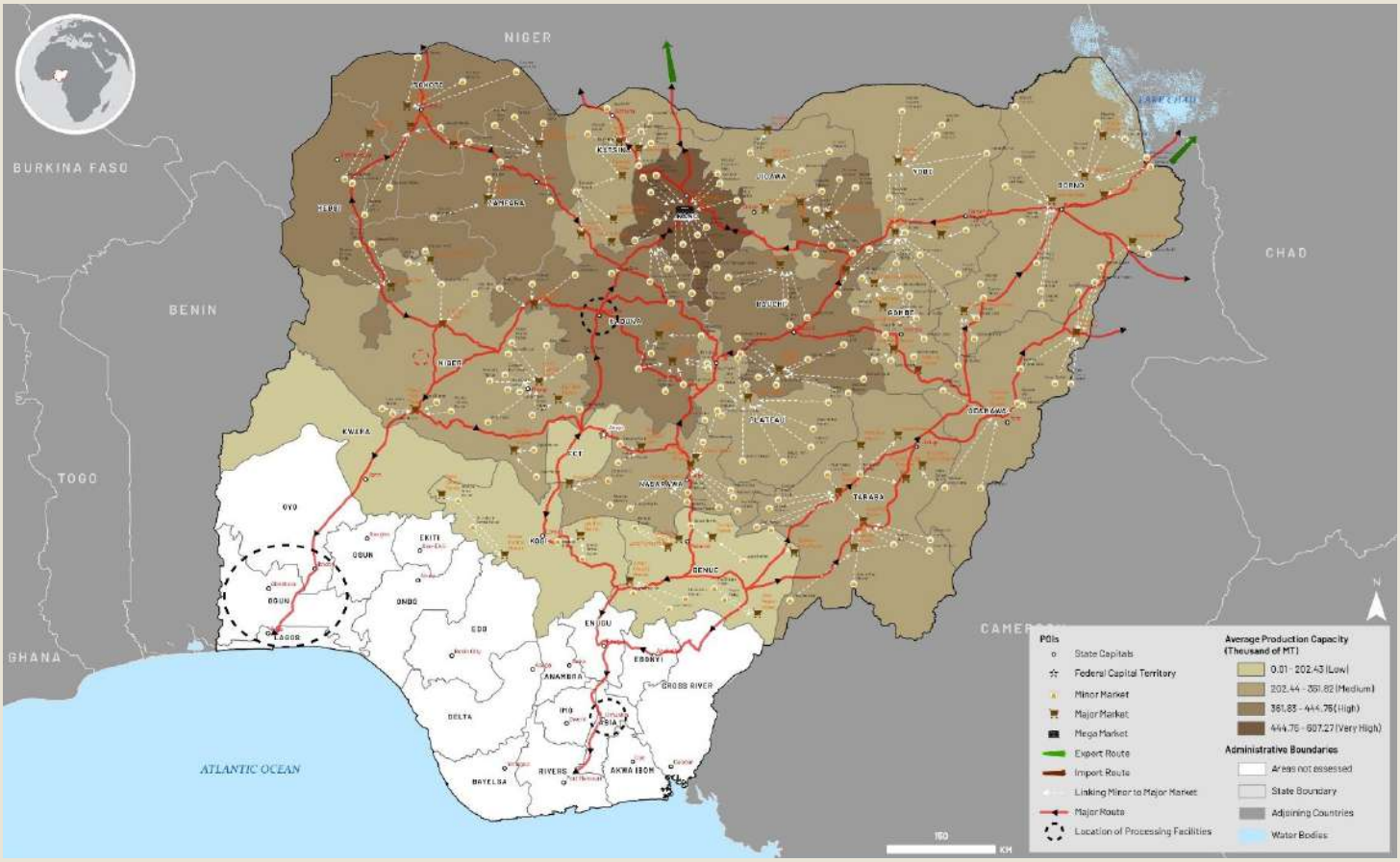
- Food supply mapping
- Cost build-up analysis
- Findings from the market price analysis
- Barriers to efficient trade in key food supply chains in Northern Nigeria
- Emergent investment opportunities for food systems transformation
- Illustrative high-potential investment opportunities

CHAPTER 05

Findings

Food supply mapping

This section presents the food supply chain mapping of eight-focus commodities: sorghum, millet, maize, wheat, cowpeas, soybeans, groundnut and tomatoes. Using maps generated from state-level production data and ground-truthing, the section discusses the supply chain of these commodities under the following headings: production, demand, marketing, processing, with concluding sub-sections on constraints and opportunities for the respective commodity value chain. Food supply chains in Northern Nigeria are increasingly vulnerable to climate-induced risks, including prolonged dry spells, excessive rainfall, and rising temperatures. For instance, droughts have led to reduced yields in millet and cowpea production, while flooding has negatively impacted tomato supply chains. These climate shocks not only disrupt production but also affect transportation and storage, leading to increased post-harvest losses and price volatility. Understanding these vulnerabilities is critical for designing targeted interventions that enhance food system resilience.



Sorghum production areas, markets and transportation routes in Northern Nigeria
Source: World Food Programme (WFP) Logistics Sector.

Sorghum

Production

Sorghum is a key crop in Nigeria's agriculture, ranking as the second-largest global producer after the United States. It is predominantly cultivated in the Northern regions, particularly in Kano, Kaduna, Katsina, Bauchi and Zamfara States, benefiting from the semi-arid climate. Sorghum is also produced at varying levels in neighbouring states such as Sokoto, Kebbi, Jigawa and Yobe which serve as additional supply zones. This is shown in Figure 1. The crop's drought resilience and ability to thrive in poor soil conditions make it ideal for these regions. Government initiatives have bolstered sorghum production, focusing on boosting productivity and ensuring food security. However, production faces challenges, including erratic rainfall, pest infestations, and limited access to modern farming techniques. Traditional farming methods, still widely used, limit yields. Despite these challenges, Nigeria is expected to produce approximately 6.4 metric tons in the 2023/2024 season, with an average yield of around 1.2 metric tons per hectare, consistent over recent years. Sorghum follows a single season cropping calendar in Nigeria, with planting during the rainy season (June to July) and harvesting from October to December. This schedule aligns with the semi-arid climate, making timing crucial for optimising yield.

Demand

Sorghum is in high demand across Nigeria for its diverse applications in food, feed, and industrial processes. It is a staple food in Northern regions, used in traditional dishes like tuwo (a thick porridge made from dry-milled, nonfermented grain flour eaten with soup), kunu (a flour paste made by wet milling after fermentation and cooked like a thin porridge) and is a key ingredient in poultry feed due to its nutritional content. The food processing industry is increasingly incorporating sorghum into various products, driven by the need for affordable, nutritious options for low-income households. The industrial demand for sorghum is also rising, especially in the production of flour, malt, and beer, supporting the growth of Nigeria's food and beverage industry. Other future sorghum values are recognised in the country, including as raw material for the biofuel industries (GAIN, 2020). Stalks, husks, and other by-products are also used as fuel and feed.

Marketing

Sorghum is a primary trading commodity in Northern Nigeria. Retailers and wholesalers play critical roles in sorghum marketing, especially in urban areas where demand is highest. Major marketers purchase sorghum in bulk and supply it to processing companies, using controlled storage facilities to minimise post-harvest losses. The Federal Government, NGOs, and international organisations support the supply chain by providing farmers with training and resources. However, recent fuel cost increases have driven up transportation expenses, affecting prices. The major trade corridors are the Kano-Kaduna-Zaria corridor (being a major collection and distribution hub, more specifically, the Dawanau grain market) and the Bauchi-Yobe-Borno axis. Sorghum also moves across export corridors towards Niger, Chad, and Cameroon, especially from border states like Sokoto and Borno.

Processing

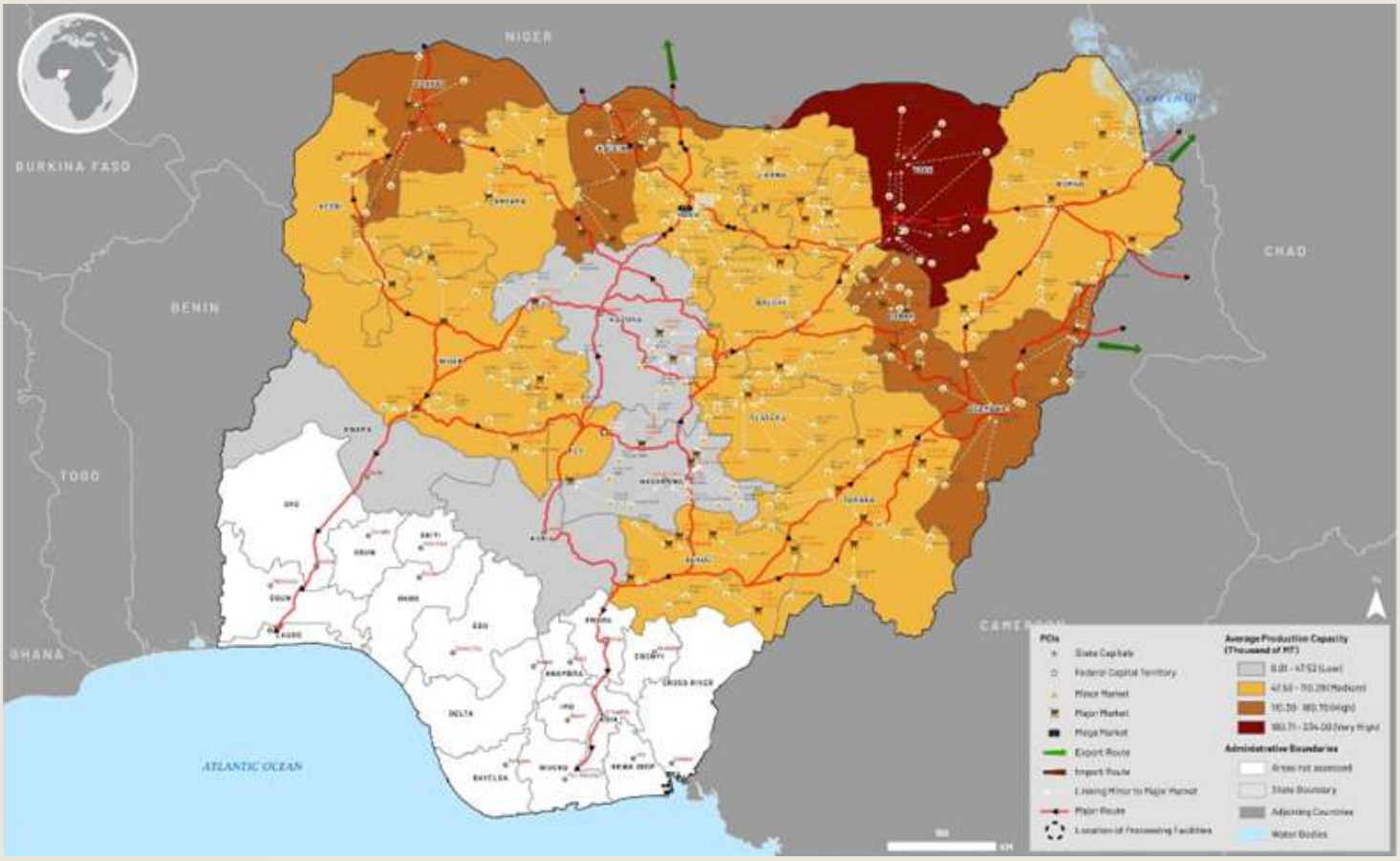
Sorghum processing in Nigeria occurs at both homestead and industrial levels. At the household level, sorghum is processed into flour for traditional dishes and beverages. Industrial processing is more mechanised, transforming sorghum into products like malt, flour, and beer. Major companies, such as Nigerian Breweries, Sona Malting and Derivatives, among others rely on sorghum as a key ingredient. The crop's versatility as a food and industrial raw material underscores its value in Nigeria's agricultural landscape, with growing demand both domestically and internationally.

Constraints

Despite its importance, the sorghum supply chain faces several challenges. Environmental factors like erratic rainfall, soil degradation, and pest infestations, along with high input costs and limited access to finance, hamper production. The lack of adequate storage facilities and efficient transportation networks further exacerbates these issues, leading to post-harvest losses and price volatility. Policy-related challenges, including trade policies and land tenure systems, also impact the sector.

Opportunities

Despite these challenges, there are significant opportunities to grow the sorghum sector, including government-led initiatives and partnerships with international organisations aimed at enhancing productivity and sustainability. The rising demand for sorghum-based products presents opportunities for expanding production and processing capacities, supporting both domestic consumption and export potential. The promotion of value addition through product diversification, strengthening farmer organisations to improve market access, and enhancing linkages between farmers and industrial users of sorghum. Additionally, there is growing interest in the use of sorghum for biofuel production, which could create new market opportunities for farmers.



Millet production areas, markets and transportation routes in Northern Nigeria
Source: World Food Programme (WFP) Logistics Sector.

Millet

Production

In 2022, global millet output reached an estimated 30.6 million tons. Although over 93 countries cultivate millets, significant production is concentrated in just a few countries. India leads, accounting for 39 percent of the world's millet production, with Niger (11percent) and China (9 percent). Nigeria, contributing about 6.5 percent, ranks highest in West Africa's millet production.[1] Over recent decades, most millet-producing Low-and Middle-Income Countries (LMICs) have seen a decline in cultivation. This is attributed to shifts towards other staple crops, evolving dietary preferences, and the assured returns from major commercial crops (Meena et al. 2021). Only a handful of countries, notably China, have managed to increase their millet production levels. From Figure 2, the main supply areas are Yobe, Borno, Bauchi and Jigawa states. Other states include Sokoto, Zamfara, Katsina and Kano.

Demand

Across West Africa's Sahel region, millet is used in various traditional dishes such as kunu (thin gruel), masa (fried cakes), fura (pounded whole grain balls eaten with milk), ogi or akamu/kamu (thick porridge), and burukutu (alcoholic and non-alcoholic beverages including beer). Millet flour is also used to make tuwo, a thick paste. The plant's stem is used in construction, while its green parts and outer seed layer serve as animal feed. Approximately 80 percent of millet

produced goes to human food, with the remainder used for animal feed and brewing. Stalks, husks, and other by-products are also used as fuel and feed.

Marketing

The main market centres for millet in Northern Nigeria are Dawanau (an assembly and wholesale market), Maiduguri (major assembly and wholesale market), Jos (retail and wholesale market), Gombe (an assembly and wholesale market), Potiskum (assembly and wholesale market), Funtua (retail and wholesale market), Jibia (an assembly and wholesale market), Illela (a retail and wholesale market), Maigatari (an assembly and wholesale market) and Ngalda (assembly and wholesale market). The most prominent trade corridor for millet is the North-South Corridor, which consists of several routes. Kano (Dawanau) to Lagos: a major flow originates from Kano, moving southward through cities like Zaria and Kaduna, eventually reaching Lagos. This represents the movement of millet from the major production areas in the north to the largest consumer market in the south. Maiduguri to Port Harcourt: Another significant flow starts from Maiduguri in the Northeast, passing through Jos and heading towards Port Harcourt in the south. This route connects the northeastern production zones with southeastern markets. Another corridor connects Maiduguri to markets in the Northwest like Kano and Katsina. This suggests intra-regional trade within the Northern production zones, possibly balancing supply, and demand across different areas. There are also border trade movements, particularly Niger Republic, potentially exporting surplus millet.

Processing

As mentioned earlier, millet is processed into various products ranging from food to feed. However, apart from feed millers and a few food processors, not very much industrial processing is recorded. Examples of millet processors in Nigeria include Nestle and Dala Foods. Whereas Nestle produces various forms of food with millet as part of the main constituents, Dala Food processes millet into already-known local foods like burabusko (a form of millet grits), kunu (a millet gruel) and fura (a kind of millet based-oat) flours both popular in Nigeria. Most millet processing is done either in the household (in rural areas) or in cottage milling firms (in urban centres).

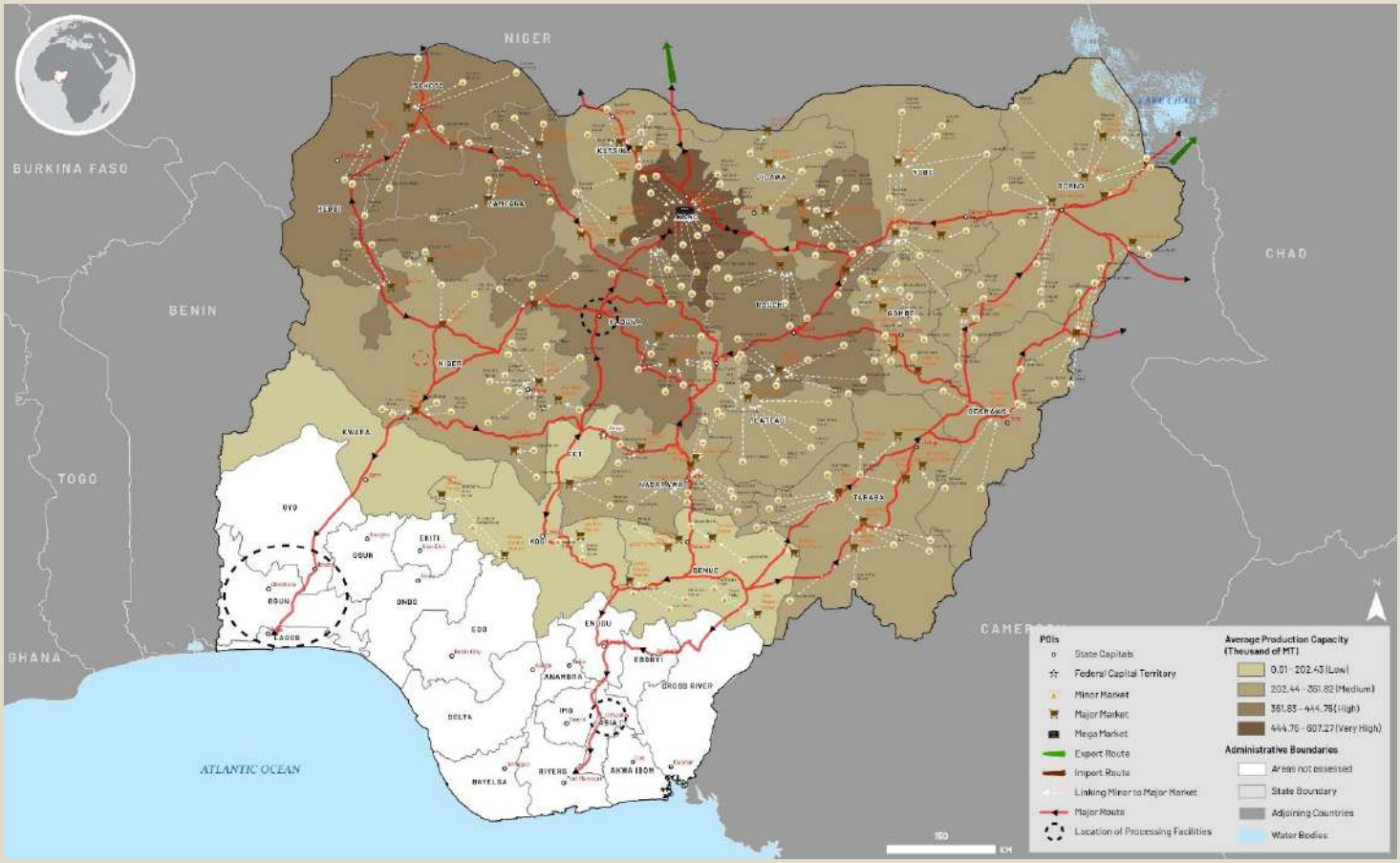
Constraints

Millet value chain actors are confronted with underinvestment, high marketing costs, unstructured markets, and millet's old stigma as a poor person's food (Resnick et. al., 2020). Significant production limitations persist, such as restricted availability of modern tools and technology, like high-quality seeds and enhanced cultivars, as well as high rates of pests, illnesses, and weed infestation. There are few modern processing facilities and labour-intensive, time-consuming traditional post-harvest processing techniques such dehulling (Meena et al., 2021).

Opportunities

The global resurgence of interest in millets is linked to various factors, including recurring droughts in Africa, the impact of the war in Ukraine on global food and fertiliser prices, and growing awareness of the environmental impact of wheat, rice, and maize cultivation. There is potential for micro-businesses in the millet sector to expand into small and medium enterprises, creating job opportunities for young people and women entrepreneurs. International organisations are advocating for increased millet production due to the crop's ability to thrive in hot, drought-prone areas. The growing support for millet value chains from both public and private sectors highlights the crop's potential to improve farmers' livelihoods, enhance nutrition for consumers across economic spectrums, contribute to climate change adaptation, promote sustainable agriculture, and create a more resilient food system. The CGIAR's HarvestPlus programme is spearheading efforts to breed and distribute micronutrient-rich crop varieties, including pearl millet, through partnerships in developing countries. In West Africa, open-pollinated varieties (OPVs) with higher iron and zinc content have been tested in several countries. Since 2014, two OPVs and nine hybrids of pearl millet have been released in India, Niger, and Nigeria.

[1]https://ipad.fas.usda.gov/cropexplorer/cropview/commodityView.aspx?cropid=0459100 and https://www.indexmundi.com/agriculture/?commodity=millet&graph=production



Maize production areas, markets and transportation routes in Northern Nigeria
Source: World Food Programme (WFP) Logistics Sector.

Maize

Production

Maize is a major cereal crop in Nigeria. The country stands out as the largest maize producer on the continent and ranks 10th globally, with production reaching approximately 12.8 million metric tons in 2020 (FAO, 2021). Key maize-producing states include Kano, Niger, Adamawa, Taraba, Plateau, Kaduna, Bauchi, Nasarawa, Kebbi, Kwara, FCT, and parts of Borno, Benue, Katsina, Jigawa, Zamfara, and Kogi (See Figure 3). The national average yield is about 2.2 tons per hectare, which is stable but lower than the potential 10 tons per hectare achievable with better farming practices and improved hybrid varieties. Nigeria's maize follows two main cropping seasons: wet season (April-June planting, August-October harvest) and dry season (October-February planting, February-April harvest), with the majority of production coming from the wet season. Recent government policies, such as a 150-day duty-free window for maize imports, aim to address food inflation, though the impact on local production remains uncertain.

Demand

Demand for maize in Nigeria is substantial, driven by its role in food security, animal feed, and industrial uses. Annual consumption is around 15 million metric tons, with significant portions used for food, feed, and industrial purposes, such as in flour, corn syrup, and starch production. The poultry industry is a major consumer, and maize is a staple in most Nigerian households. Stalks, husks, and other by-products are also used as fuel and feed.

Processing

Maize processing in Nigeria occurs at both homestead and industrial levels. At home, maize is milled into flour for traditional dishes like tuwo and snacks like pap or akamu. This process is often manual and labour-intensive but essential for household food security. Industrial processing is highly mechanised, converting maize into products like flour, beer, malt drinks, cornflakes, starch, syrup, dextrose, and animal feeds. Significant players in this sector include Flour Mills of Nigeria (FMN) and Nagari Seeds Nigeria.

Constraints

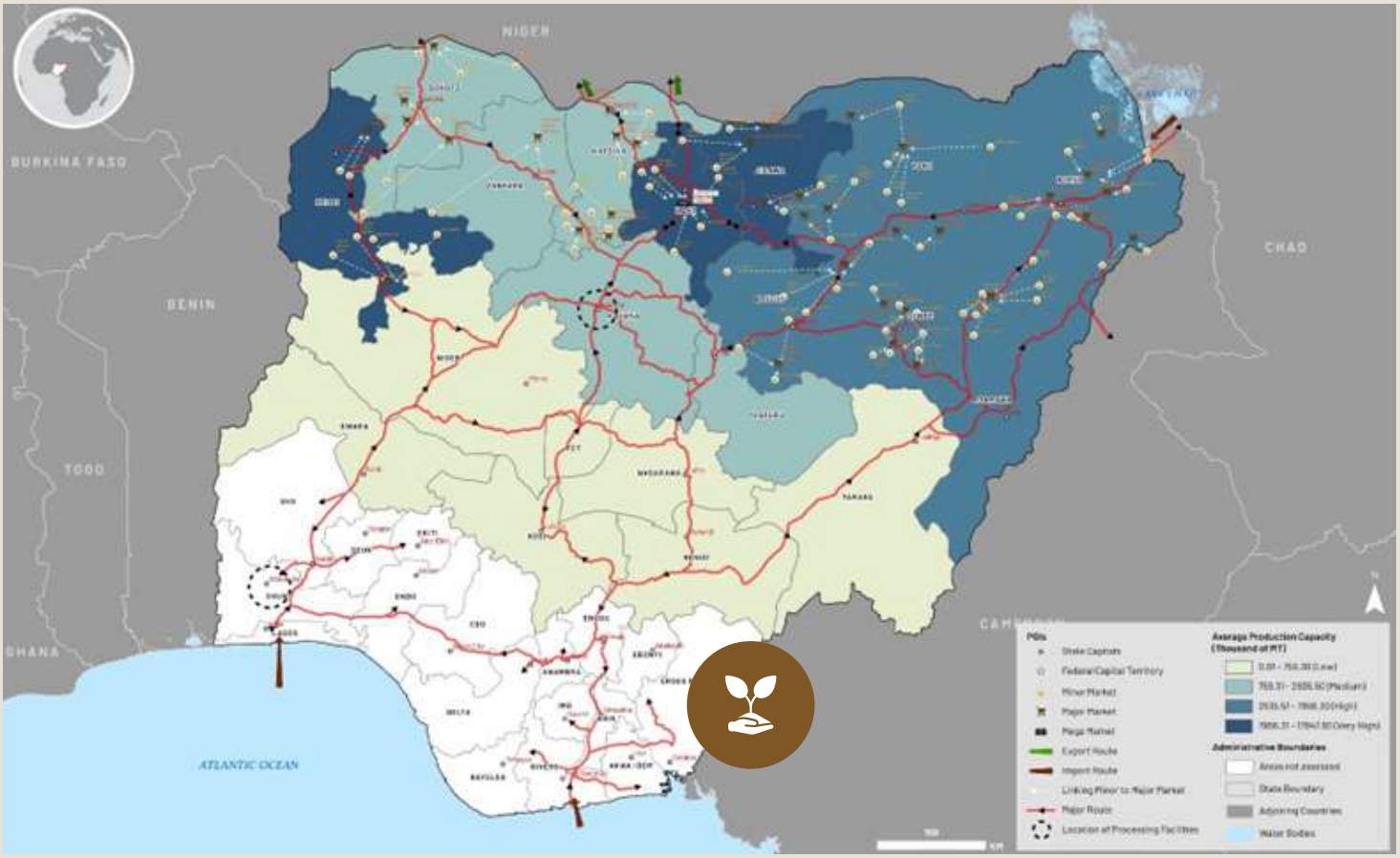
Despite government efforts, the maize supply chain faces significant challenges. Insecurity, particularly in the Northeast and recently in Kaduna, Niger, Taraba, and Plateau states, is a major issue. Other challenges include inadequate infrastructure, limited irrigation, insufficient storage, restricted access to improved seeds and finance for smallholders, and price volatility. Environmental factors and outdated technology further hinder the supply chain.

Marketing

Maize marketing in Nigeria is dominated by small-scale farmers who rely on middlemen, which reduces profit margins due to added costs and inefficiencies. The marketing chain typically involves farmgate buyers, village market aggregators, urban buyers, transporters, company buyers, and processors. Price volatility remains a significant challenge, contributing to financial instability for farmers and limiting their ability to plan and invest in future production cycles. In response, government initiatives such as the Agricultural Promotion Policy (APP), have sought to improve agricultural productivity and market access for smallholder farmers. The main market corridors are the Kano-Kaduna-Abuja axis, Sokoto-Kebbi-Niger axis, and Maiduguri-Yobe-Bauchi axis. Key demand centres include cities like Kano, Kaduna, Zaria, Bauchi, and Maiduguri, among others. There is also significant, though unofficial, maize export to Niger and Cameroon.

Opportunities

Maize production presents opportunities for economic growth and food security in Nigeria. The rising demand for maize in food and industry, including the expanding poultry and livestock sectors, offers significant growth potential. Investing in agricultural technologies and improved farming practices can boost yields and farmer incomes. There is also potential for value-added processing and exports. Developing agro-processing facilities can enhance the maize value chain, producing higher-value products like corn oil, cornmeal, and ethanol, which can fetch better prices domestically and internationally.



Wheat production areas, markets and transportation routes in Northern Nigeria
Source: World Food Programme (WFP) Logistics Sector.

Wheat

Production

Wheat is a crucial staple in Nigeria, yet domestic production falls far short of meeting demand, leading to significant imports. According to the Central Bank of Nigeria (CBN), wheat is the country's third most consumed grain after maize and rice. However, local production satisfies only 1 percent of the 5–6 million metric tons consumed annually, valued at over USD 2 billion (Central Bank of Nigeria, 2024). Wheat is cultivated exclusively through irrigation from November to March, primarily in the Northern states of Jigawa, Kebbi, Kano, Bauchi, Yobe, Gombe, Borno, Adamawa, Plateau, Sokoto, Katsina, and Kaduna, where the semi-arid climate supports growth as shown in Figure 4. Production in the Northeast has declined sharply due to insurgency and inadequate irrigation infrastructure.

To address this gap, the Federal Government of Nigeria, through the Federal Ministry of Agriculture and Food Security (FMASFS), has launched the 2023/2024 Dry Season Wheat Farming Program under the National Agricultural Growth Scheme and Agro Pocket (NAGS-AP) project. This initiative aims to increase wheat production capacity, curb food inflation, and advance self-sufficiency. Additionally, the Seeds for the Future programme—a collaboration between Olam Agri Nigeria, the Lake Chad Research Institute (LCRI), and the International Centre for Agricultural Research in the Dry Areas (ICARDA) focuses on enhancing wheat production. This programme seeks to develop new wheat seed varieties suited to local conditions, support smallholder farmers, promote modern agronomic practices, and scale up high-quality seed production. Together, these government and private sector efforts are positioned to make meaningful progress toward wheat self-sufficiency and improved food security in Nigeria.

Demand

The demand for wheat and wheat-based products has grown significantly in recent years, driven by changing dietary preferences, urbanisation, and population growth. The primary consumers of wheat flour in Nigeria are bakeries, which produce a wide range of products such as bread, pastries, and other baked goods. Bread is a staple food in Nigeria, consumed by millions daily. Other significant consumers include households, restaurants, and food processing companies that produce noodles, pasta, and other wheat-based products. Nigerians consume a variety of wheat-based products daily, with bread being the most popular. Other flour products commonly used in Nigerian households include cake, biscuit, pasta, spaghetti, pancake, Danwake, Waina, Alkhubs, Gurasa, Khubza, and as additives to many other foods. According to the World Bank data, an average Nigerian consumes about 28 kilograms of wheat products per year[2]

Marketing

Nigeria faces significant dependency on wheat imports due to its domestic production deficit. In 2020, the country's wheat imports were valued at over USD2.15 billion, marking a 40 percent increase from the previous year. This positioned Nigeria as the fourth-largest wheat importer globally, following Egypt, China, and Turkey (Balana et al., 2022). Wheat represents the country's largest import expenditure after petroleum products (petrol and diesel) and stands as the most imported food item (National Bureau of Statistics (NBS), 2021). The major wheat suppliers to Nigeria include Lithuania, Latvia, the United States, Russia, and Ukraine. While this import reliance ensures adequate wheat supply for domestic consumption, it also makes the country vulnerable to global price fluctuations and international trade policies. The wheat import market is dominated by several major milling companies, including Flour Mills of Nigeria (FMN), Dangote Flour Mills, Honeywell Flour Mills, Olam Nigeria, Crown Flour Mills, and BUA Group.

Processing

Nigeria has a growing milling industry, with several large-scale flour mills operating primarily in urban centres (Chinenye, 2015). These mills process both domestically produced and imported wheat into flour for various end-uses, including bread, pasta, and confectionery products (Adegbite & Adegbite, 2021). The leading flour millers in the country are Flour Mills of Nigeria (FMN), Northern Nigeria Flour Mills (NNFM), OLAM-Crown Flour Mill, Honeywell Flour Mills, Dufil-Pure Flour Mills, and Life Flour Mills, Dangote flour Mills, Crown Flour Mills, Jos Flour Mills, Port Harcourt Flour Mills.

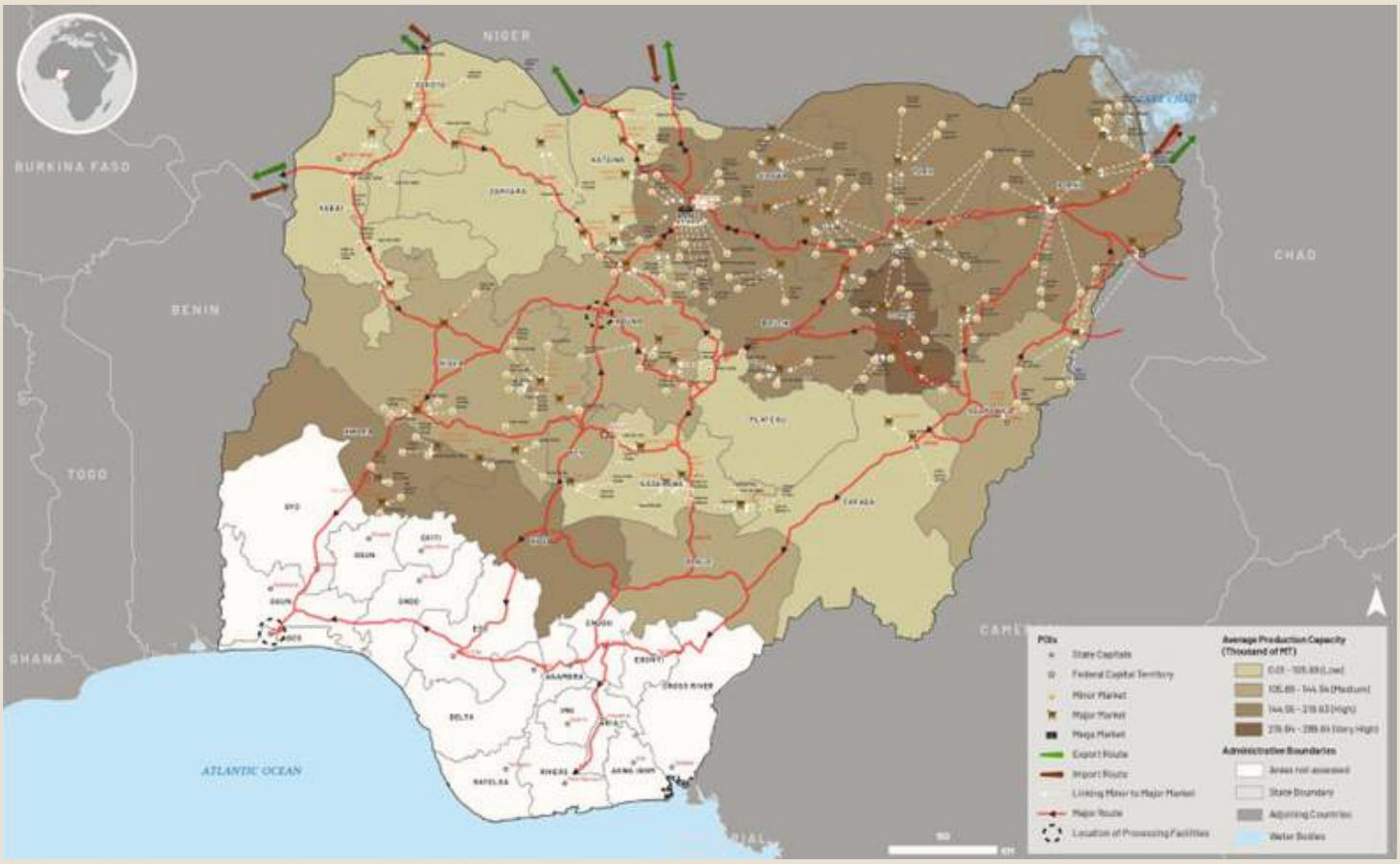
Constraints

The challenges facing wheat production in Nigeria are several. Climate change and variability pose significant threats, with increasing temperatures and unpredictable rainfall patterns affecting crop yields. Limited access to improved, heat-tolerant wheat varieties and inadequate irrigation infrastructure further constrain production. Additionally, poor soil fertility, pest, and disease pressures, and limited mechanisation contribute to low productivity (Tadesse et al., 2018).

Opportunities

Nigeria's wheat sector presents several compelling investment opportunities. With the country's production of certified, high-yielding seeds still limited, there is significant potential for investors to support the development of improved wheat varieties and scale up seed production. Additionally, setting up a specialised commodity exchange for wheat grain could help streamline the supply chain, reducing costs and inefficiencies for processors. Importantly, the strong forecast for continued growth in wheat consumption in Nigeria underscores the need for expanded production and more robust logistics. Lastly, investment in modern grain storage infrastructure would help mitigate post-harvest losses and ensure a more stable wheat supply year-round. By capitalising on these opportunities, investors can play a pivotal role in bolstering Nigeria's wheat self-sufficiency and food security.

[2]https://data.worldbank.org/indicator/AG.CON.WHEAT.PC



Cowpea production areas, markets and transportation routes in Northern Nigeria
Source: World Food Programme (WFP) Logistics Sector.

Cowpea

Production

West Africa accounts for approximately 95 percent of global production, with Nigeria being the largest producer and consumer (Phillip et al., 2019). According to FAOSTAT, in 2021, Nigeria had the highest cowpea production of 3.63 million metric tons across an extensive area harvested of 4.7 million hectares. Niger followed closely with 2.66 million metric tons produced, with a larger area harvested of 5.97 million hectares. The map in Figure 5 indicates that cowpea production is predominantly concentrated in Northern Nigeria, with varying production capacities. Notable production areas are Borno, Yobe, Jigawa, and parts of Kano, Sokoto, Zamfara, Katsina, and parts of Bauchi, Adamawa, Taraba, and some areas of North Central Nigeria. This production pattern aligns with the suitable agro-ecological conditions of the Northern region, particularly the Sudan and Sahel savanna zones.

Demand

In Nigeria, cowpea demand is predominantly for household use, with minimal demand from the industrial sector. Almost all Nigerian households incorporate cowpea into their meals, whether as a main dish or a component of other recipes. For example, popular cowpea-based dishes include Moimoi and Akara, which are widely enjoyed throughout the country. Additionally, rice and beans (a

combination of boiled rice and beans) is a common meal across Nigeria. Nigeria's per capita consumption of cowpea is estimated to be around 23 kilograms per year. In comparison, other African nations and global averages tend to have lower per capita consumption rates. For instance, Niger averages around 9 kilograms per year, and Burkina Faso averages 7 kilograms per year. The global average per capita consumption of cowpea is significantly lower, around 1 - 2 kilograms per year[3].

Marketing

The cowpea market in Nigeria is largely dominated by informal traders (unregistered enterprises, usually small holdings). Cowpeas are widely available in urban markets across Nigeria, both in the Northern and southern regions. Main market centres are Dawanau Market in Kano serving as the primary hub for cowpeas trade in Northern Nigeria. Other major markets are strategically located across the region, including Maigatari Market in Jigawa, Potiskum Market in Yobe, Maiduguri Monday Market in Borno, and Illela Market in Sokoto. These markets are characterised by substantial storage facilities and high trading volumes. There are also numerous secondary markets that serve as collection points from farming communities and facilitate distribution to larger markets.

The major trade corridors are the north-south routes connecting Northern production zones to southern consumption centres, passing through key cities like Zaria, Kaduna, and Abuja. Also, inter-state routes linking major markets within the Northern region, facilitating regional trade flow. Additionally, a significant quantity is exported to neighbouring Niger, Chad, and Cameroon.

Processing

Cowpea processing in Nigeria is primarily done at home or in small cottage milling facilities scattered throughout towns as confirmed by the participants. Recently, there has been an emergence of processors producing cowpea flour for retail in stores and supermarkets, although this practice has not yet gained widespread popularity. Some of these processors include Ayoola Foods and Lifeberg Foods located in Lagos, and Helencia Foods in Abuja. These emerging processors aim to provide a more convenient option for consumers and potentially tap into urban markets where demand for ready-to-use products is increasing. However, the traditional home processing methods continue to dominate due to their deep-rooted cultural acceptance and accessibility.

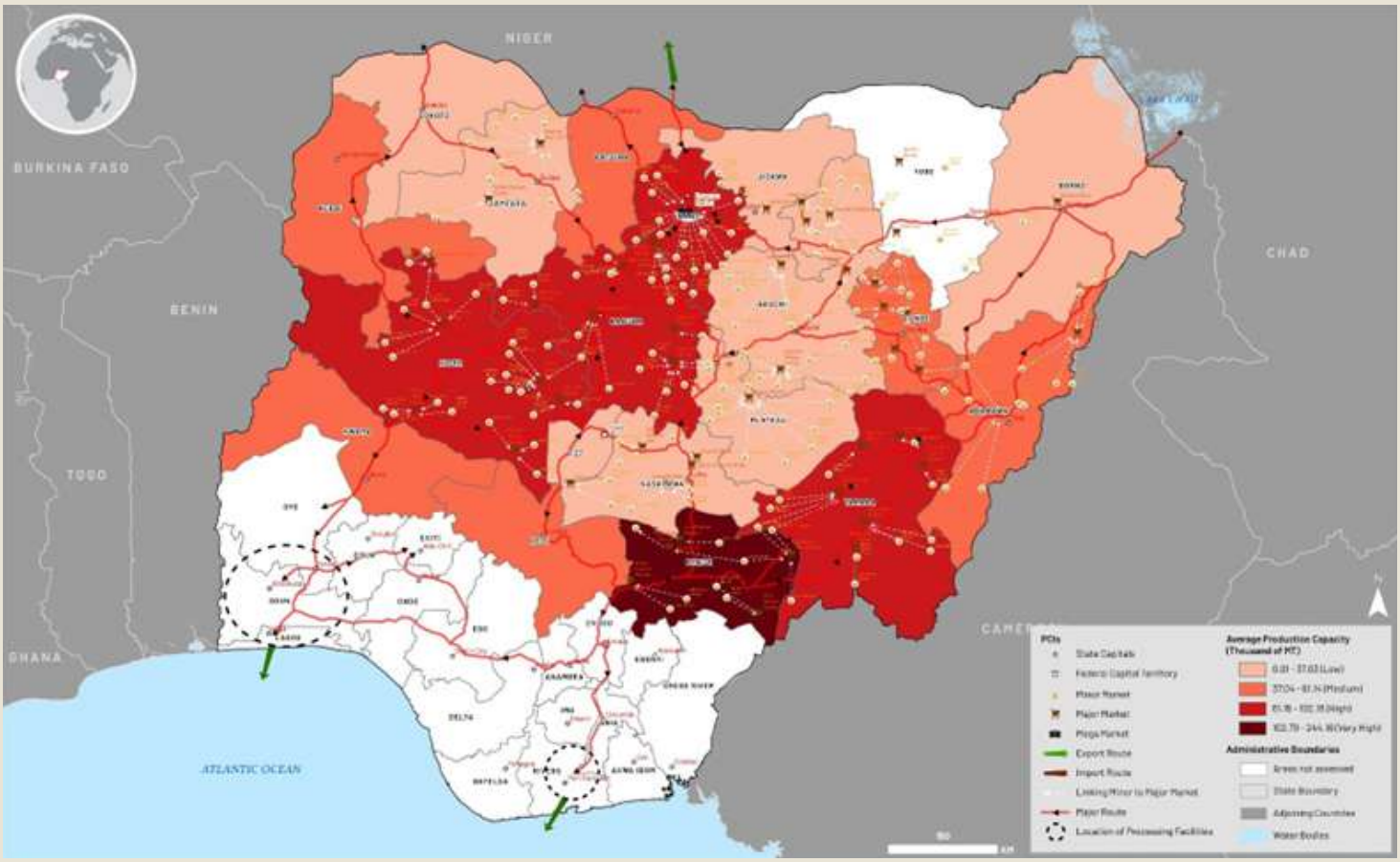
Constraints

Despite being a leading producer, cowpea productivity in Nigeria faces several challenges. Pest infestations, particularly the Maruca pod borer, pose a significant threat to yields. Climate variability, including irregular rainfall patterns and drought, also affects production (Sindhu et al., 2019). Limited access to improved seeds, fertilisers, and modern farming techniques further constrain productivity. Additionally, most cowpea farmers in Nigeria are smallholders with limited resources, which affects their ability to invest in productivity-enhancing inputs and technologies (Nwagboso et al., 2024). Post-harvest handling and storage are critical stages in the cowpea value chain. Traditional storage methods, such as the use of local granaries or bags, are still prevalent among smallholder farmers. Other issues include limited market information, the dominance of middlemen (due to the number of value chain actors between the farmers and the consumers), lack of quality standards, limited value-addition activities.

Opportunities

Opportunities for improving the cowpea supply chain include the availability of high-yielding, pest-resistant varieties, support from government and donor agencies, advanced training in Integrated Pest Management (IPM), increasing domestic demand, export potential, value-added activities, and climate-smart agriculture practices. Another important factor that could enhance the production of cowpeas is access to finance for the expansion of cultivation and purchase of inputs. To tap into these opportunities requires a coordinated effort between government, donors, NGOs, and CBOs.

[3]https://www.aatf-africa.org/wp-content/uploads/2021/02/Cowpeabrief.pdf



Soybeans production areas, markets and transportation routes in Northern Nigeria
Source: World Food Programme (WFP) Logistics Sector.

Soyabeans

Production

Nigeria is the second largest producer of soybeans in Africa; the country's main soybean-growing states include Bauchi State, Kaduna, Kano, Plateau, Benue, Nasarawa, Katsina, Kwara, Kogi, Oyo, Jigawa, and Federal Capital Territory (See Figure 6). The middle belt, which includes Benue, Plateau, Kogi, Nasarawa, Niger, and Kwara, has greater yields and accounts for 65 to 75 percent of the entire production (NIRSAL, 2022). According to current estimates, Nigeria's annual soybean production falls short of 600,000 tons, despite the country's demand for 2.2 million tons.[4]

Demand

By 2027, it is anticipated that the worldwide soy food market, which was valued at USD 44.7 billion in 2021, will have grown to USD 60.7 billion. Although domestic producers' supply has not kept up with industrial processing capacity, the market for soybeans processed industrially is nevertheless expanding at a rapid pace. Soybean oil is major source of salad oil used in households, serving as an affordable substitute for olive oil. Approximately half of the built capacity of soybean processing facilities is not being utilised (Santana et al., 2020). The industrial usefulness of soybeans encourages big producers to collaborate with regional smallholders to secure and increase domestic output. The biggest purchaser of Nigerian soybeans, Olam, released information about their partnership with the International Institute of Tropical Agriculture (IITA) to increase farmers' access to "tropicalised" IITA seed varieties (OLAM, 2018). Soybeans are processed locally by homes and businesses to produce

a range of food items such as flour, soy milk, infant food (like "Tom Brown"), cakes, porridges, fortified cereal staples (including gari, tuwo, and pap), and wara, which is a soy cheese.

Marketing

About 20 to 30 percent of chicken feed and 20 percent of fish feed are made of soybean meal, which is regarded as an ideal crop and a necessary and desirable source of protein in compound feed (NIRSAL, 2022). Though it is not a traditional staple meal like cowpeas, it is enjoyed throughout the region. The soybean trade corridors in Nigeria reveal a sophisticated network centre.
The most intensive trading activity occurs in a central belt where production is highest, with major market hubs in Kaduna and Kano states serving as primary aggregation points. From these central markets, goods flow both northward and southward through established corridors. The Northern trade corridor extends through Sokoto region, ultimately connecting to Niger Republic, facilitating cross-border trade. In the Northeast, a significant trade route extends through Bauchi and Borno states toward the Chad border. The Northwest corridor, encompassing the Sokoto-Kebbi region, maintains strong connections to both Benin and Niger borders.

Processing

There are various products along the soybean processing value chain ranging from soy flour, soy protein, tofu, soy milk, soy sauce, and soybean oil and even animal feed. Soybean oil is usually refined for cooking and other edible uses in related products such as margarine and salad dressings; other times it is used for biodiesel production and other industrial uses. Soybeans can be used in the production of more environmentally friendly products like industrial lubricants, cleaners, paints, and solvents which can safely and rapidly remove oil from creeks, streams and shorelines without harming people, animals, and the environment. Candles made with soybean oil burn longer and with less smoke and soot. Soy crayons made with soy oil instead of petroleum are non-toxic and safe for children. Soy based lubricants are much better than petrol -based lubricants as they are more heat resistant, non-toxic, renewable and environmentally friendly.

Constraints

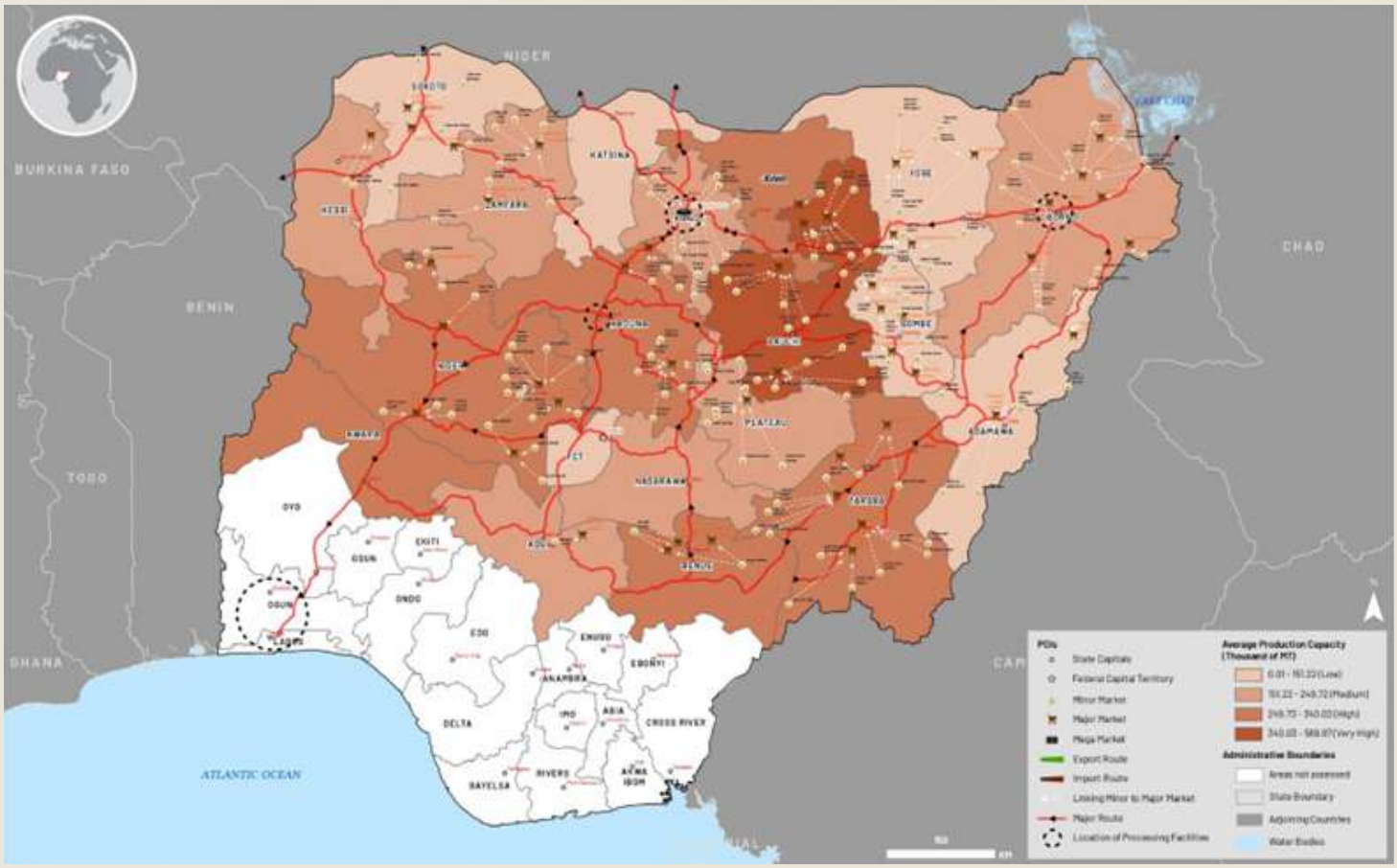
Soybean value chain is affected by several factors, including low yield seed varieties, inadequate knowledge of good agronomic practices, high input costs, inadequate connections to processors and markets, scarcity of financing, and inadequate infrastructure.[5] High seed costs for better varieties and limited availability of superphosphate fertiliser are further factors limiting production, as does erratic rainfall and absence of irrigation.

Opportunities

Even though there are significant gaps in the soybean value chain, these gaps offer commercial opportunities and, if taken advantage of, might help improve the value chain in Nigeria. Around the value chain, the following are suggestive opportunities: soybean possesses significant potential for processing various products throughout the value chain, including milk, animal feed, edible oil, pap, and so on. Due to its usage in animal feed formulation, local demand has also increased, many feed mills have sprung up requiring higher supply across the country. It is the primary supply of vegetable oil on the global market, and nutritionists advise it to be a healthy oil. The crop demand is expected to rise due to the growing array of environmentally sustainable products that may be produced through agricultural processing. It boasts a low cholesterol level, high protein and fibre content, and excellent nutritional value. The meal is marketed as a cost-effective and nourishing option, particularly for undernourished children. There is a growing trend of women engaging in soybean cultivation. The promotion of soybeans is undoubtedly a programme to reduce poverty, as it serves as a cash crop for farmers to earn more money or as a rich food crop for households to get better nutrition and health. Nigeria, and consequently Africa, can profit from a significant unfulfilled demand for the crop on the global market.

[4]https://sedin-nigeria.net/wp-content/uploads/Soy-Processing-Value-Chain.pdf

[5]https://sedin-nigeria.net/wp-content/uploads/Soy-Processing-Value-Chain.pdf



Groundnut production areas, markets and transportation routes in Northern Nigeria
Source: World Food Programme (WFP) Logistics Sector.

Groundnut

Production

Nigeria is the largest groundnut producing country in West Africa, accounting for 51percent of production in the region and contributing about 10 percent of total global production and 39 percent to that of Africa (Ajeigbe et al., 2020). Currently, Nigeria ranks as the fourth largest producer of groundnut globally, yet it ranks as the 63rd largest exporter in 2021. This indicates that Nigeria holds abounding potential to outperform its current levels of exports if given the required attention (Ajibade et al., 2023). Groundnut is produced in almost all the Central, Northern, and part of the derived Savannah of Eastern and Western Nigeria. By volume of production, the major producing states as shown in Figure 7 are Bauchi, Benue, Niger, Kaduna, Taraba, Kwara, Jigawa, Nasarawa, Plateau, Kogi, Borno, Kebbi, FCT. Others are Kano, Zamfara, Katsina, Gombe, Adamawa, Sokoto and Yobe States. Groundnut is a rainfed crop planted at the onset of the rainy season and harvested when the rain ceases.

Demand

The main demand is for the extraction of its oil for cooking. The by-products are used for animal feed and shells for mulching. Large numbers of groundnuts are purchased by oil millers and snack makers. The by-products of the millers' activities are sold through a different supply chain that involves dealers,

wholesalers, retailers, and livestock farmers. However, the level of exports out of Lagos is reported. National Bureau of Statistics (NBS)[6] reported that in 2023, Nigeria exported 77,019.35 metric tons of groundnuts, valued at approximately USD115 million.

Marketing

The marketing and distribution system for groundnuts in Nigeria is characterised by a complex network of intermediaries, including local collectors, wholesalers, and retailers. This fragmented supply chain often leads to inefficiencies and challenges for small-scale farmers in accessing markets (Vabi et al., 2019). Price fluctuations and information asymmetry in the market pose significant challenges for producers (Ani et al., 2013). The role of middlemen in the supply chain has been a subject of debate, with some studies suggesting that their involvement may negatively impact farmer incomes. The market is primarily around Kano. Also, the Sokoto-Kebbi markets along the border regions and the Yobe-Borno centres. The transport corridor from Kano through Katsina to Niger Republic, complemented by a secondary route through Sokoto. Another is the Kano through Bauchi to Yobe.

Processing

The quantity sold through retail for snacks and sweets is processed at home and in cottage industries scattered within Nigerian communities. The nuts are processed into roasted or boiled peanuts, peanut butter, groundnut flour, snacks (coated peanuts), and traditional foods such as groundnut soup and forage. Other processes include the production of cosmetics and pharmaceutical materials. Oil extraction is the largest portion of groundnut processing done by industries (oil mills). Groundnut processing includes several key stages that include shelling, roasting, grinding, and pressing to produce various products such as groundnut oil, groundnut cake, groundnut flour, and peanut butter. The by-products processing, which is a result of the activities above, may include development processes such as drying, crushing, and packaging.

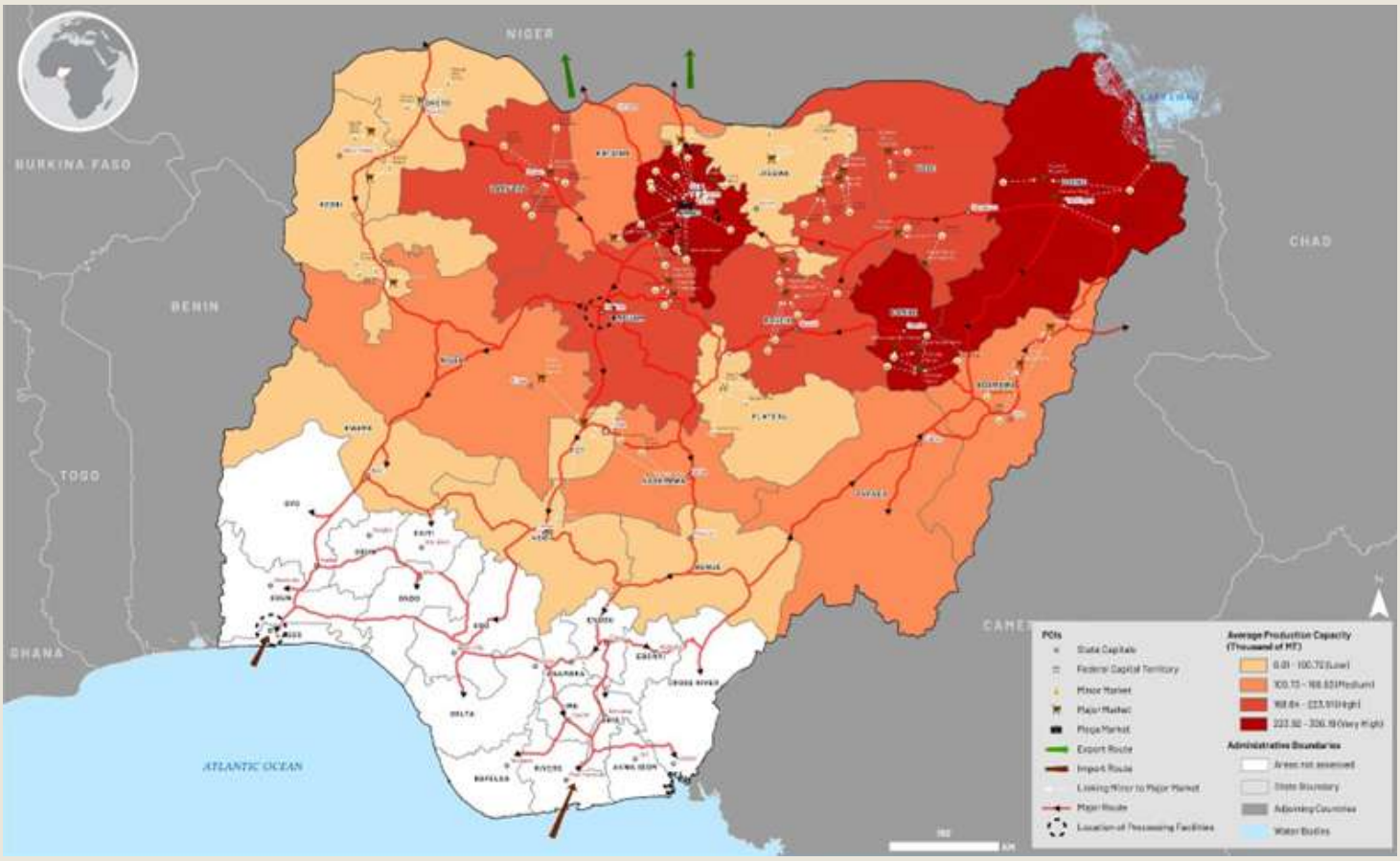
Constraints

The groundnut supply chain in Nigeria faces several overarching challenges, including limited access to credit for farmers and processors, poor infrastructure and high transportation costs, and the increasing impacts of climate change on production. Furthermore, the absence of established quality standards and limited access to finance hinder efforts to increase production and market competitiveness. A major challenge facing the export sector is aflatoxin contamination, which has severely impacted the acceptance of Nigerian groundnuts in international markets (Meijer et al., 2021). Compliance with international quality standards remains a key concern for exporters. The Nigerian government has implemented various export promotion efforts to revitalise the sector, but challenges persist. Furthermore, trading activities in the groundnut value chain are grossly underreported due to the high levels of uncaptured cross-border trading (Ajibade et al., 2023).

Opportunities

Producing and marketing groundnuts in Nigeria offers considerable potential for growth and economic advancement. The adoption of high-yielding and pest-resistant groundnut varieties can enhance productivity and resilience to climate challenges. Support from the government and donors, through subsidies, training programmes, and improved agricultural practices, will further strengthen production capabilities. Rising domestic demand for groundnuts and their by-products, along with export potential to neighbouring countries, creates profitable market opportunities. Additionally, advancements in value-added processing, such as groundnut oil and flour production, open new revenue streams. Implementing climate-smart agriculture and integrated pest management techniques also ensures sustainable production growth, positioning Nigeria to improve its performance in both local and international markets.

[6]https://nigerianstat.gov.ng/pdfuploads/Q1%202023%20Foreign%20Trade%20Statistics%20Report.pdf



Tomato production areas, markets and transportation routes in Northern Nigeria
Source: World Food Programme (WFP) Logistics Sector.

Production

Tomato is an important horticultural crop in Nigeria, significantly contributing to the country's agricultural sector and food security. Nigeria is the 14th largest tomato producer globally and the second in Africa, yet it ranks as the 13th largest importer of tomato paste worldwide and third in Africa. The primary tomato-growing regions in Nigeria are Kano, Jigawa, Kaduna, Katsina, Sokoto, and Benue, which benefit from favourable agro-climatic conditions as shown in Figure 8. The cultivation is largely rain-fed, with two main growing seasons: the dry season (October to April) and the rainy season (May to September). However, productivity remains low compared to global standards due to several factors. One of the primary challenges in tomato production is the prevalence of pests and diseases. The tomato leaf miner (Tuta Absoluta), detected in Nigeria in 2016, has been particularly devastating, causing significant yield losses (Sanda et al., 2018). Other pests include whiteflies, aphids, and fruit borers.

Demand

The demand for tomatoes in Nigeria is influenced by several factors, including population growth. Increased consumption is also driven by urbanisation and the dietary habits associated with it,

with tomatoes being a staple in various Nigerian dishes. Additionally, the expansion of processing industries contributes to higher demand. Moreover, there is a growing preference for milder flavours in soups and stews.

Marketing

The marketing system for tomatoes in Nigeria is largely informal, with much of the produce sold in local markets. Market intermediaries play a crucial role but often lead to price distortions and reduced profit margins for farmers (Balana et al., 2022). Major markets for tomatoes in Nigeria include the Mile 12 Market in Lagos, which is one of the largest food markets in the country, and the Dawanau Market in Kano. Marketers and farmers are constantly dealing with fluctuating prices due to the seasonality of the crop. Marketers face significant losses due to poor road networks and a lack of refrigerated transport, which affect the quality of tomatoes delivered. The tomato supply chain could be more effective if market information is available in real-time and storage facilities, including cold chain, were adequate.

Processing

Tomato processing in Nigeria is underdeveloped despite the country's high production volumes. Most tomatoes consumed in Nigeria are fresh, with only a small percentage processed into products like paste, sauce, and ketchup (Takeshima et al., 2023). The inadequate processing infrastructure and high cost of processing equipment are major barriers to the industry's development (Sibomana et al., 2016). While there are large-scale processing facilities, such as those operated by Tomato Jos in Kaduna and Dangote in Kano, their capacity utilisation remains low due to inconsistent supplies of quality tomatoes and competition from imported paste (Tafida et al., 2019). Small-scale processing, like sun-drying, is practiced in some areas. Other notable Nigerian tomatoes processing companies include Erisco Foods in Lagos, Savanna Integrated Farms in Kaduna, CHI Farms in Lagos, Sonia Foods Industries in Ibadan, Vegefresh Group in Lagos, and Nigeria Agric Business Group (NABG).

Constraints

Key challenges in tomato cultivation in Nigeria are influenced by climatic factors such as temperature variations and inconsistent rainfall, along with issues like pest and disease outbreaks, the quality of inputs (including seeds), inadequate irrigation systems, and insufficient training. In terms of marketing, obstacles include post-harvest losses stemming from inadequate storage and processing options, price fluctuations, and poor transportation and handling facilities. Additional challenges involve the impact of middlemen and limited market access. Transportation is a major bottleneck in the Nigerian tomato supply chain. Tomatoes are typically transported from Northern production areas to southern markets in open trucks without proper packaging or temperature control. Poor road infrastructure, particularly in rural areas, leads to long transit times and significant damage to produce, resulting in high spoilage rates and quality deterioration before reaching the market (Ugonna et al., 2015). The high cost of transportation further contributes to supply chain inefficiency. Additionally, inadequate packaging during transportation leads to mechanical damage and increased perishability (Arah et al., 2015).

Opportunities

In recent years, there has been increased interest in improving Nigeria's tomato value chain. Both the government and private sector have initiated various interventions, such as promoting improved varieties, establishing modern greenhouses, and investing in processing facilities. Technology adoption in the supply chain is gradually increasing. Improved seeds, better agronomic practices, and greenhouse technology are being introduced to address production challenges. In post-harvest handling, plastic crates are gaining popularity for reducing transit damage (Takeshima et al., 2023). Investment in cold chain systems, better storage facilities, and improved transportation infrastructure can reduce post-harvest losses (Takeshima et al., 2023). Encouraging private sector investment in tomato processing and providing incentives for establishing processing plants can enhance value addition and create employment opportunities.

Cost build-up analysis

This section provides the cost build-up analysis of the eight food commodities considered in this study (sorghum, millet, maize, wheat, groundnut, tomatoes, cowpeas and soybeans). First, the cost build-ups for the producers of these commodities are presented, deploying the input-costs based approach where costs are disaggregated into land rental cost, labour cost (mainly hired labour) seeds, inorganic fertiliser, organic fertiliser, agrochemicals (pesticides and herbicides), agricultural machinery (rental value), and irrigation costs (if irrigated farming is involved). All values are reported in Nigerian Naira per hectare.

Cost build-ups for agricultural producers

Sorghum

Sorghum is the most widely cultivated crop in Northern Nigeria, known for its climate resilience and yielding an average of 2,550 kilogram per hectare. The typical farm size for sorghum in this region is approximately 1.44 hectares. Figure 9 presents the cost breakdown for sorghum production in Northern Nigeria. Land rental, estimated at Naira 89,000 per hectare, poses a significant expense for farmers without land ownership. While seed and agrochemical costs (pesticides and herbicides) are relatively low, the costs for inorganic fertiliser (Naira 196,437.5 per hectare) and labour (Naira 278,482 per hectare) are substantial. Machinery rental, averaging Naira 110,250 per hectare, highlights the labour-intensive nature of farming and the shift toward mechanisation, albeit at a high cost. High fertiliser and labour expenses indicate that improvements in these areas could substantially boost profitability. Machinery rental costs suggest a growing trend in mechanisation, but they remain a significant financial hurdle for smaller farmers. This breakdown underscores the critical decisions sorghum farmers face around inputs, in particular labour, fertiliser, and machinery, as they strive to enhance profitability while managing resources sustainably.

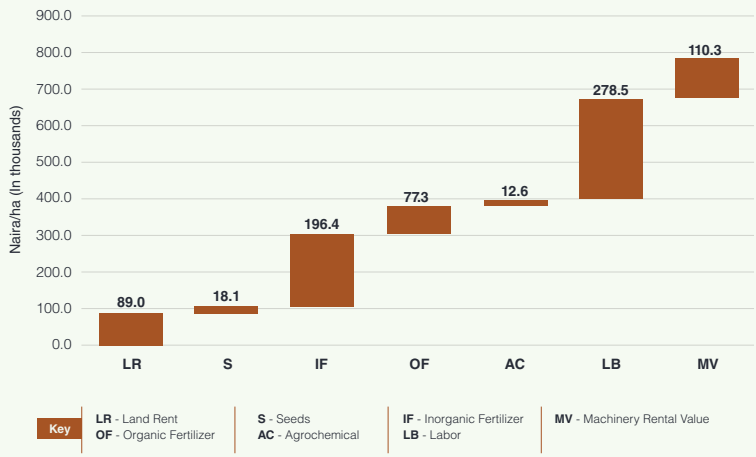


Figure 1: Cost build-up for a sorghum farmer in Northern Nigeria.
Source: 2024 field survey, IFPRI.

Millet

Millet production in Nigeria is characterised by high labour costs and minimal mechanisation. As shown in Figure 10, millet yields average 1,856.7 kilograms per hectare, with typical farm sizes around 1.42 hectares reflecting the smallholder nature of Nigerian agriculture. Fertiliser costs, especially for inorganic fertilisers, are considerable, while labour costs are substantial at Naira 98,704 per hectare. Machinery rental costs are low, suggesting limited mechanisation in millet farming. Agrochemical expenses are also low at Naira 16,125 per hectare, which may indicate efficient pesticide and herbicide use or limited application. Labour costs constitute a large share of total production expenses, highlighting the manual nature of many farming operations. Effective labour management is therefore crucial for profitability in millet production. Additionally, sustainable practices, particularly in fertiliser use, could improve soil health over time and potentially lower input costs.

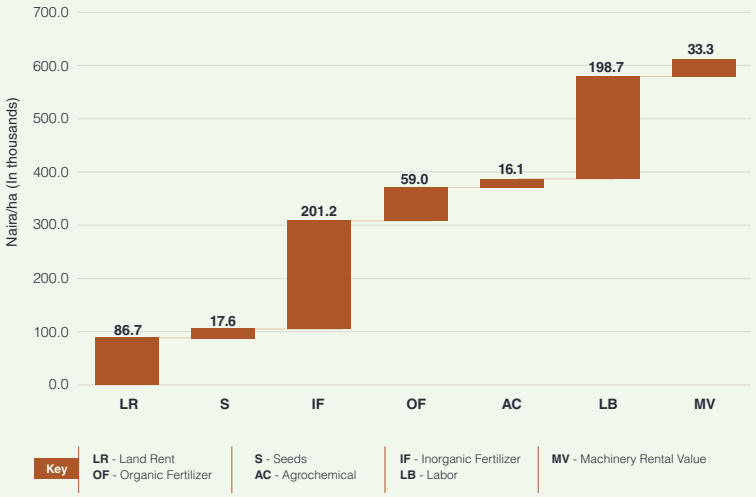


Figure 2: Cost build-up for a millet farmer in Northern Nigeria.
Source: 2024 field survey, IFPRI.

Maize

Maize is a crucial staple crop in Nigeria with high input costs but strong market demand. Findings indicate an average maize yield of 2,700 kilograms per hectare on farms averaging 1.63 hectares in Northern Nigeria. As shown in Figure 11, maize production involves significant input costs, especially for fertilisers, with inorganic fertiliser expenses reaching Naira 381,950 per hectare due to maize's high nutrient requirements. Seed costs are also notable at Naira 31,229 per hectare, higher than for sorghum and millet, and agrochemical use is substantial. Despite these high costs, maize's yield potential makes it a profitable crop. Farmers sell large volumes of maize to meet high domestic demand for food, poultry feed, and industrial applications.

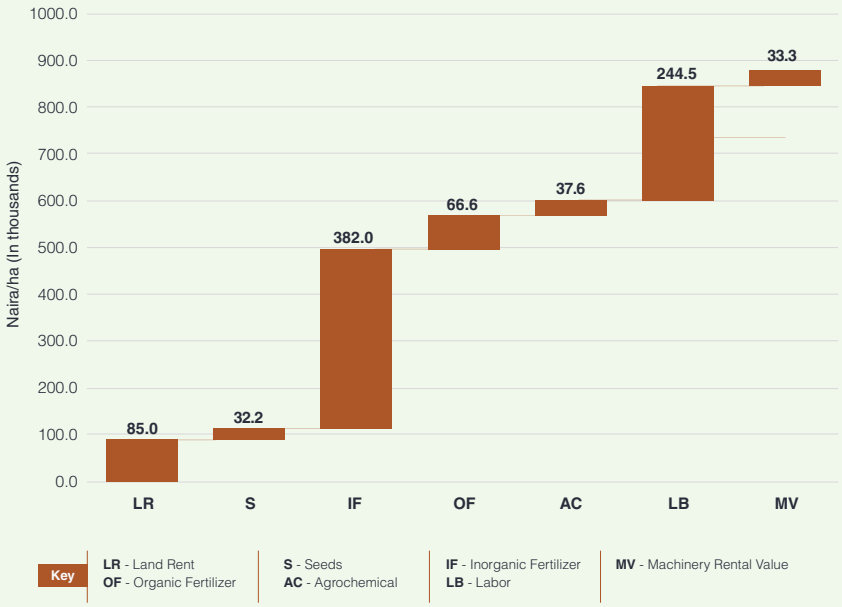


Figure 3: Cost build-up for a maize farmer in Northern Nigeria. Source: 2024 field survey, IFPRI.

Wheat

Wheat is Nigeria's third most-consumed grain, yet domestic production meets only 1 percent of the 5 to 6 million metric tons consumed annually (Balana et al., 2022). This reliance has led to significant wheat imports, but recent initiatives aim to boost local production and reduce dependency on imports. The average yield for wheat in Nigeria is 2,391.9 kilograms per hectare, which is relatively low compared to global wheat yields, due in part to limited mechanisation, reliance on small-scale irrigation, and challenges in accessing high-quality inputs. The typical farm size for wheat production is 1.45 hectares, which reflects the smallholder-dominated nature of Nigeria's wheat farming. These small-scale operations often lack the resources needed for higher productivity, further constraining yield potential. The cost structure for wheat production in Nigeria is also a barrier to profitability and is presented in Figure 12. Seed costs are particularly high, amounting to Naira 62,856.1 per hectare. This high expense may stem from limited local production of improved wheat seed varieties, which forces farmers to rely on expensive imported seeds or on less efficient, locally produced seeds that do not offer the same yield benefits. Labour is another major cost, reaching Naira281,820.5 per hectare. Wheat farming in Nigeria remains highly labour-intensive, largely due to limited mechanisation and reliance on manual planting, weeding, and harvesting. For smallholder farmers, these labour costs constitute a substantial portion of total expenses and limit their ability to scale production. Overall, the high costs of seeds and labour place significant financial pressure on wheat farmers, making it challenging for them to achieve profitability. These expenses highlight areas where targeted support, such as subsidies for high-quality seeds, promotion of labour-saving technologies, and investments in mechanisation could improve yields and reduce costs, ultimately enhancing the viability of domestic wheat production.

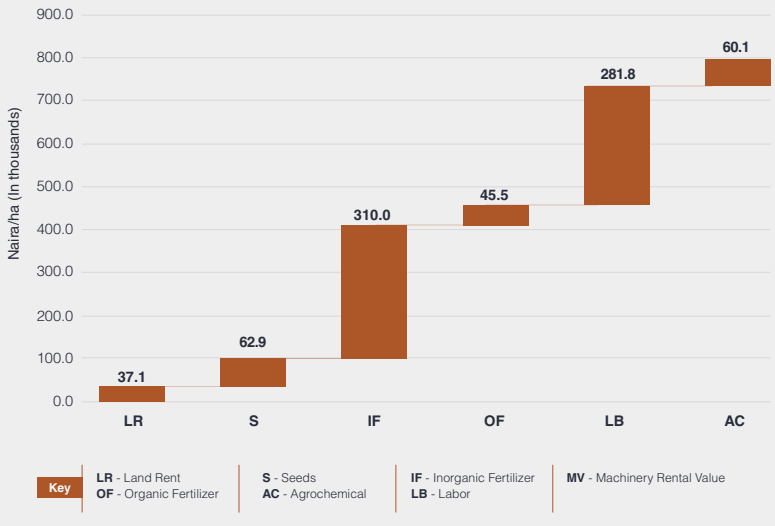


Figure 4: Cost build-up for a wheat farmer in Northern Nigeria.
Source: 2024 field survey, IFPRI.

Cowpea

Labour costs dominate cowpea production expenses, highlighting its labour-intensive nature. As shown in Figure 13, cowpea yields in Northern Nigeria average 383.5 kilograms per hectare, with a typical farm size of 1.65 hectares. Land rent is relatively moderate at Naira 31,000 per hectare, while labour costs are the largest expense, reaching Naira 152,400 per hectare. This high labour cost reflects the demands of repeated harvesting and intensive pest control, essential for maintaining crop quality. Seed costs are also significant at Naira 34,400 per hectare, likely due to the use of improved varieties designed for pest resistance and higher yield potential. Fertiliser expenses are relatively low, limited to inorganic fertilisers at Naira 55,800 per hectare, which aligns with cowpea's nitrogen-fixing ability, reducing dependency on nitrogen-based inputs. Agrochemical costs, totalling Naira 26,800 per hectare, underscore the need for effective pest and weed management, given cowpea's vulnerability to pests. Machinery rental costs are modest at Naira 33,000 per hectare, suggesting limited mechanisation and a reliance on manual labour. Overall, the cost structure reveals that labour and pest control are critical for efficiency improvements to enhance profitability for smallholder cowpea farmers.

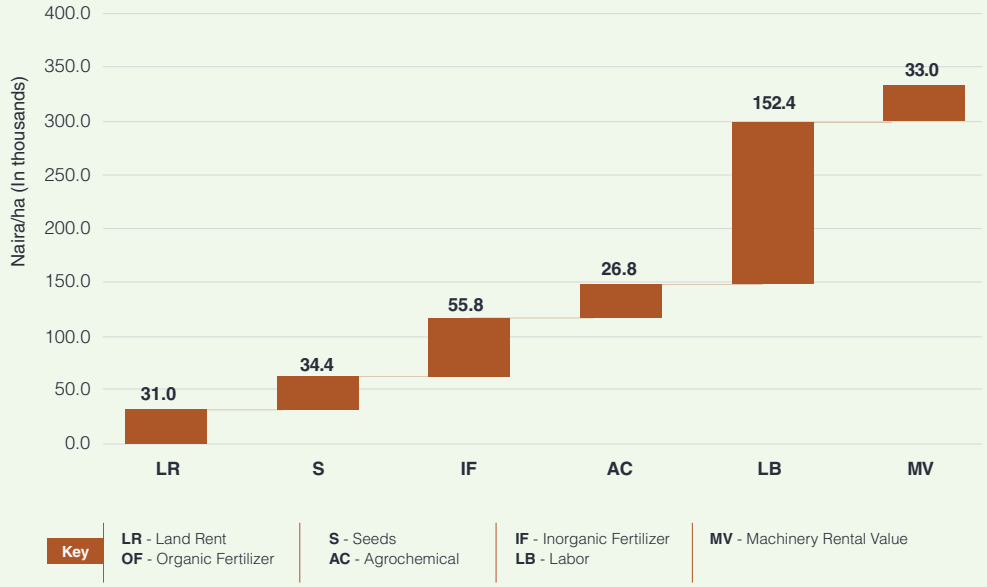


Figure 5: Cost build-up for a cowpea farmer in Northern Nigeria.
Source: 2024 field survey, IFPRI.

Soybean

Fertiliser and labour dominate the cost structure for soybean production in Nigeria. As shown in Figure 14, land rental costs amount to Naira 40,833 per hectare, while seeds contribute Naira 10,242 per hectare to the total. This initial investment in quality seeds is essential for achieving favourable yields. Fertiliser expenses are the largest input, with inorganic fertiliser at Naira 160,043 per hectare and organic fertiliser adding Naira 29,000 per hectare, reflecting soybean's high nutrient demands. Agrochemical costs are moderate at Naira 13,167 per hectare, covering essential pesticides and herbicides for managing weeds, pests, and diseases. Labour represents a significant cost, reaching Naira 110,329 per hectare, due to the extensive manual work required from planting through harvest. Machinery expenses complete the cost structure at Naira 51,444 per hectare, accounting for equipment use across various stages of production. Overall, the high costs of fertiliser and labour underscore the resource-intensive nature of soybean farming, with machinery also playing a notable role.

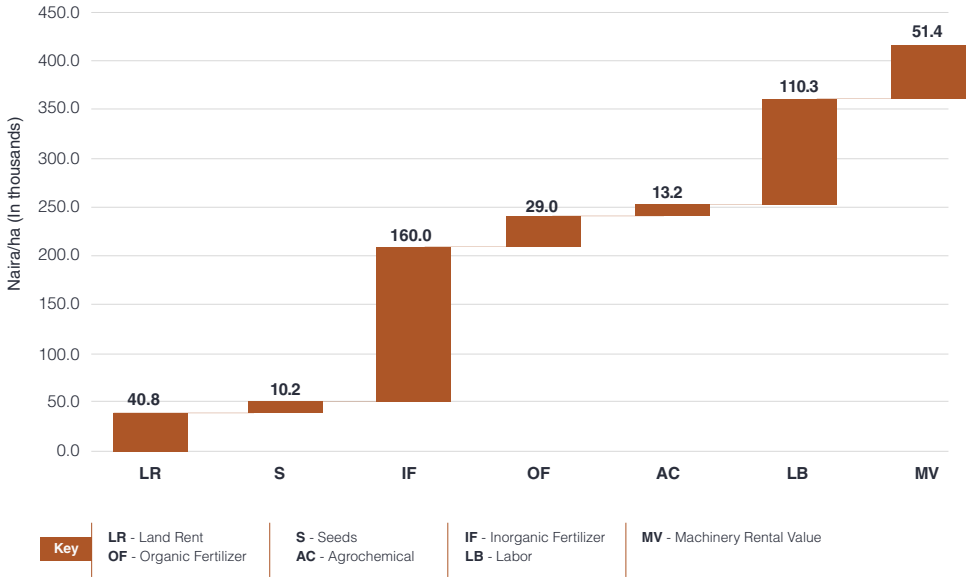


Figure 6: Cost build-up for a soybean farmer in Northern Nigeria.
Source: 2024 field survey, IFPRI.

Groundnut

Groundnut is a vital oil and protein crop in Nigeria, with a relatively low-cost profile that appeals to smallholder farmers. As shown in Figure 15, groundnut yields an average of 1,891.7 kilograms per hectare, typically grown on one-hectare farms. Land rental costs are moderate at Naira 52,000 per hectare, and seeds cost Naira 32,600 per hectare. Agrochemical expenses, covering pesticides and herbicides, amount to Naira 25,400 per hectare, reflecting essential pest and weed management. Inorganic fertiliser and labour costs are the largest expenses in groundnut production, at Naira 216,000 and Naira 143,500 per hectare, respectively, making up over 50 percent of the total production costs. These high fertiliser and labour requirements indicate the importance of nutrient management and manual labour in groundnut farming. Overall, groundnut's low overall cost structure, compared to other crops, makes it an appealing choice for resource-limited farmers looking for a profitable crop option.

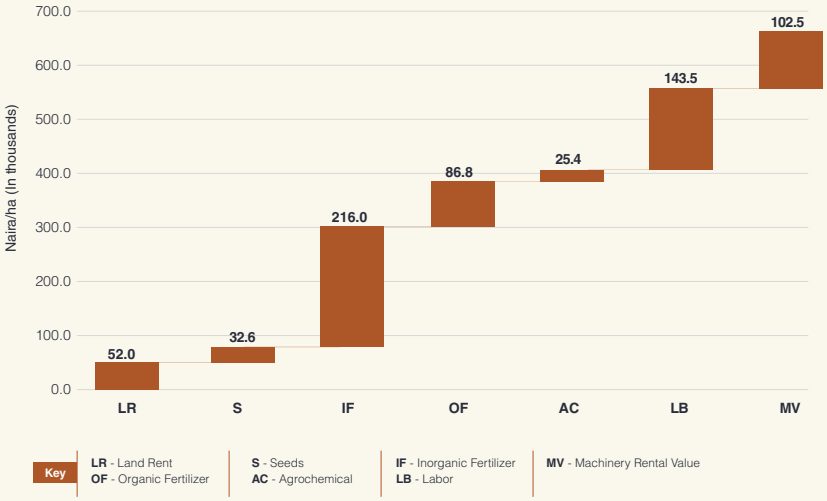


Figure 7: Cost build-up for a groundnut farmer in Northern Nigeria.
2024 field survey, IFPRI.

Tomato

Tomato yields in Nigeria are higher during the dry season, with distinct differences in cost structure and farming practices across seasons. Figures 16 and 17 illustrate the cost breakdowns for tomato farming in the dry and wet seasons. In the dry season, yields reach 9,222.7 kilograms per hectare — about 19.6 percent higher than the wet season yield of 7,710.5 kilograms per hectare. This increase likely reflects improved fruit quality in the dry season. Despite this yield advantage, dry season farms average 1.20 hectares, smaller than the 1.32 hectares typical in the wet season, suggesting more intensive or efficient cultivation during the dry season. Land rent is higher in the wet season at Naira 80,000 per hectare, compared to Naira 67,500 per hectare in the dry season, likely due to the demand for land for multiple crops during the rainy months. Seed costs are similar between seasons, with a slight increase in the dry season (Naira 42,575.34 per hectare versus Naira 42,070 per hectare in the wet season). Fertiliser costs are notably higher in the dry season; inorganic fertiliser expenses rise by 22 percent to Naira 172,862 per hectare, with organic fertiliser costs also increasing slightly. This suggests a need for additional soil nutrients during the dry season to offset the lack of natural rainfall. Agrochemical expenses are also elevated in the dry season, at Naira 52,354 per hectare compared to Naira 47,008 per hectare in the wet season, likely due to greater pest and weed management needs. Labour costs are marginally higher in the wet season, reaching Naira 159,728 per hectare versus Naira 156,903 per hectare in the dry season, possibly due to increased labour demands during harvest. Machinery rental costs, however, are significantly lower in the dry season (Naira60,000 per hectare) than in the wet season (Naira 95,833 per hectare), indicating differences in mechanisation requirements between the seasons.

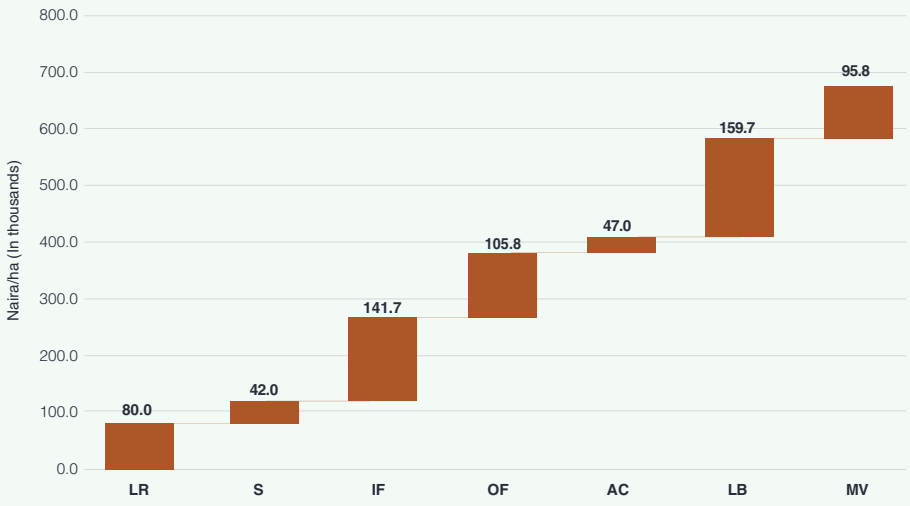
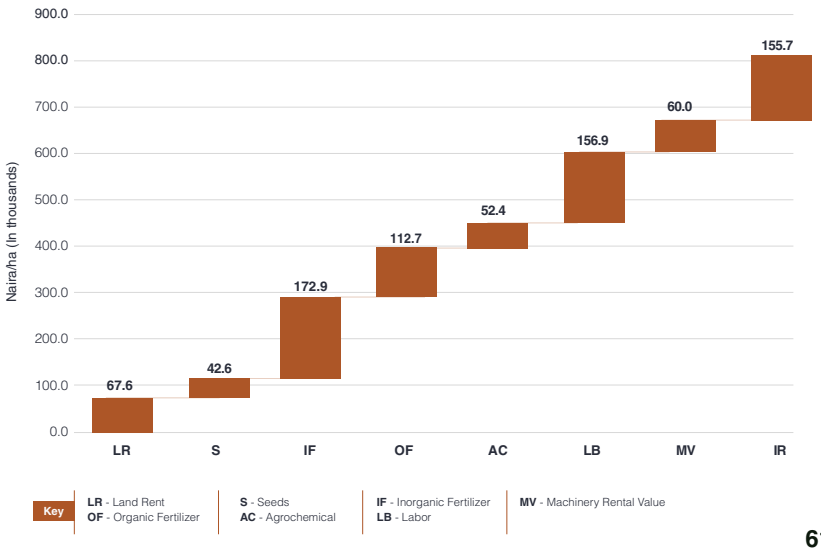


Figure 8: Cost build-up for a tomato farmer (wet season) in Northern Nigeria.
2024 field survey, IFPRI.



Cost build-up for a tomato farmer (dry season) in Northern Nigeria.
2024 field survey, IFPRI.

The consolidated cost structure to produce the eight food commodities highlights the varying importance of each cost component across different crops. As shown in Figure 18, each element - land rent, seeds, fertilisers (both inorganic and organic), agrochemicals, labour, machinery, and irrigation - plays a distinct role in the production process, with its share varying significantly by crop type.

Land rent

reflects the cost of securing farmland, with the share ranging from 4.5 percent for wheat to 14.1 percent for millet. Millet and sorghum incur relatively high land rent costs (14.1 percent and 11.4 percent, respectively), possibly due to the extensive land requirements of these low-input crops. **Seed costs** also vary widely. Cowpea has the highest seed costs (10.3 percent), likely due to its reliance on high-quality or certified seeds. Millet, soybeans, and sorghum show minimal seed costs (2.9 percent, 2.5 percent, and 2.3 percent, respectively), suggesting the use of farm-saved seeds or less expensive local varieties.

Inorganic fertiliser

is crucial for soil fertility, especially for nutrient-demanding crops. Maize (43.3 percent), soybeans, and wheat (37.7 percent) show the highest dependence on inorganic fertiliser, reflecting their intensive nutrient needs. Groundnut and millet follow at 32.8 percent each, a significant share of their production costs. Tomatoes use moderate levels of inorganic fertiliser, while cowpea has the lowest share (16.7 percent), benefiting from its nitrogen-fixing capacity.

Organic fertiliser

supports long-term soil health, with tomatoes (wet season) showing the highest organic fertiliser costs (15.7 percent), emphasising soil conditioning. Groundnut (13.2 percent) and sorghum (9.9 percent) also rely on organic fertiliser, while wheat shows a low organic fertiliser cost share (5.5 percent), focusing more on chemical inputs.

Agrochemical costs

reflect the need for pest and disease control. Cowpea (8.0 percent), wheat (7.3 percent), and tomatoes (wet season) (7.0 percent) have higher agrochemical costs due to their susceptibility to pests and diseases, while sorghum (1.6 percent) and millet (2.6 percent) have the lowest. Labour costs are substantial for all crops, often the largest expense. Cowpea (45.7 percent) and sorghum (35.6 percent) show the highest labour costs, indicating labour-intensive practices. In contrast, tomato (dry season) have lower labour costs (19.1 percent), likely due to greater mechanisation or efficient labour practices.

Machinery costs

indicate the level of mechanisation. Groundnut (15.6 percent) and tomato (wet season) (14.3 percent) have the highest machinery costs, while millet (5.4 percent) and maize (3.8 percent) reflect limited mechanisation.

Irrigation costs

are essential for crops grown in dry conditions. Tomato (dry season) incurs the highest irrigation costs (19.0 percent), indicating high water needs, while wheat has minimal irrigation costs (3.1 percent), suggesting a reliance on rain-fed methods or less water-intensive practices.

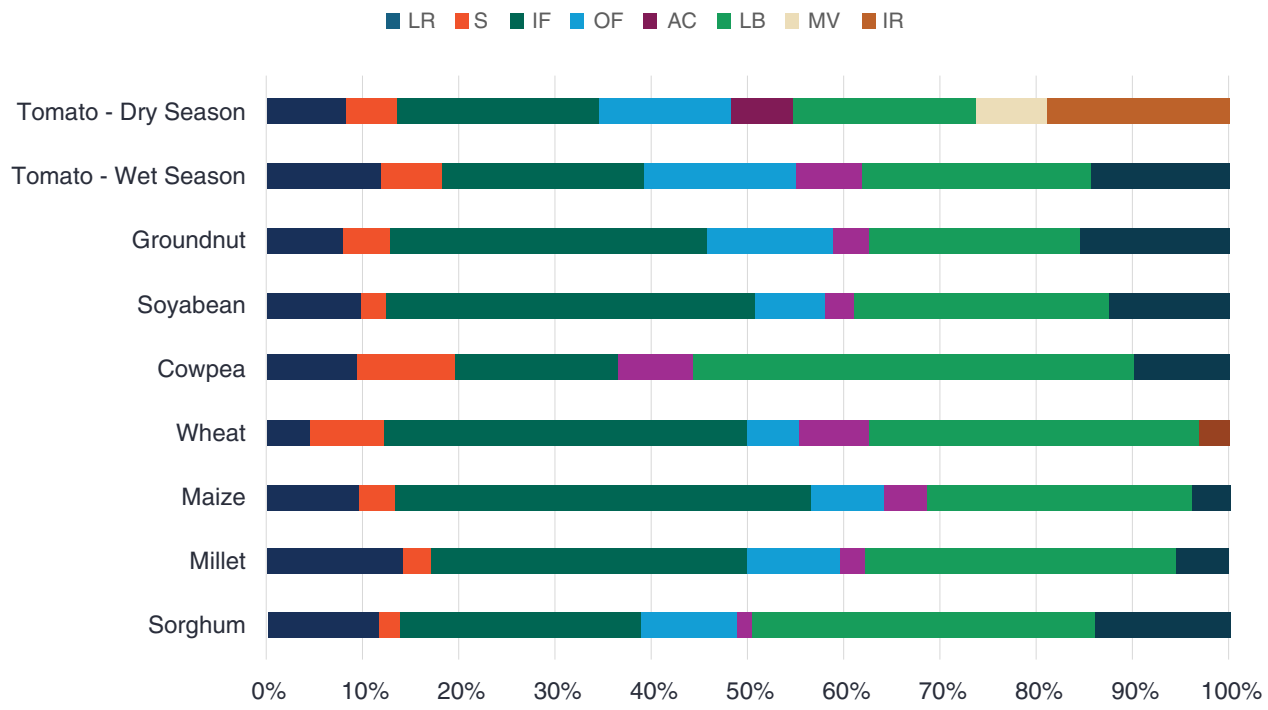


Figure 9: Combined cost build-up for maize, sorghum, millet, wheat, cowpeas, groundnut, soybeans, and tomato (dry and wet seasons).
Source: 2024 field survey, IFPRI.

Gross margins of the focus commodities

The prices and gross margins of focus commodities are presented in Figures 19 and 20.

Sorghum demonstrates solid profitability with a total production cost of Naira 782,200 and a revenue of Naira 1,883,800, resulting in a gross margin of Naira 1,101,600. This margin represents approximately 58.5 percent of its revenue. Sorghum's relatively high gross margin highlights its suitability for low-input farming systems, which helps keep costs manageable while maintaining steady yields. Its adaptability to semi-arid conditions and resilience to pests and diseases reduce the need for costly inputs, making it an attractive crop for smallholder farmers in resource-constrained environments. This makes sorghum a reliable choice in areas where both cost efficiency and environmental resilience are critical factors.

Millet achieves a total cost of Naira 612,600, with revenue reaching Naira 1,499,300 and a gross margin of Naira 886,700, which equates to 59.2 percent of its revenue. Like sorghum, millet thrives in arid and semi-arid regions, with minimal input requirements due to its natural resilience. Its lower reliance on inorganic fertilisers and agrochemicals helps keep costs down while maintaining stable yields, making it highly profitable for farmers in challenging environments. The hardiness of millet against climate variability and its role as a staple food further enhances its economic appeal, particularly for small-scale farmers looking to optimise profitability with limited resources.

Maize is more input-intensive, with a high total production cost of Naira 881,100. However, it generates substantial revenue at Naira 1,620,000, yielding a gross margin of Naira 738,900, or about 45.6 percent of revenue. Maize's profitability is driven by its high demand, both as a staple food and as a key ingredient in animal feed and industrial products. Despite its profitability, maize production is sensitive to input costs, particularly for inorganic fertilisers and improved seeds. Market price volatility and fluctuating input costs can significantly impact its gross margins. Nevertheless, maize remains a staple in the agricultural economy, offering moderate returns in exchange for its relatively higher investment requirements.

Wheat incurs a total production cost of Naira 797,300 and generates Naira 1,913,500 in revenue, resulting in a gross margin of Naira 1,116,200, or 58.3 percent of revenue. Despite substantial costs associated with labour and input demands, wheat's high gross margin underscores its viability, particularly in areas with access to reliable irrigation. Wheat's economic potential is especially strong in regions where farmers can manage the crop's water requirements efficiently, offsetting its relatively high input costs. This profitability reflects the importance of investing in adequate infrastructure for irrigation and water management to maximise the returns on wheat farming.

Cowpea stands out for its cost efficiency, with a total production cost of Naira 333,500 and revenue of Naira 1,165,500, yielding a gross margin of Naira 832,100, or 71.4 percent of its revenue. Cowpea's profitability is largely due to its low input costs, as it benefits from nitrogen fixation, reducing the need for costly fertilisers. Additionally, cowpea's adaptability across various agroecological zones and its strong market demand as a protein source make it one of the most lucrative crops for farmers. Its high gross margin emphasises cowpea's role as a financially attractive option for smallholder farmers, particularly those looking for high returns on a low-cost investment.

Soybean generates a total revenue of Naira 721,400 from a production cost of Naira 415,000, resulting in a gross margin of Naira 306,400, which represents 42.5 percent of its revenue. While soybeans' input costs are moderate, its profitability is constrained by relatively low market prices compared to other crops. The economic returns from soybeans could be enhanced by promoting value-added soybean products or improving market access and linkages. Expanding market opportunities and processing facilities could drive up soybeans' profitability, making it a more attractive option for farmers looking to diversify their income sources.

Groundnut has a total production cost of Naira 658,700 and generates Naira 906,100 in revenue, yielding a gross margin of Naira 247,400, or 27.3 percent of revenue. Groundnut's profitability is limited by its high labour costs and moderate dependency on inputs, coupled with relatively low market prices. Although groundnut is valued for its oil and protein content, its modest profitability suggests that it may be better suited as a supplementary crop rather than a primary income source. Enhancing groundnut's market value, possibly through processing or improved supply chains, could help increase returns for farmers engaged in groundnut cultivation

Tomato (wet season) proves exceptionally profitable, with a production cost of Naira 672,100 and revenue of Naira 3,752,400, resulting in a gross margin of Naira 3,080,300, or 82.1 percent of revenue. Wet-season tomato production benefits from reduced irrigation costs and high market demand, which drive up its economic returns. The wet season provides optimal growing conditions, but farmers must manage risks such as increased pest and disease prevalence. The high profitability of wet-season tomatoes highlights its potential for substantial income, particularly for farmers who can effectively manage crop protection and quality.

Tomato (dry season) emerges as the most profitable crop, with a total cost of Naira 820,700, generating revenue of Naira 4,669,500 and yielding a gross margin of Naira 3,848,700, or 82.4 percent of revenue. Despite higher costs for irrigation and other inputs, dry-season tomatoes command premium market prices due to limited supply during off-peak periods. The substantial returns associated with dry-season tomato production underscore the economic advantages of investing in irrigation infrastructure and water management systems. For farmers able to manage these investments, dry-season tomato cultivation offers unparalleled profitability in the agricultural sector.

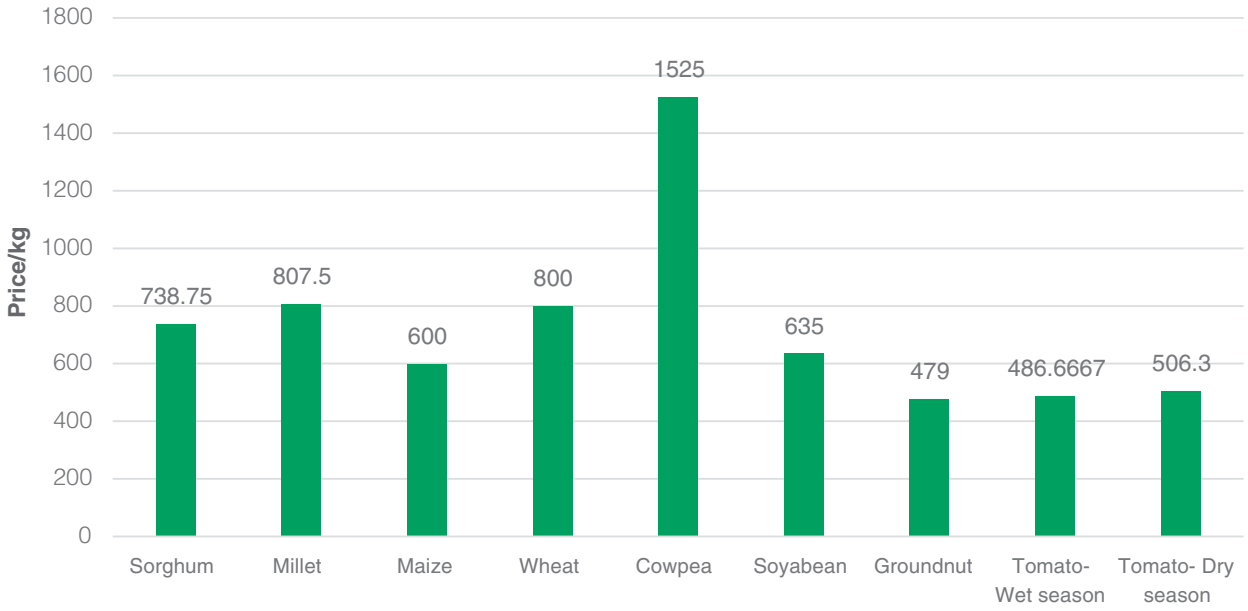


Figure 10: Price per kilogram for eight food commodities.
Source: 2024 field survey, IFPRI.

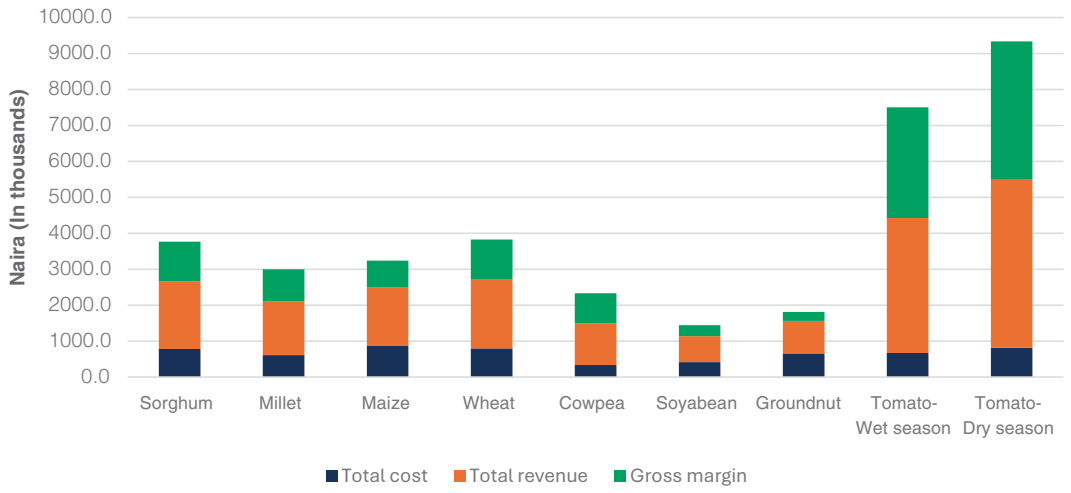


Figure 11: Gross margins for the selected commodities.
Source: 2024 field survey, IFPRI.

Cost build ups for food transporters

This sub-section analyses the cost structure for food transporters within the agri-food value chain. Transportation costs are assessed based on the volume (metric tons) transported, distance, and specific routes rather than the type of commodity. For consistency and clarity, all costs have been standardised to metric tons, allowing for a comparison across various routes. The primary costs faced by transporters include labour for loading and off-loading, as well as truck rental or hiring expenses, which represent a significant portion of the overall cost structure. Notably, transporters often move mixed food groups as determined by the goods' owners, reflecting the variable nature of transportation needs in this sector.

1. From Kano to Damaturu and Maiduguri

Figures 21 and 22 provide insights into the cost breakdown for routes between Kano and Damaturu, and Kano and Maiduguri. For both routes, the fixed cost of labour for loading and off-loading is Naira 2,000 per metric ton. This cost encompasses the labour-intensive work required to handle goods at both the point of origin and the destination. However, the most substantial cost component is truck hire. The hiring cost is Naira 22,500 per metric ton for goods transported to Damaturu and Naira 23,750 per metric ton for goods transported to Maiduguri. This truck hire cost includes fuel, driver wages, and essential vehicle maintenance, which are critical in covering long distances on sometimes challenging roads.

For revenue, the haulage rate stands at Naira 26,000 per metric ton for the Kano-Damaturu route and Naira 29,600 per metric ton for the Kano-Maiduguri route, reflecting market-driven pricing dynamics and demand for transportation services. The transport margins, or profit, for these routes are Naira 3,500 per metric ton to Damaturu and Naira 5,850 per metric ton to Maiduguri. These margins represent 13.5 percent of revenue for the Damaturu route and 19.8 percent for the Maiduguri route. Although these profit margins may appear modest, they help to accommodate various additional costs that may arise, such as vehicle repairs due to poor road conditions, delays, and unforeseen expenses. Moreover, the operational landscape along these Northern routes poses unique challenges, with seasonal variations and infrastructure limitations impacting transportation efficiency and reliability.

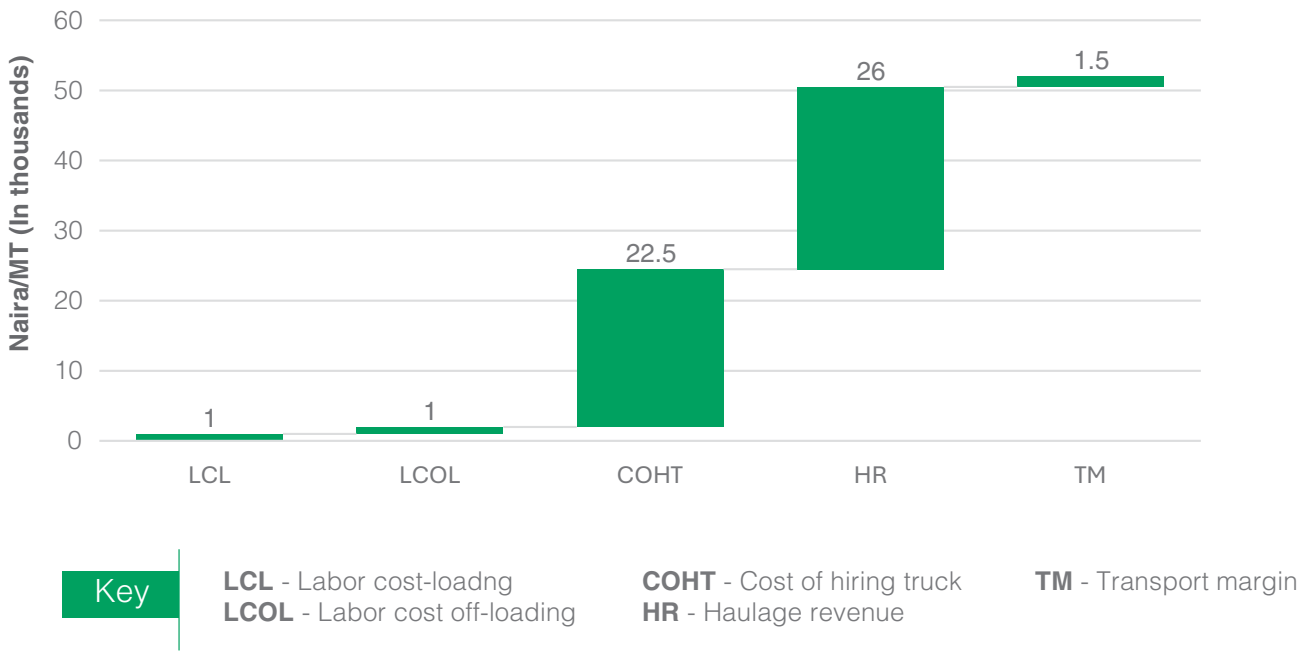


Figure 12: Cost and returns for transporting sorghum, millet, and maize from Kano to Damaturu.

Source: 2024 field survey, IFPRI.

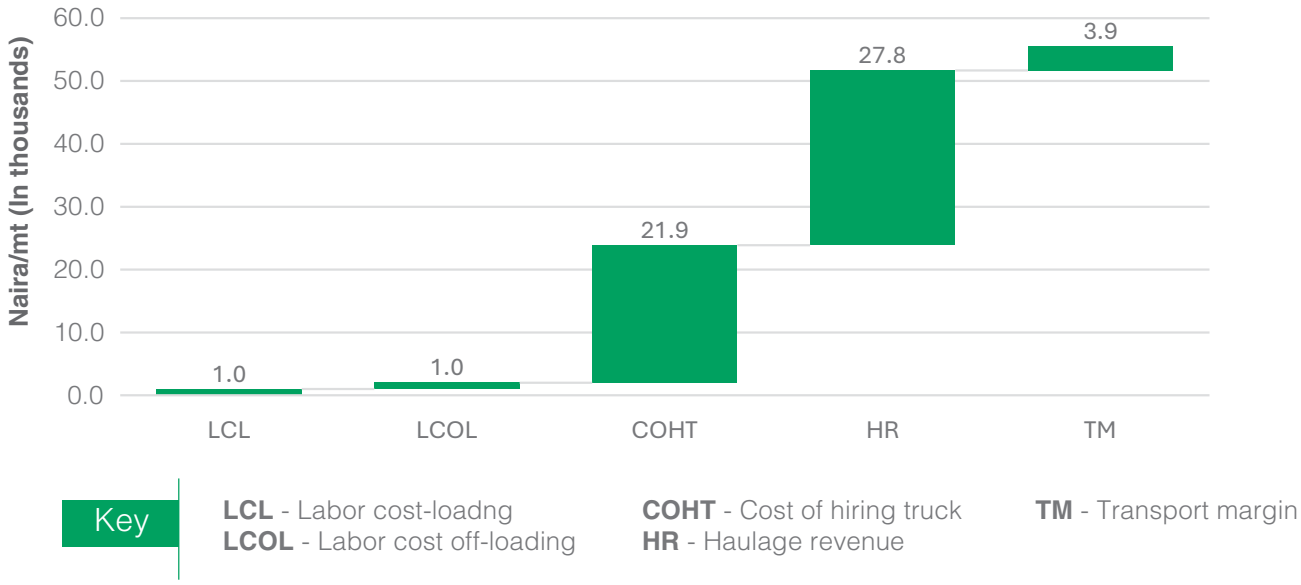


Figure 13: Cost and returns for transporting from Kano to Maiduguri.
Source: 2024 field survey, IFPRI.

2. Maiduguri (Borno) to Michika (Adamawa)

Figures 23 and 24 outline the cost, revenue, and profit margins for transporting goods from Maiduguri to Michika, comparing the standard route and an alternative route used when road damage is present. Similar to other routes, the loading and off-loading cost remains steady at Naira 2,000 per metric ton, covering the labour involved at both ends of the journey. Truck hire, again, is the largest cost factor. On the normal route, truck hire costs Naira 13,750 per metric ton, but this increases to Naira 15,000 per metric ton on the alternative route. The increased cost for the alternative route reflects the longer distance, additional time, and potentially greater vehicle wear due to road damage.

The total cost for transporters ranges from Naira 15,750 per metric ton on the regular route to Naira 17,750 per metric ton on the alternative route. Haulage revenue is Naira 16,500 per metric ton for the regular route, yielding a modest transport margin of Naira 750 per metric ton.

On the alternative route, haulage revenue significantly increases to Naira 26,000 per metric ton, resulting in a much higher transport margin of Naira 9,000 per metric ton. This increased margin serves as a premium for the risks and additional costs associated with taking the longer, more challenging route. This substantial profit margin on the alternative route is due to the added difficulties and risks, including increased fuel consumption, extended travel times, and more significant vehicle wear and tear. Furthermore, the Maiduguri-Michika corridor is marked by security challenges that can increase operational costs, sometimes necessitating payments for security escorts. Although these security expenses are not part of the primary cost breakdown, they are a crucial consideration for transporters working in this volatile region. In the case of the normal route, transporters rely more on high-frequency trips and large volumes to maintain profitability, as the margins per trip are relatively slim.

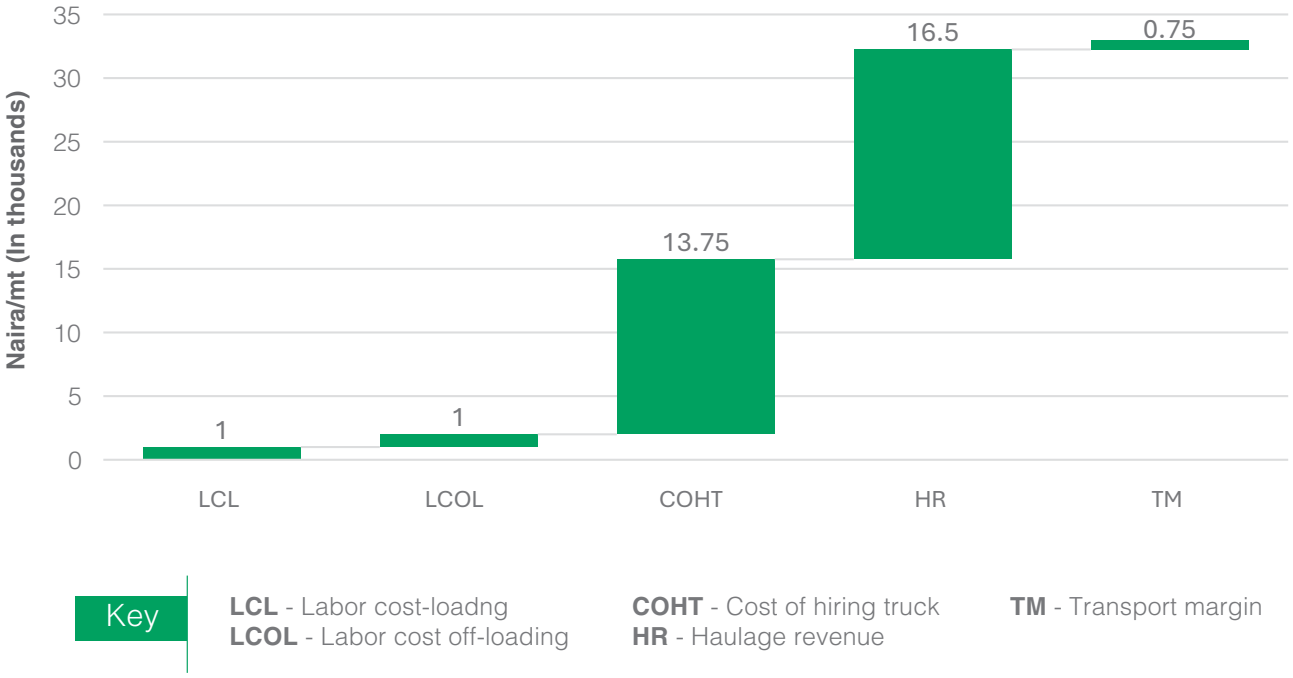
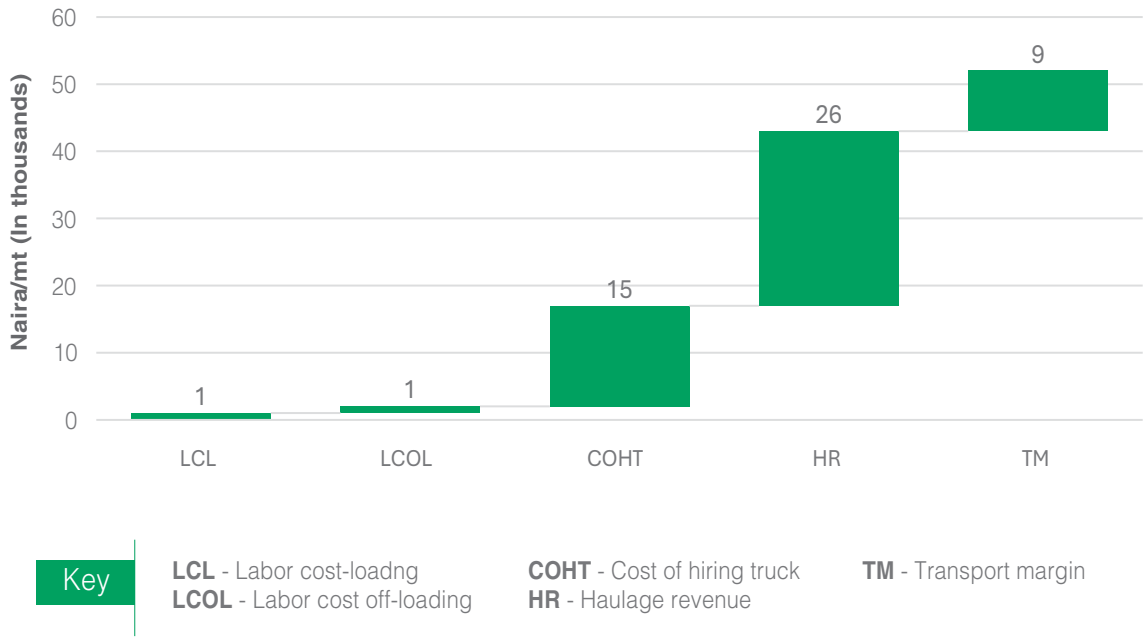


Figure 14: From Maiduguri, Borno to Michika, Adamawa (normal route).

Source: 2024 field survey, IFPRI.



15 From Maiduguri, Borno to Michika, Adamawa (route change).

Source: 2024 field survey, IFPRI.

Cost build-up for food traders

This section provides a detailed analysis of the cost structure for food traders focusing on four major commodities: groundnut, white sorghum, millet, and maize. Due to limited responses from some traders, data for the other four commodities was unavailable.

1. Groundnut

The groundnut supply chain, detailed in Figure 25, begins with sourcing groundnuts from major agricultural states such as Benue, Adamawa, Taraba, and Niger. These groundnuts are typically acquired through aggregator markets, where traders source large volumes to meet demand. A critical early expense is the market agent fee, amounting to Naira 6,500 per metric ton which ensures access to reliable supplies and facilitates transactions within these markets. The purchase price of groundnut itself stands at Naira 1,800,000 per metric ton, forming the primary base cost and reflecting the value at the farm gate, inclusive of the farmer's production expenses and profit margin.

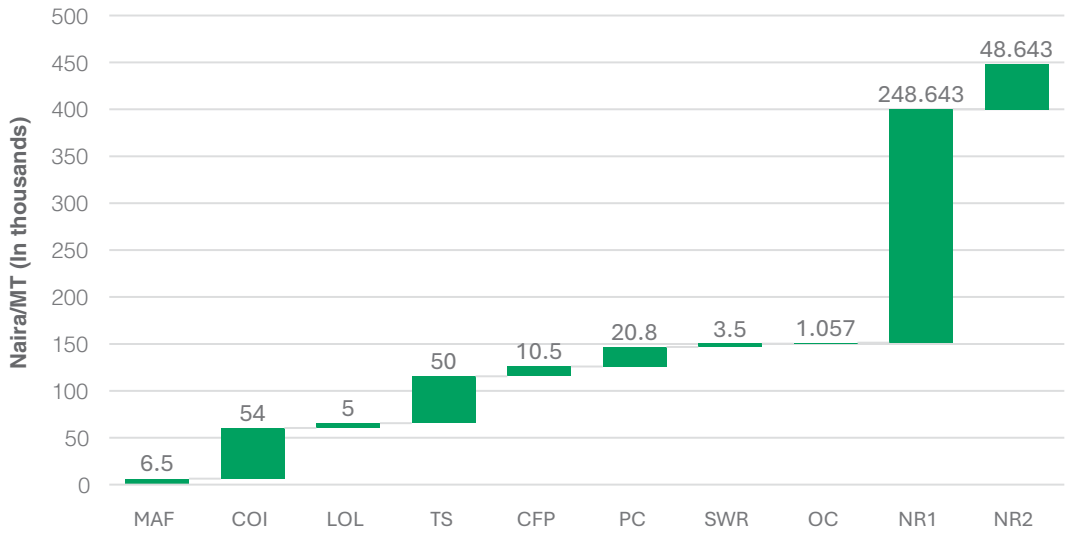
Quality control is a crucial aspect of the groundnut trade. An impurity charge of Naira 54,000 per metric ton accounts for cleaning and sorting processes, which are necessary to remove debris and ensure product quality. This impurity cost underscores the initial quality issues, likely due to inconsistent harvesting or post-harvest handling. Packing at source costs Naira 2,500 per metric ton, covering basic containment for transit, while loading and off-loading charges add Naira 5,000 per metric ton to the cost. Transportation costs from source to the primary distribution hub in Kano amount to Naira 50,000 per metric ton, a significant logistical expense influenced by fuel prices, road conditions, and the distance travelled.

Downstream costs for groundnut traders include cleaning (Naira 8,000 per metric ton) to meet market quality standards, followed by packaging (Naira 20,800 per metric ton), which ensures that the product is ready for retail. Storage costs are relatively modest at Naira 3,500 per metric ton, reflecting short-term holding times to avoid deterioration. Additional minor expenses total Naira 1,057, covering miscellaneous operational requirements. Groundnut is sold at two price levels: Naira 2,200,000 per metric ton for premium quality with no broken grains and Naira 2,000,000 per metric ton for a standard grade. This dual pricing structure enables traders to cater to different segments, maximising profitability through market segmentation.

2. Sorghum

Sorghum's cost structure, shown in Figure 26, emphasises raw commodity expenses, with the purchase price at Naira 980,000 per metric ton. This initial cost reflects sorghum's accessibility and the relatively lower production costs associated with this hardy grain, widely cultivated in Northern Nigeria. During processing, a standard loss of 2.5 percent (Naira 24,500 per metric ton) occurs, attributed to wastage or subpar grains discarded in cleaning and handling processes. This loss could potentially be minimised with better handling and processing techniques, contributing to higher operational efficiency.

Handling charges, including loading, and off-loading costs of Naira 3,000 per metric ton (Naira 1,500 each), appear modest but are critical for moving goods between locations, especially in regions with limited mechanisation. Cleaning costs (Naira 8,000 per metric ton) and sewing costs (Naira 600 per metric ton) indicate efforts to uphold quality standards and ensure the sorghum is well-packaged for market distribution. Additional costs include quarantine and documentation at Naira 700 per metric ton, a regulatory expense that highlights the importance of food safety compliance in the market. Significant logistical expenses, such as bagging (Naira 10,000 per metric ton) and transportation (Naira 15,000 per metric ton), impact the final cost, with the high financing cost of Naira 78,624 reflecting challenges in accessing affordable credit. The total cost per metric ton is Naira 1,127,934, with a revenue of Naira 1,240,728, resulting in a profit margin of Naira 112,794 (9.1 percent). This modest margin indicates the high-cost pressures within the sorghum supply chain, suggesting room for optimising financing and logistics to improve profitability.



Key

MAF - Market agent fee LCOL
COI - Cost of impuritiesLabor cost off-loading
COHT - Cost of hiring truck
HR - Haulage revenue
NR1 - Net revenue (clean and unbroken grain)
NR2 - Net revenue (clean, broken grain mixed)
TM - Transport margin

Figure 16: Cost and returns for groundnut trade in Northern Nigeria.
Source: 2024 field survey, IFPRI.

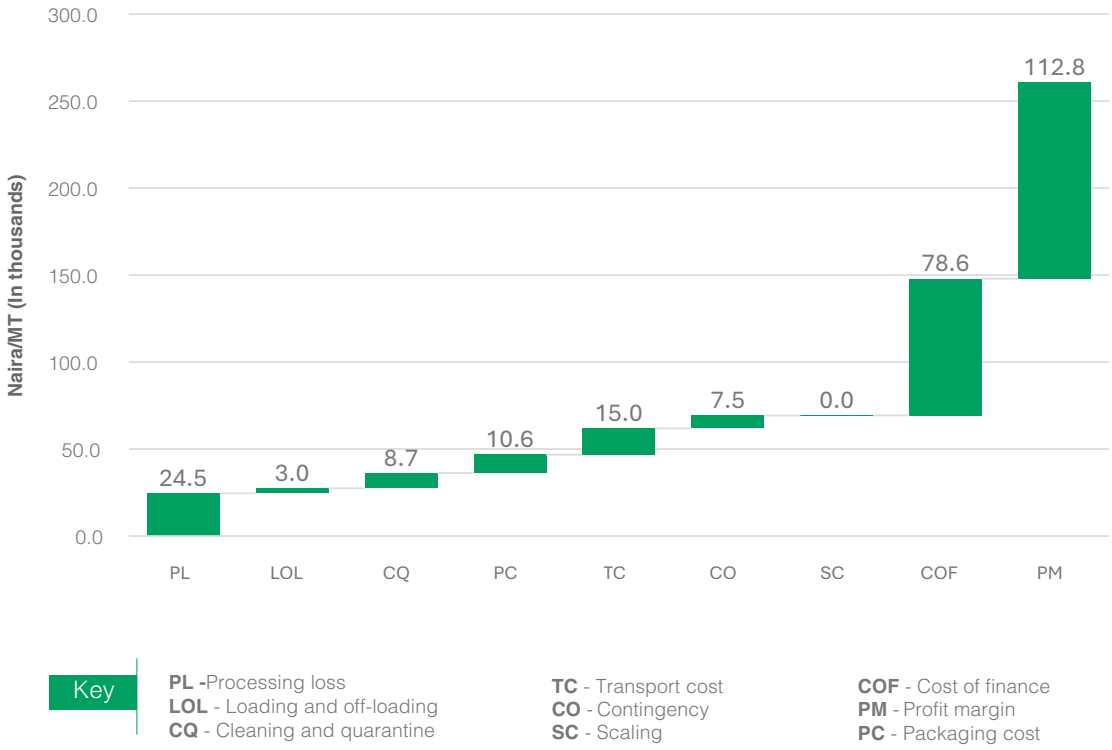


Figure 17: Cost component for white sorghum trade in Northern Nigeria.

Source: 2024 field survey, IFPRI.

3. Millet

Figure 27 provides insight into the cost structure of millet, beginning with a base cost of Naira 900,000 per metric ton for raw millet grain. This initial outlay highlights the substantial capital investment required in millet trading. Transport expenses for millet follow a three-tiered structure totalling Naira 14,000 per metric ton: Naira 10,000 per metric ton for the journey from farm-gate to warehouse, followed by Naira 2,000 per metric ton each for transit to and from the cleaning facility. These segmented transport costs reflect the multiple handling points required to bring millet to market, emphasising the importance of efficient logistics in reducing overall costs.

Millet processing involves a substantial cleaning loss of Naira 90,000 per metric ton which could stem from the grain's small size or poor quality at harvest, resulting in significant material wastage. Cleaning incurs Naira 8,000 per metric ton, with labour costs for handling and machine feeding amounting to Naira 3,000 per metric ton. Operational overheads include utility costs (Naira 4,900 per metric ton), fumigation (Naira 1,100 per metric ton) for pest control, administrative expenses (Naira 22,230 per metric ton), and warehouse rental (Naira 800 per metric ton). The packing and branding of millet requires an additional Naira 7,500 per metric ton, ensuring the product is adequately prepared for retail.

The financing cost of Naira 25,534 per metric ton further increases operational expenses, with a 3 percent miscellaneous margin (Naira 32,311.92 per metric ton) providing contingency for unplanned costs. The high base cost and significant cleaning losses indicate profitability challenges in the millet trade, underscoring a need for improved processing technologies and better initial grain quality to support long-term sustainability in this supply chain.

MILLET PROCESSING INVOLVES A SUBSTANTIAL CLEANING LOSS OF NAIRA 90,000 PER METRIC TON WHICH COULD STEM FROM THE GRAIN'S SMALL SIZE OR POOR QUALITY AT HARVEST, RESULTING IN SIGNIFICANT MATERIAL WASTAGE.

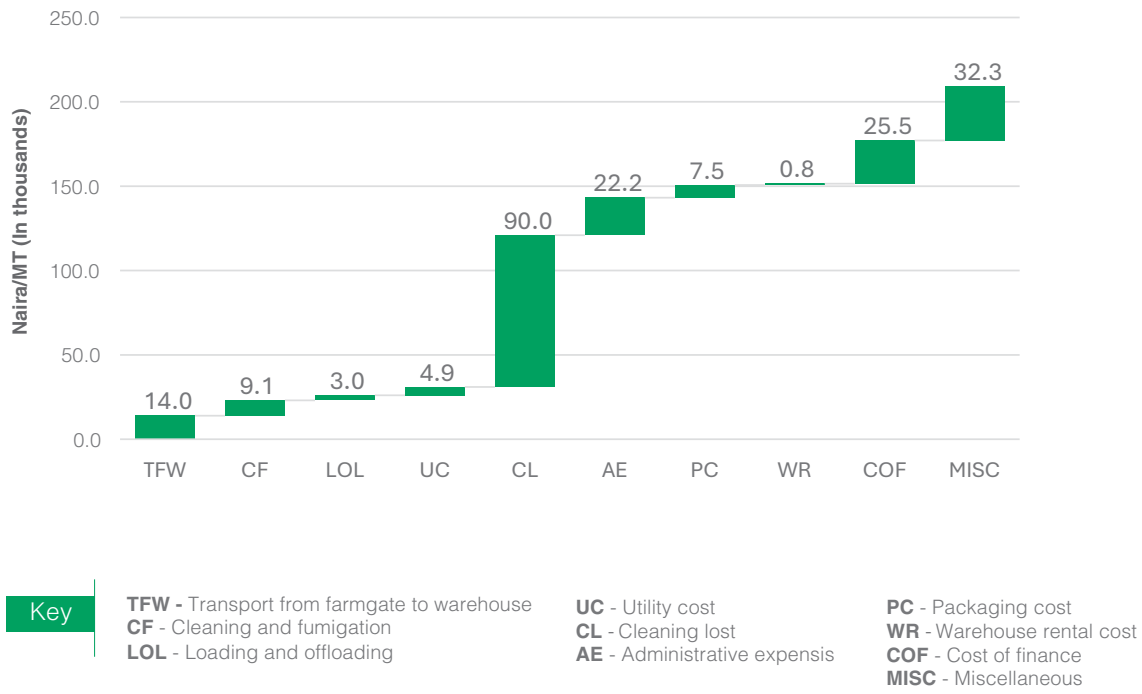


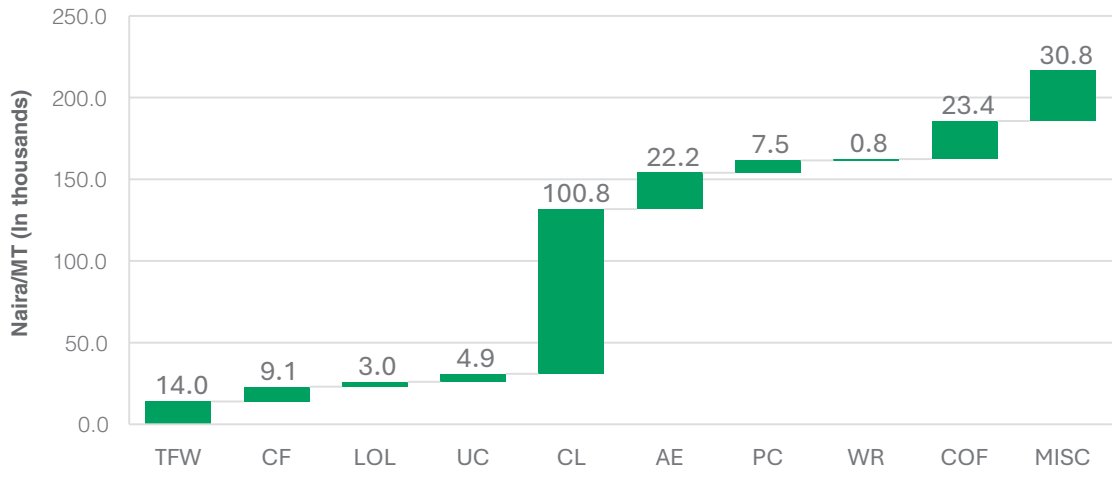
Figure 18: Cost component for millet trade in Northern Nigeria.
Source: 2024 field survey, IFPRI.

4. Maize

Maize has a base cost of Naira 840,000 per metric ton (Figure 28), reflecting its widespread cultivation and demand. The maize transport structure involves Naira 10,000 per metric ton from the farm-gate to the warehouse, with Naira 2,000 per metric ton each for secondary movements to and from cleaning facilities, totalling to Naira 14,000 per metric ton. Such a transport setup underscores the importance of streamlined logistics for maize, which often involves multiple handling stages to ensure quality and readiness for the market.

The cleaning process for maize includes a significant loss of Naira 100,800 per metric ton, reflecting challenges in maintaining grain quality during processing. Cleaning costs add Naira 8,000 per metric ton, while labour costs for handling and feeding machines amount to Naira 3,000 per metric ton. The overheads include utilities (Naira 4,900 per metric ton), fumigation (Naira 1,100 per metric ton), administrative costs (Naira 22,230 per metric ton), and warehouse rental (Naira 800 per metric ton). Packing and branding requires 7,500 per metric ton, ensuring product presentation meets market standards.

The financing cost of Naira 23,360 per metric ton highlights the significant capital requirement for maize trading, while a 3 percent miscellaneous margin (Naira 30,770.70) covers unforeseen costs. Maize's cost structure emphasises the need for efficient cleaning and handling operations to reduce losses and maintain profitability, particularly in a high-demand market where small operational improvements can yield considerable returns for traders.



Key

TFW - Transport from farmgate to warehouse
CF - Cleaning and fumigation
LOL - Loading and offloading
COF - Cost of finance
UC - Utility cost
CL - Cleaning lost
AE - Administrative expensis
PC - Packaging cost
WR - Warehouse rental cost
MISC - Miscellaneous

Figure 19: Cost components for maize trade in Northern Nigeria.
Source: 2024 field survey, IFPRI.

Assessment of food storage in Nigeria

Nigeria's food storage infrastructure faces critical challenges, particularly in the Northeast, highlighting the urgency for strategic intervention in the country's food systems transformation agenda. A 2023 study on Nigeria's Strategic Food Reserve reveals that the storage capacity is far below what is needed to safeguard food security during crises. Since 1987, Nigeria's storage policy, which includes on-farm storage, buffer stock, and strategic grains reserves (now the Strategic Food Reserve), has aimed to address emergency food shortages and support vulnerable groups (FMARD and AGRA, 2023). Despite these efforts, the Federal Government of Nigeria (FGN) owns just 33 silo complexes with a total capacity of 1.336 million metric tons and 51 warehouses with a combined capacity of 108,000 metric tons. Currently, the reserve holds only 100,000 metric tons, meeting a mere 7.6 percent of the minimum six-month supply required for food security.

The Northeast, with a total storage capacity of 275,000 metric tons, plays a crucial role in Nigeria's food storage landscape. But as shown in Table 9, the region's storage infrastructure reveals a stark reality: only 25,000 metric tons in government-retained silos and an additional 25,000 metric tons in concessioned silos are operational. A further 50,000 metric tons in storage facilities remains unused, awaiting either concession or operationalisation. A total of 175,000 metric tons of capacity is classified as "challenged", meaning nearly two-thirds of the storage is currently unusable. This severely hampers the region's capacity to stabilise food supplies, reduce post-harvest losses, and maintain price stability throughout the year.

This limited operational capacity in the Northeast, accounting for only 18 percent of its total storage, exacerbates food insecurity issues and hinders efforts to maintain food availability. While it has the second highest storage capacity among Nigeria's geopolitical zones, its unusable facilities represent both a profound challenge and a substantial opportunity. Rehabilitating these facilities could be transformative for food security, reducing post-harvest losses and ensuring steady supplies in a region marked by vulnerability and high food demand.

Table 1: Current distribution and locations of strategic food reserves silos in Nigeria by geo-political zones

Geo- political zone	Concessioned silo (metric tons)	FGN retained silo (metric tons)	Completed, yet to be either concessional or operational (metric tons)	Silos with challenges (metric tons)	Total capacity (metric tons)
North Central	161, 000	50, 000	25, 000	0	236, 000
North East	25, 000	25,000	50, 000	175,000	275, 000
North East	200, 000	125, 000	0	0	325, 000
South East	50, 000	0	0	100, 000	150, 000
South South	25, 000	25, 000	0	125, 000	150, 000
South West	175, 000	25, 000	0	0	200, 000
Total	636,000	255, 000	75,000	400,000	1,336,000

Source: FSRD FMARD, 2022.

Figure 29 provides a breakdown of costs associated with grain storage in Northern Nigeria. Warehouse ownership, leasing, or rental is the most significant cost, accounting for over 46 percent of the total. This high percentage suggests that the cost of securing storage facilities represents a substantial part of the storage expenditure, reflecting possibly high property prices or limited availability of adequate storage infrastructure in the region. Warehouse management is the second largest cost, at 18.29 percent of total costs, indicating the importance of labour, organisation, and operational resources necessary to maintain and secure stored grain

Other activities contributing to storage costs include loading/unloading and stacking, which account for 11.62 percent and 11.02 percent of the total, respectively. These activities, along with repacking/rebagging (4.79 percent) and pest control (8.09 percent), highlight the operational aspects required for effective storage management. Pest control costs emphasise the importance of maintaining grain quality, while repacking and loading and offloading costs reflect the need for efficient handling. Overall, these figures reveal that while the physical infrastructure (warehouse ownership/rental) dominates the cost structure, there is also considerable expenditure on labour-intensive activities which are critical to preserving grain quality and accessibility.

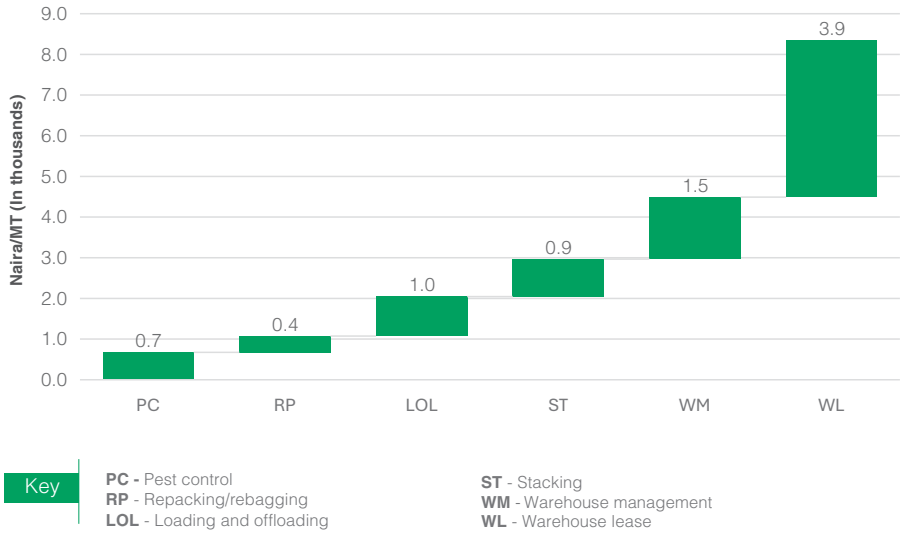


Figure 20: Breakdown of costs associated with grain storage in Northern Nigeria.
Source: 2024 field survey, IFPRI.

Cost build ups for food processors

This section examines the cost structure for processors of key food commodities, specifically focusing on tomato and wheat processing. Due to time constraints and limited response from other processors, only these two commodities are analysed here, providing insights into both the operational challenges and opportunities for cost optimisation.

1. Tomato processing

The cost structure for tomato processing, detailed in Table 10, reflects a medium-scale operation that processes 30 metric tons per cycle, running four cycles in total. This facility primarily produces tomato paste, packaged into small sachets catering to consumer preferences in Northern Nigeria, where smaller, affordable unit sizes are favoured due to limited purchasing power.

The cost of raw tomatoes stands at Naira 40,000 per metric ton, forming the baseline production expense. This price reflects farm-gate costs and the initial value of raw inputs from farmers. The transportation cost of Naira 13,000 per metric ton highlights the logistical expenses involved in bringing fresh tomatoes to the processing facility. Given the perishable nature of tomatoes,

maintaining quality during transport requires careful handling, adding to the transportation expense.

Labour costs amount to Naira 24,000 per metric ton and cover various processing stages, including sorting, washing, blanching, pulping, grinding, mixing, concentrating, and sterilising. Each of these stages demands skilled labour to ensure that the tomatoes are adequately prepared for paste production, highlighting the labour-intensive nature of tomato processing. Labour represents a crucial part of the operational cost, as quality at each stage directly affects the final product's taste, safety, and market appeal.

The milling cost at Naira 66,660 per metric ton represents the expenses associated with processing tomatoes into a fine paste, covering machine operation, maintenance, and other related costs. This component is essential to achieve the desired texture and consistency of tomato paste, which is key for consumer satisfaction and market competitiveness.

The most significant component of the cost structure is the packaging cost, totalling Naira 5,008,889 per metric ton. This high figure reflects the reliance on packaging materials, which could be imported or otherwise costly due to limited local production options. The substantial expense underscores the need for developing local packaging solutions. Reducing packaging costs could lower overall production expenses and improve profitability, as packaging currently constitutes a major operational hurdle in cost efficiency.

Quality control costs at Naira 56,000 per month ensure compliance with food safety standards. This process is crucial for meeting regulatory requirements and gaining consumer trust. Quality control processes help maintain consistency, prevent contamination, and enhance shelf-life, making it indispensable despite the additional expense.

Water and energy costs stand at Naira 2,400 and Naira 15,000 per metric ton, respectively. Water is required for various stages, including washing and processing, while energy is critical for running machinery and maintaining optimal processing conditions. These utility costs are vital but highlight the operational burden of maintaining consistent energy and water supplies, especially in regions with limited infrastructure.

The production output is substantial, yielding 21,778 sachets per metric ton. Each sachet is priced at Naira 1,800, which results in revenue of Naira 39,200,400 per metric ton. This high revenue potential is driven by the product's alignment with consumer preferences, offering smaller, retail-friendly packages. However, the high packaging costs indicate that local investments in packaging solutions could significantly reduce operational costs, enhancing profitability. Major opportunities for cost savings reside in packaging and potentially in logistics.

Table 2: Tomato processing in Northern Nigeria

Cost and revenue	
No of cycles	4 cycles
Qty per cycle	30 metric tons
Cost of raw materials/MT	40,000
Transportation of raw materials	13, 000
Milling/MT	66,660
Packaging/MT	5,008,889
Quality control/MT	56,000
Water cost/MT	2,400
Storage cost/MT	2,000
Energy cost/MT	15,000
Labour cost/MT	24,000
Government tax/MT	1,666.7
Transport of finished product to market/MT	10,000
Quantity processed/MT	21,778 sachets
Price of processed product per unit (Naira)	1,800
Sales revenue/MT	39,200,400

Source: 2024 field survey, IFPRI.

2. Wheat processing into flour

The cost structure for wheat processing, as shown in Table 11 and Figure 30, provides a breakdown of costs per metric ton of wheat processed into flour. This analysis reveals financial commitments across different operational areas and offers insights into profitability and potential areas for optimisation.

The cost of raw materials is the highest component at Naira 350,000 per metric ton, accounting for 56.6 percent of total expenses. This substantial cost reflects the investment needed to procure quality wheat, which is essential for producing high standard flour. Given the central role of wheat in food security, this cost highlights the need for stable supply chains and effective sourcing strategies to manage raw material expenses.

Transportation costs for raw materials to the processing facility are Naira 50,000 per metric ton, representing 8.1 percent of the total cost. Transporting wheat requires efficient logistics to minimise delays and reduce spoilage, as wheat's quality can be affected during long distance transport. Optimising this component could involve exploring bulk transportation options or regional sourcing to reduce transportation expenses.

Milling costs, at Naira 80,000 per metric ton (12.9 percent of the total cost), reflect the expenses associated with transforming raw wheat into flour. Milling is an energy-intensive process, covering machine operation, maintenance, and labour associated with running milling equipment. This cost highlights the importance of equipment efficiency, as well-maintained machinery can improve productivity and reduce wear-and-tear costs over time.

Energy or electricity costs amount to Naira 62,500 per metric ton, or 10.1 percent of total costs, underscoring the high energy demands of wheat processing. Consistent energy is essential for milling, but it also represents a significant operational expense. In regions with unreliable energy supplies, processors might incur additional costs for backup power solutions, such as generators, which further impact the energy cost.

Labour costs are relatively low at Naira 20,000 per metric ton (3.2 percent of the total), possibly reflecting either an efficient labour force or lower wage levels within the region. Despite being a smaller portion of total expenses, labour is integral to the quality control and maintenance activities that ensure the final product meets market standards.

Rent expenses, at Naira 5,800 per metric ton (0.9 percent), account for the cost of leasing the facility. While minimal in comparison to other expenses, this cost ensures a stable processing environment, which is crucial for long-term operations. Utilities contribute Naira 20,000 per metric ton, covering essential services like water, communications, and other operational necessities.

The transportation of finished products to market costs Naira 30,000 per metric ton, marking the final logistical step in delivering flour to consumers. More effective distribution networks can reduce this cost but ensuring timely and safe transport is vital for meeting demand.

With total processing costs at Naira 618,300 per metric ton and a revenue of Naira 1,075,000 per metric ton from selling the flour, the operation yields a gross margin of Naira 456,700 per metric ton. This profitability suggests a strong market demand for wheat flour, which can sustain processors despite high raw material and energy costs. Nevertheless, optimising transportation and energy expenses could further enhance profit margins, making wheat processing a viable economic activity within Nigeria's food system.

Table 3: Cost build-up for wheat processing

Cost items	Naira per metric ton
Cost of raw materials	350, 000
Transportation cost of raw materials	50, 000
Milling cost	80, 000
Energy/Electricity cost	62, 500
Labour cost	20, 000
Rental expenses	5, 800
Utility expenses	20, 000
Transportation cost of finished product to the market	30, 000
Total cost	618, 300
Revenue from processing	1, 075, 000
Gross margin	456, 700

Source: 2024 field survey, IFPRI.

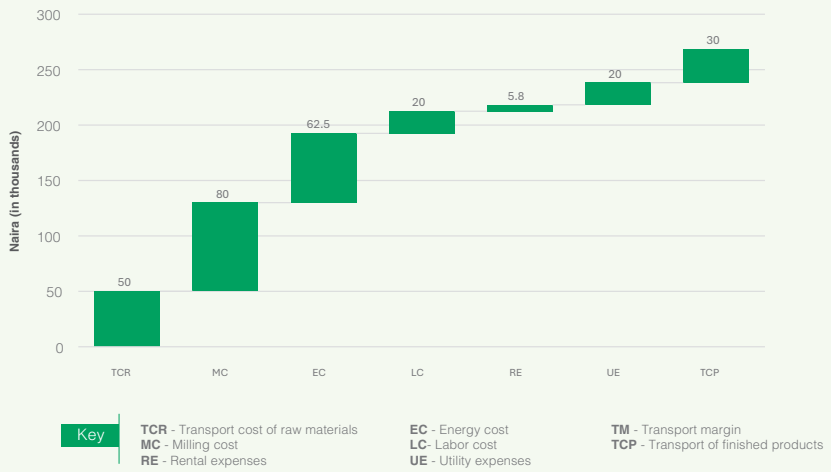


Figure 21: Cost build-up for wheat processing in Northern Nigeria.
Source: 2024 field survey, IFPRI.

In summary, the analysis reveals significant profitability potential for both tomato and wheat processing. For tomato processors, addressing packaging costs through local solutions could unlock substantial savings, while for wheat processors, optimising raw material sourcing and energy usage offers opportunities to enhance margins. Both commodities demonstrate the challenges and opportunities within Nigeria's food processing sector, highlighting the impact of infrastructure, energy, and material sourcing on overall profitability.

Comparison between farmer and trader shares of final prices

Figures 31 and 32 illustrate the distribution of final consumer prices between farmers and traders in Nigeria's food supply chains, focusing on selected commodities transported from Fika in Yobe state to Lagos, located approximately 1,000 kilometres to the south. These data provide a snapshot of the economic returns to key actors, farmers and traders, along this critical supply route, offering insights into the relative shares of final consumer prices captured by each group in the focus supply chains. The analysis sheds light on the underlying dynamics of Nigeria's food markets, where systemic inefficiencies, market structures, and value chain bottlenecks influence how value is distributed across stakeholders.

Farmers in these supply chains receive an average of 23 percent of the final consumer price, with considerable variation across commodities. Producers of staples like white maize, millet, and white sorghum receive notably low shares - 12.4 percent, 9.6 percent, and 13.5 percent, respectively. In contrast, higher-value crops such as white cowpeas and brown cowpeas allow farmers to capture significantly larger shares of 37.6 percent and 46 percent, respectively. These differences suggest that market demand, crop perishability, production costs, and value addition processes play crucial roles in determining farmers' earnings.

Traders, on the other hand, capture an average of 29 percent of the final consumer price, with more consistency across commodities. For example, their share remains steady at nearly 38 percent for white and brown cowpeas and 32.5 percent for groundnuts. For commodities like white sorghum and millet, the trader share falls to 18.9 percent, reflecting varying transport costs, risk levels, and market power across the supply chain. The trader share highlights the importance of logistics, transport infrastructure, and intermediary networks in determining the economic returns to this group.

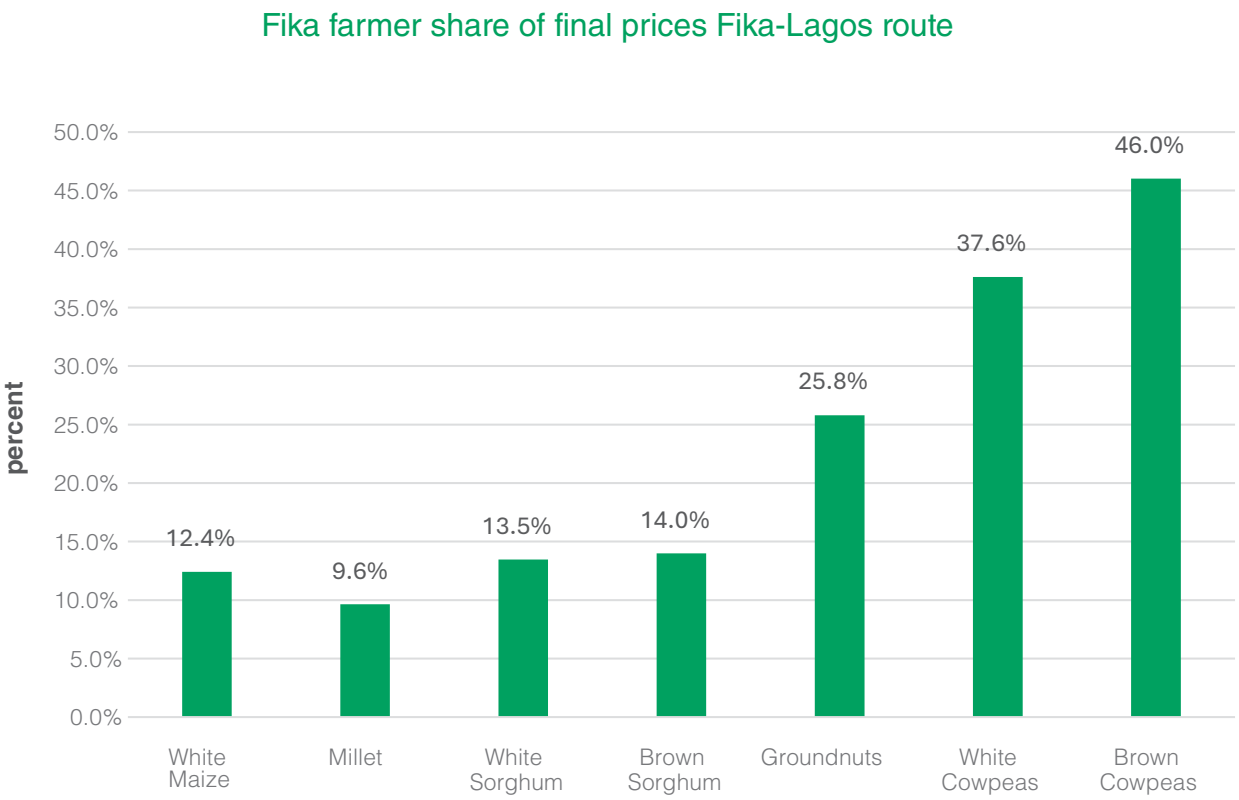


Figure 22: Farmer share of final prices for selected commodities along Fika-Lagos route.
Source: 2024 field survey, IFPRI.

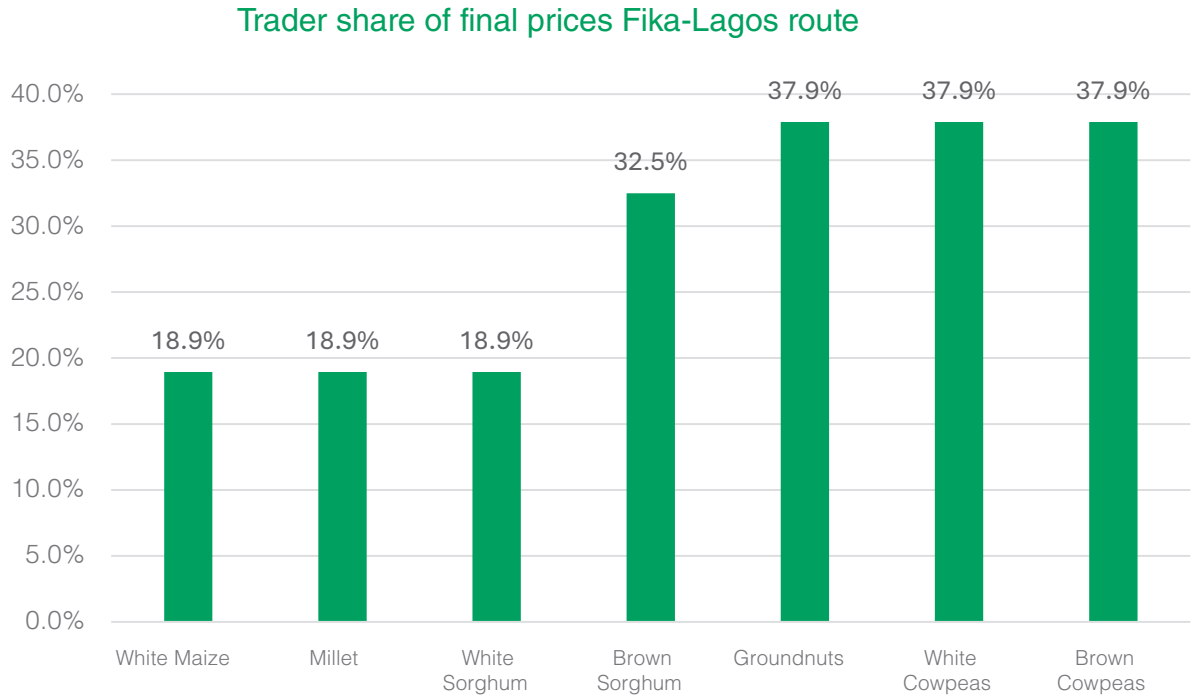


Figure 23: Trader share of final prices for selected commodities along Fika-Lagos route.
Source: 2024 field survey, IFPRI.

Findings from the market price analysis

Price trends across states and geopolitical zones

This section provides an in-depth analysis of price trends for major food commodities across Nigeria, highlighting significant interstate price variability and underlying market dynamics influenced by factors like climate, logistics, and demand pressures. Such insights are crucial for shaping effective agricultural policies and interventions aimed at stabilising prices and ensuring food security.

Table 4 summarises the interstate price variations for selected commodities from 2016 to 2024, with data covering Nigeria's 36 states and the Federal Capital Territory (FCT) for a total of 37 regions. It provides a breakdown of mean prices, standard deviations, and the minimum and maximum prices observed for each commodity. This table captures the breadth of price fluctuations across the country, revealing critical information about the level of volatility for each commodity.

Maize shows the most pronounced price variability, with a minimum price of Naira 164.88 recorded in Plateau state, known for its robust maize production, and a maximum price of Naira 995.90 in Rivers state, which likely faces challenges in local supply and adverse weather conditions. The high standard deviation of Naira 195.64 reflects the extent of interstate price fluctuations for white maize, making it one of the most variable commodities. Such disparities in price can be attributed to the differences in production levels, transportation costs, and market accessibility across states.

The wide range in maize prices indicates that certain regions are better positioned to produce maize at lower costs, while other regions struggle with limited supply and higher consumer prices.

Groundnut and brown cowpeas also exhibit high price variability, with groundnut prices ranging from Naira 331.64 to Naira 668.92 and a standard deviation of Naira 89.77. These fluctuations suggest that groundnut production is concentrated in specific areas, while other regions depend on imported supplies, leading to higher prices. Brown cowpea, with prices ranging from Naira 310.06 to Naira 654.11, demonstrates significant interstate variability as well. This variability may stem from localised production challenges or transportation costs that increase prices in regions further from production hubs. In contrast, yellow maize, and wheat flour display more stable prices, with yellow maize showing a standard deviation of Naira 59.19 and wheat flour at Naira 43.71. The stability in wheat flour prices is likely due to the nation's reliance on imported wheat, which ensures a more consistent supply across regions despite fluctuations in local production. This reliance, however, also highlights Nigeria's vulnerability to global market changes, given its dependency on imported wheat to meet the national demand.

Table 4: Descriptive statistics of interstate price variability (by selected commodities)

Variable	Obs	Mean	Std. Dev.	Minimum	Max
Cowpea (brown)	37	421.36	88.94	310.06	654.11
Cowpea (white)	37	390.39	82.86	295.05	601.68
Maize (grain, yellow)	37	229.08	59.19	162.06	381.80
Maize (grain, white)	37	286.95	195.64	164.88	995.90
Wheat flour	37	405.86	43.71	233.81	472.58
Groundnut	13	438.80	89.77	331.64	668.92
Millet	13	192.38	45.00	159.62	311.15
Sorghum (brown)	13	193.05	56.79	140.04	332.28
Sorghum (white)	13	191.33	61.45	132.51	359.91

Source: Authors' computations. Analysis based on NBS data set: over the period January 2016 to October 2024.

Figures 33 and 34 provide a graphical analysis of price trends for brown cowpeas and maize grain across Nigeria's six geopolitical zones, illustrating unique patterns that reflect the economic and environmental characteristics of each region. In the North Central zone, cowpea prices have shown a steady upward trend. This price increase could be attributed to growing demand for cowpeas in urban centres and supply challenges driven by climate change, which has impacted yields in some areas. The rising prices signal potential opportunities for expanded production in regions with favourable conditions to meet urban demand.

The Southeast zone shows more significant variability in cowpea prices, which may result from seasonal factors, disruptions in supply chains, or the higher cost of transporting cowpeas from production areas to Southeast markets. This variability reflects the challenges faced by regions that are heavily reliant on inter-state supply networks. In contrast, the North East and South West zones demonstrate relatively stable cowpea prices, suggesting a more balanced relationship between local supply and demand. These stable prices may also indicate that production within these zones is better aligned with regional consumption needs, reducing dependency on inter-state trade.

For maize grain, the price varies by region. In the North Central zone, maize prices exhibit a consistent upward trend, likely driven by strong local demand coupled with constraints in supply due to climate impacts and changes in farming practices. As maize is a staple crop with broad applications in food and livestock feed, rising prices in this zone highlight the need for increased investment in maize production and climate-resilient practices to support food security.

In contrast, the Southeast, North East, and South West zones maintain relatively stable maize prices, suggesting a more balanced supply-demand situation in these regions. This price stability could be due to diversified sources of maize, effective regional distribution networks, or a sufficient supply base that meets local needs. The regional stability in maize prices could provide policymakers with insights into areas where interventions in production and supply chains are less urgent, allowing a targeted approach in more volatile regions.

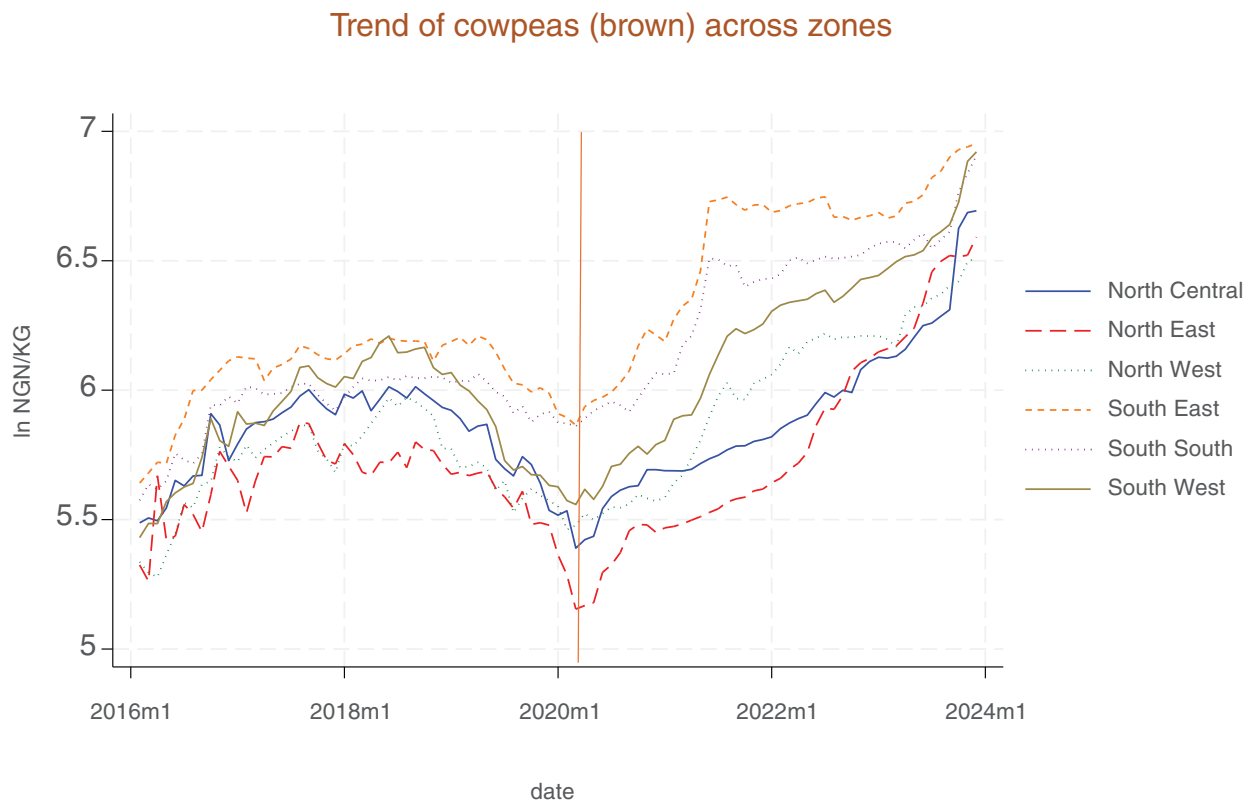


Figure 24: Trends in prices for cowpeas.

Source: Authors' computations. Analysis based on NBS data set over the period January 2016 to October 2024.

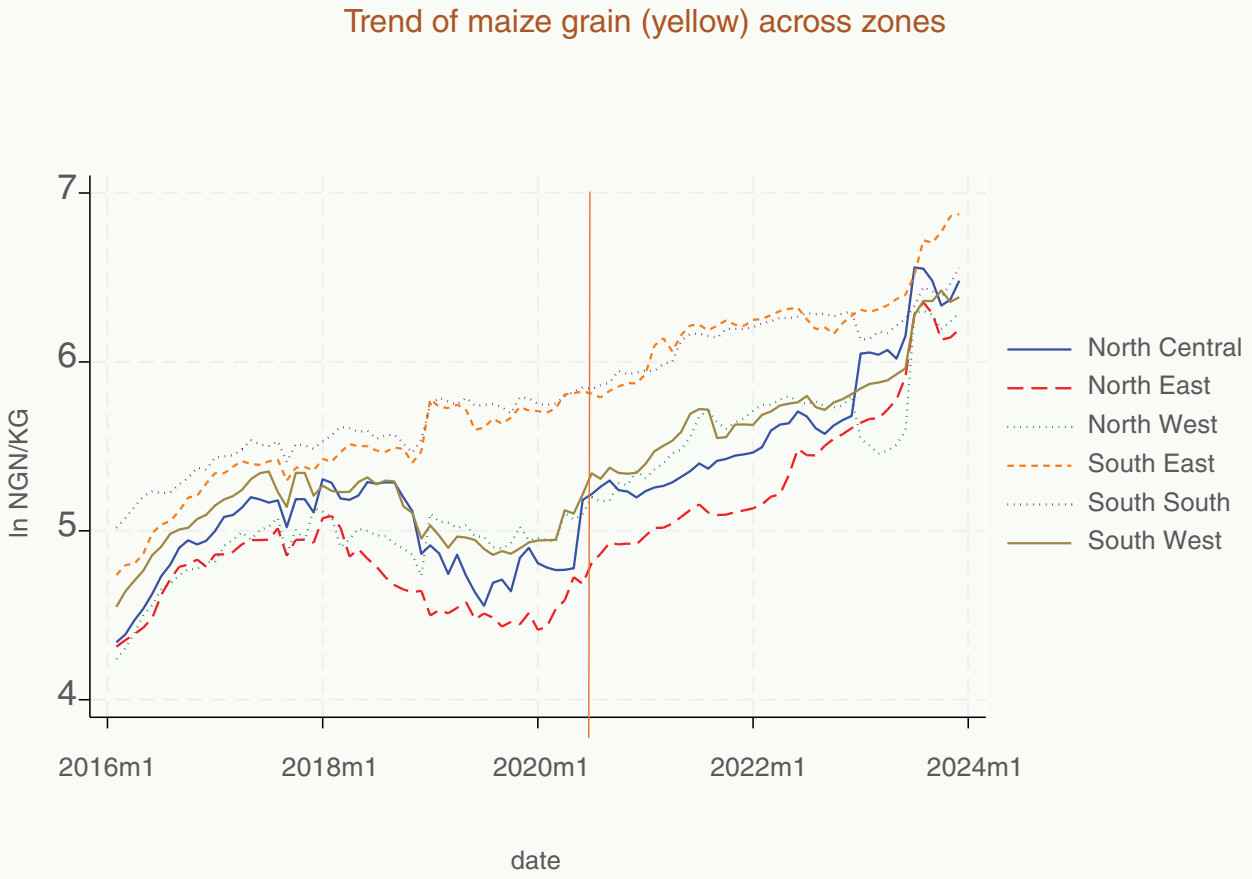


Figure 25: Trends in prices for maize grain.

Source: Authors' computations. Analysis based on NBS data set over the period January 2016 to October 2024.

Figures 35 - 38 expands the analysis to cover wheat flour, groundnuts, millet, and sorghum, offering a comprehensive view of price dynamics across Nigeria's geopolitical zones. Each panel illustrates unique trends that reveal the complex factors affecting these commodities' prices.

Wheat flour shows a steady, sharp upward trend across all geopolitical zones with minimal regional variability, indicating a national reliance on imported wheat. The limited variability suggests that fluctuations in wheat flour prices are more reflective of global market changes than local production factors, as Nigeria's wheat production only meets about 1 percent of its annual consumption needs. This dependency on imports underscores a vulnerability to external price shocks, which can drive inflation in local markets. The consistent rise in wheat flour prices across zones points to an urgent need for policies that either boost local wheat production or seek alternative strategies to stabilise prices for this essential commodity.

Groundnuts, millet, and sorghum display significant inter-zonal price variability, highlighting the diverse regional conditions affecting their production and distribution. Groundnut prices vary widely across zones, implying that certain areas have a comparative advantage in production, while others depend on inter-regional trade to meet demand. This variability also suggests a potential lack of market integration, which could be addressed by improving inter-zonal trade infrastructure.

Millet and sorghum, essential grains for food security in Northern Nigeria, similarly exhibit price variability that reflects differences in production costs, climatic suitability, and local demand. The significant price disparities for millet and sorghum between zones indicate room for enhancing trade to balance supply and demand across regions, which could help stabilise prices.

The Northwest and North Central zones tend to have relatively lower prices for groundnuts, millet, and sorghum, likely due to more favourable growing conditions and established production practices. In contrast, Southern zones show higher prices for these commodities, reflecting either higher transportation costs or limited local production capacity. Addressing these price disparities could involve investments in regional market integration, infrastructure, and storage facilities to reduce post-harvest losses and improve the efficiency of commodity distribution.

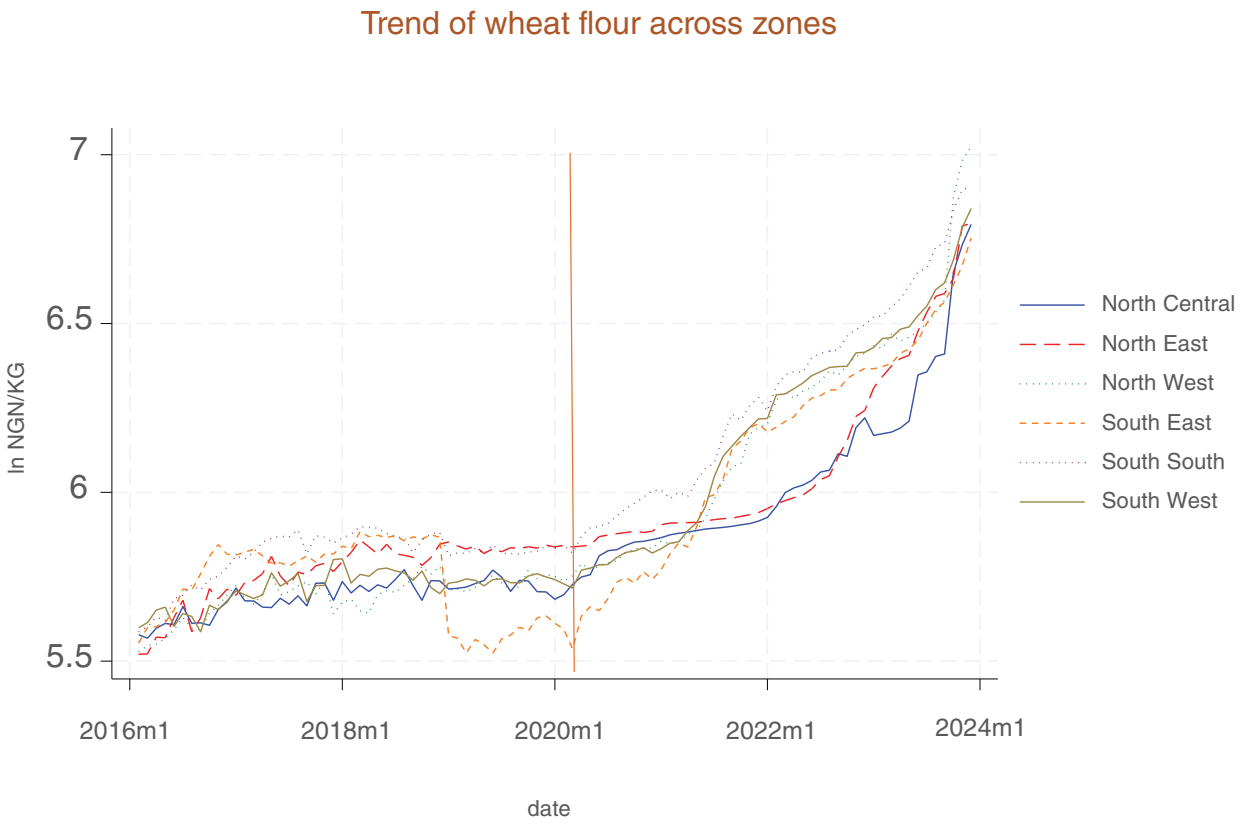


Figure 26: Trend in prices for wheat flour.

Source: Authors' computations. Analysis based on NBS data set over the period January 2016 to October 2024.

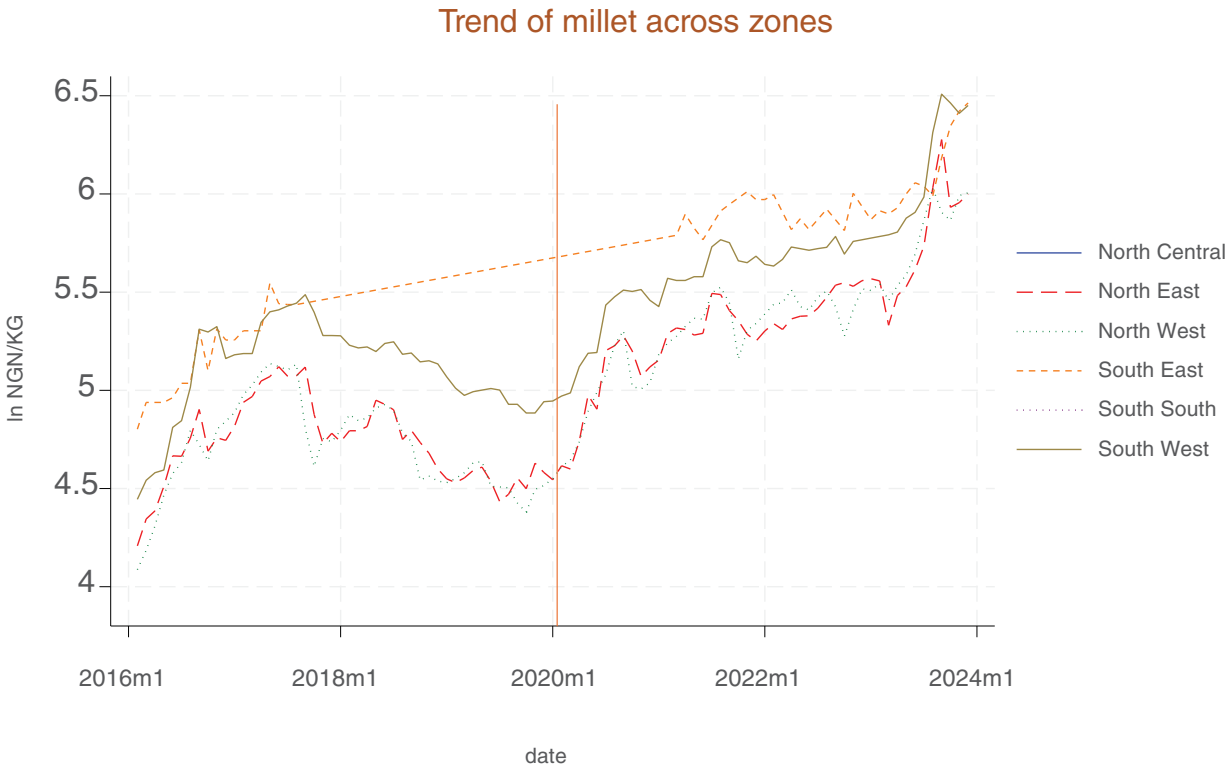


Figure 27: Trend in prices for millet.

Source: Authors' computations. Analysis based on NBS data set over the period January 2016 to October 2024.

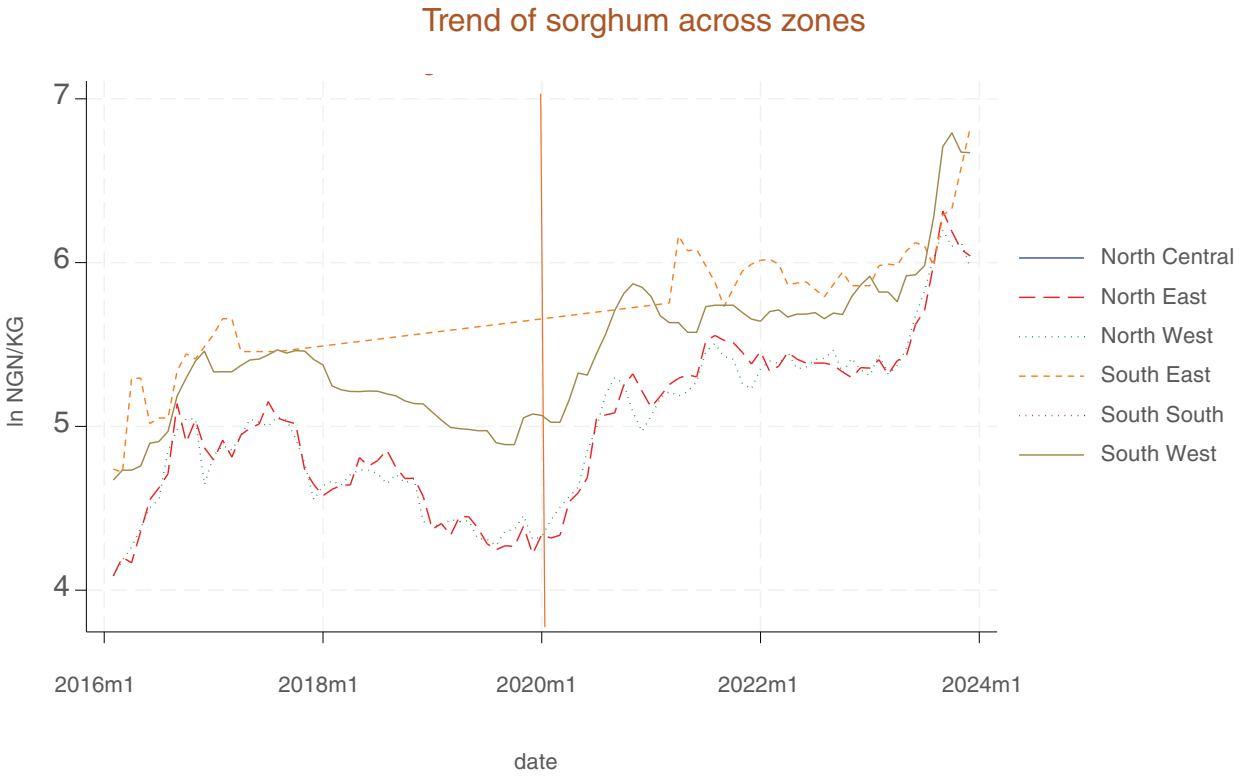


Figure 28: Trend in prices for sorghum.

Source: Authors' computations. Analysis based on NBS data set over the period January 2016 to October 2024.

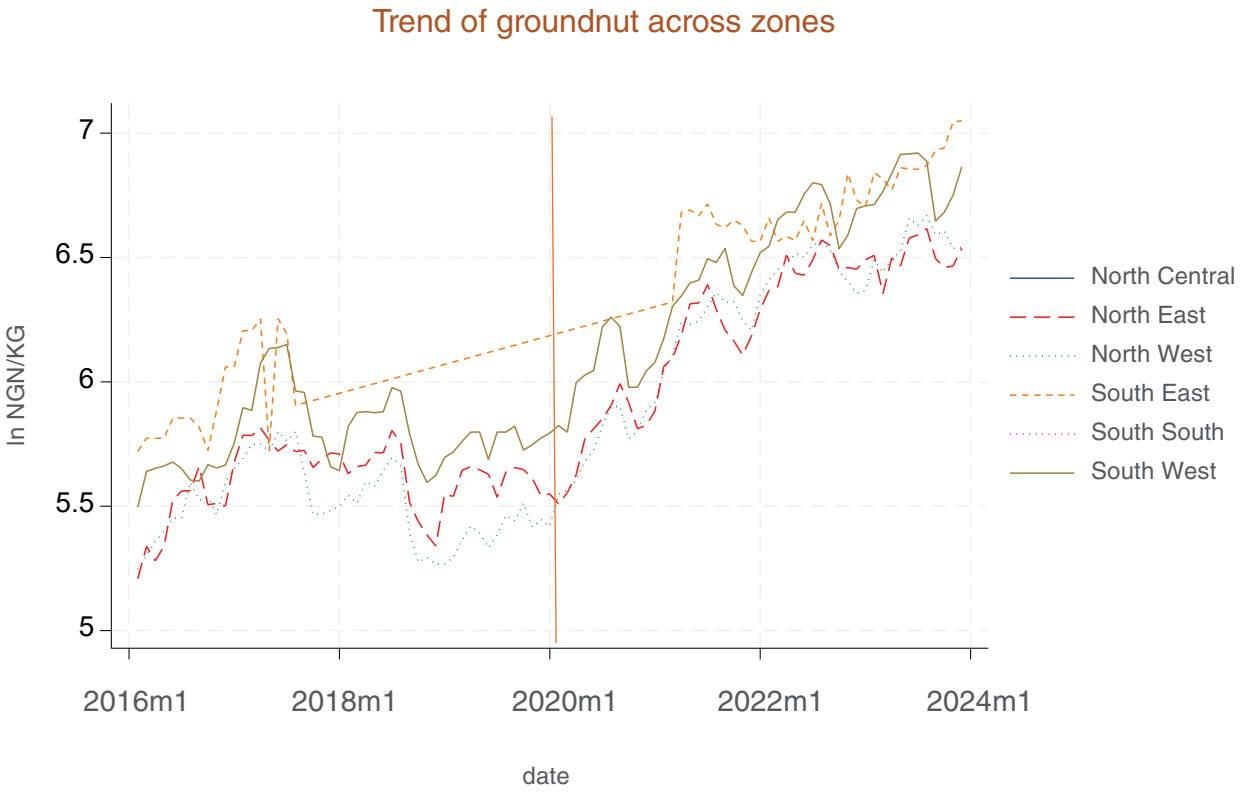


Figure 29: Trend in prices for groundnut.

Source: Authors' computations. Analysis based on NBS data set over the period January 2016 to October 2024.

The effect of shocks on price fluctuations

A. The COVID-19 pandemic on prices

Figures 39 and 40 present the price movements for cowpeas and maize, tracking their response to the COVID-19 pandemic period. Prior to the onset of COVID-19, cowpea and maize prices were relatively stable, with minor fluctuations. This stability reflects a well-functioning market environment with predictable price movements, characteristic of typical pre-pandemic conditions. Following the outbreak of COVID-19 and the enforcement of lockdowns, both cowpea and maize prices spiked sharply around mid-2020. The initial lockdown measures disrupted supply chains, leading to shortages and heightened demand, especially for staple food items. The upward trend is particularly noticeable for cowpeas, whose prices increased substantially (Amare et al., 2024a). Unlike a typical short-term price shock, the price increases persisted beyond the initial COVID-19 wave. Cowpea prices maintained elevated levels throughout 2020 and into 2021, reflecting ongoing supply chain challenges and sustained demand pressures. This extended period of high prices indicates that the pandemic's impact was prolonged, and that recovery was slow, with the market unable to revert to pre-pandemic price levels quickly. The chart also reveals heightened price variability across different regions during the pandemic, showing that while some areas experienced severe price increases, others saw more moderate changes. This variability highlights the uneven distribution of supply chain disruptions and demand spikes across Nigeria's regions, resulting in a wider gap in prices.

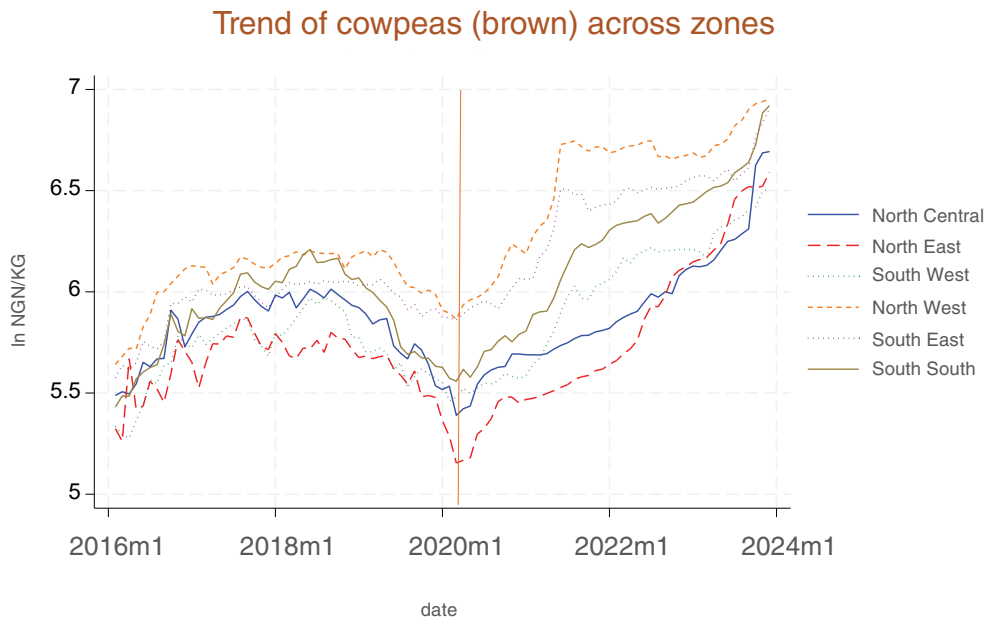


Figure 30: COVID-19 shocks and trends in cowpea prices.

Source: Authors' computations. Analysis based on NBS data set over the period January 2016 to October 2024.

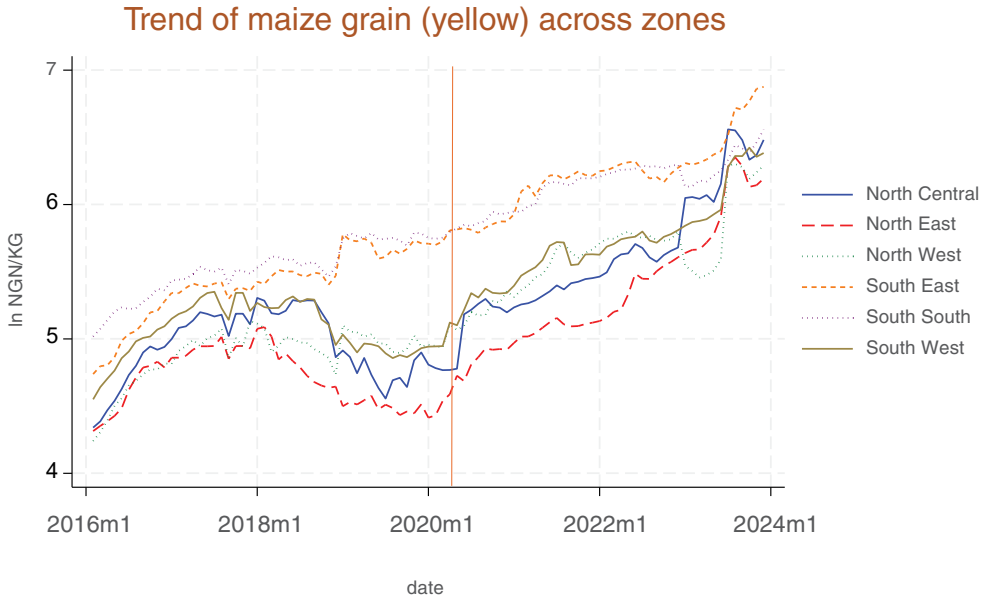


Figure 31: COVID-19 shocks and trend in maize prices.

Source: Authors' computations. Analysis based on NBS data set over the period January 2016 to October 2024.

B. The effects of the war in Ukraine on prices

Figure 41 and Table 5 illustrate the effect of the war in Ukraine on wheat prices in Nigeria, showing a marked price escalation following the conflict. Before February 2022, wheat prices in Nigeria were stable, with an average price of Naira 487.43 per unit. The market appeared unaffected by any significant disruptions, maintaining a steady price trend. As the conflict began, wheat prices rose sharply to an average of Naira 796.29 per unit by May 2023, representing a 63.34 percent increase. This substantial price hike aligns with the global wheat shortage caused by the disruption of wheat exports from Ukraine and Russia, two of the world's largest wheat suppliers. Post-conflict, wheat prices did not stabilise or decrease but remained consistently high, indicating that the supply constraints persisted and that Nigeria, as an importer, faced sustained pressures in sourcing wheat. The chart shows a clear and abrupt upward shift in wheat prices immediately following the start of the war in Ukraine, indicating a direct correlation between the conflict and price increases. This trend remained consistent across all Nigerian regions, reflecting a national impact rather than localised price differences.

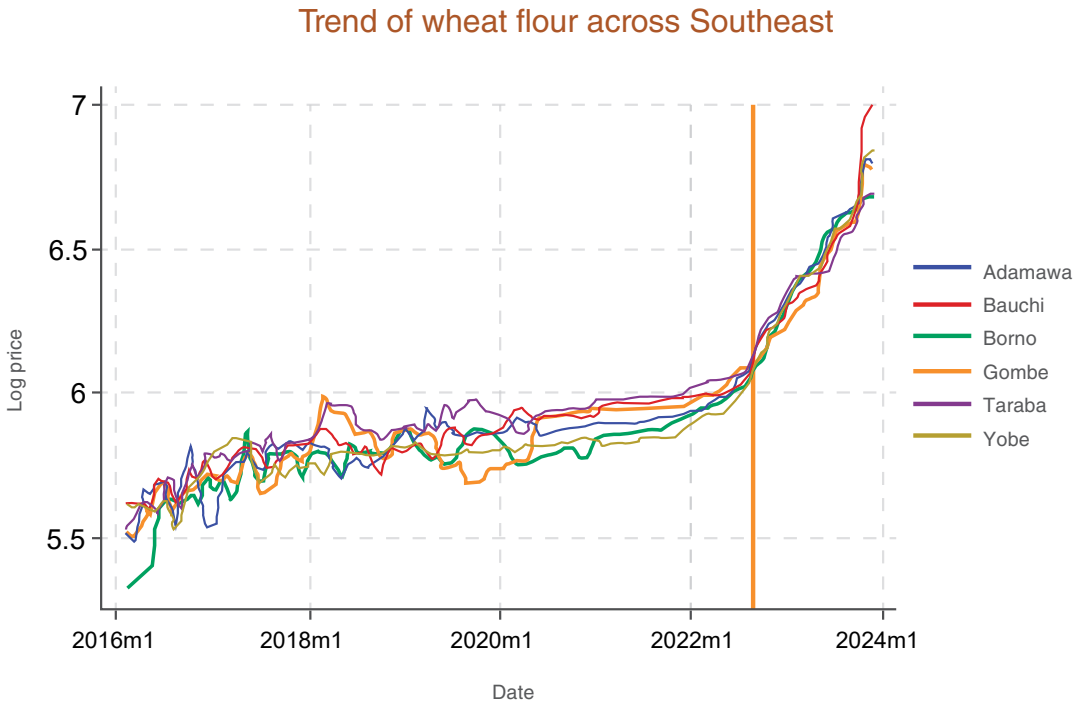


Figure 32: Effects of the war in Ukraine on wheat prices in Northeast Nigeria.

Source: Authors' computations. Analysis based on NBS data set over the period January 2016 to October 2024.

Table 5: Wheat prices before and after the war in Ukraine

Time Period	Average Price (Naira per kilogram)	Percentage change
Before the war (Jan 2022)	487.43	N/A
Before the war (Jan 2022)	796.29	63.34

Source: Authors' computations. Analysis based on NBS data set: over the period January 2016 to October 2024.

C. Removal of government fuel subsidy on food prices

Figures 42 - 43 and Table 6 reveal the effects of the removal of fuel subsidies in May 2023 on the prices of key food commodities in Nigeria. The removal of the fuel subsidy led to a notable rise in the prices of all analysed commodities, with significant hikes in maize, millet, and sorghum. For example, white maize prices increased by 56.68 percent, while brown sorghum saw an even larger rise of 83.91 percent. Different commodities experienced varied levels of price increases. Sorghum and millet, both staple grains, saw some of the highest percentage increases, indicating that they may be particularly sensitive to transportation costs. Groundnut prices increased more moderately at 10.59 percent, suggesting some relative stability or lower sensitivity to transportation price changes. Both brown and white cowpeas experienced price increases but to different extents - 19.67 percent for brown cowpeas and 24.65 percent for white cowpeas. These variations reflect differences in market dynamics or production, and transportation conditions for each type of cowpea. Among the commodities, millet and sorghum exhibited some of the highest percentage changes (57.65 percent for millet, 83.91 percent for brown sorghum). This indicates a high dependency on fuel-impacted transport systems, likely due to their production in rural areas with longer distribution routes to urban markets.

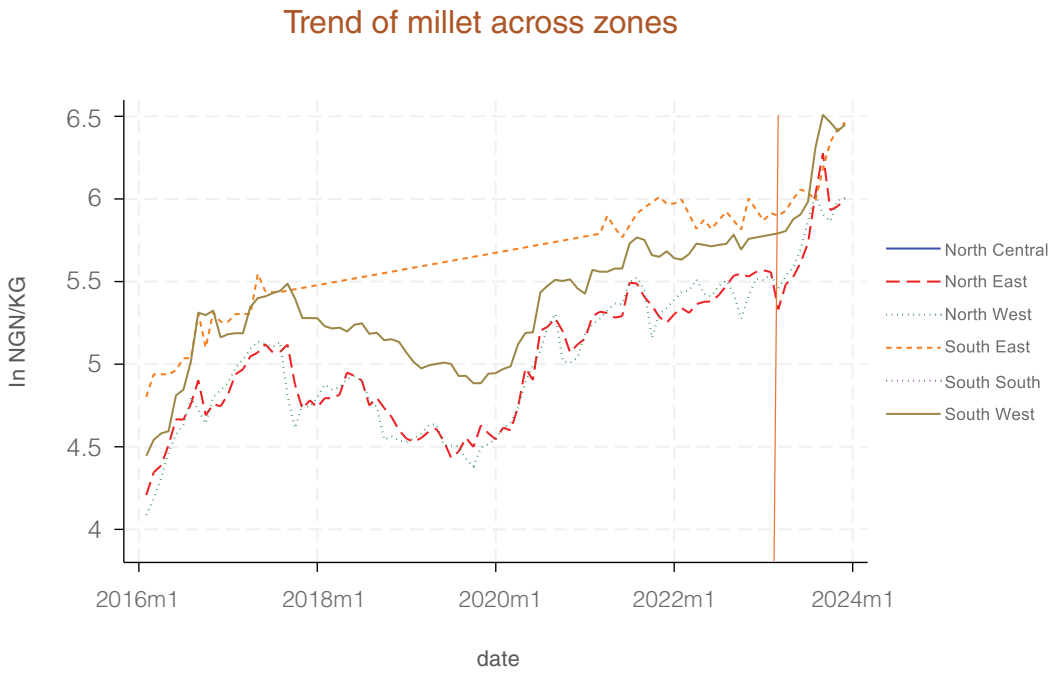


Figure 33: Effects of fuel subsidy removal on price of millet.

Source: Authors' computations. Analysis of NBS over the period January 2016 to October 2024.

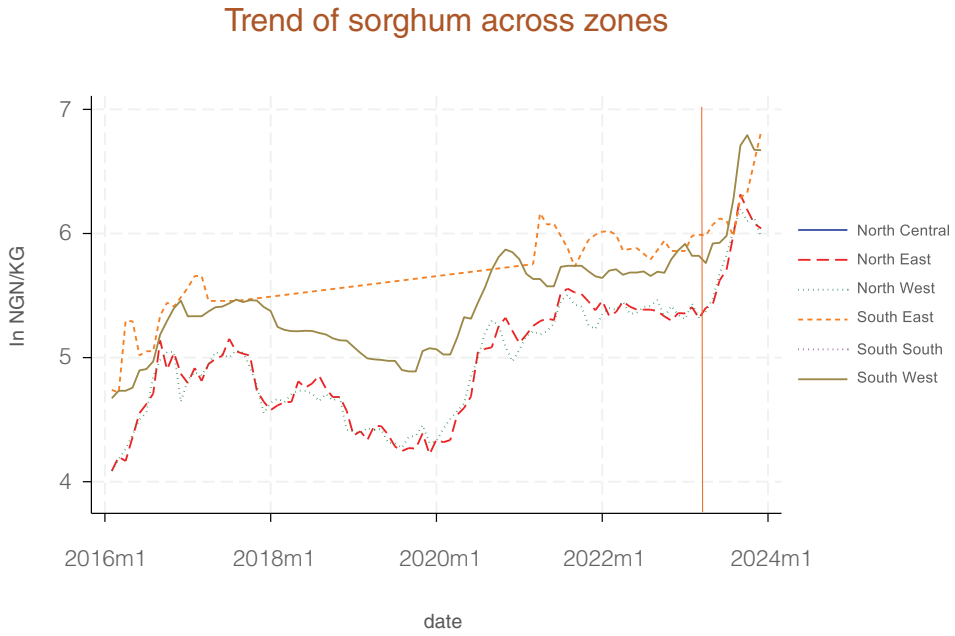


Figure 34: Effects of fuel subsidy removal on price of sorghum.

Source: Authors' computations. Analysis of NBS over the period January 2016 to October 2024.

Table 6: Average price of food commodities before and after subsidy removal

Commodity	Average price before subsidy removal (Naira	Average price after subsidy removal (Naira)	Percentage change
Cowpeas (brown)	626.2	749.57	19.67
Cowpeas (white)	582	725.57	24.65
Maize grain (white)	337.2	528.14	56.68
Maize grain (yellow)	415.4	609.14	46.66
Wheat flour	620.63	796.29	28.35
Groundnut	711.6	787.14	10.59
Millet	272.2	429.14	57.65
Sorghum (brown)	253	465.57	83.91
Sorghum (white)	256.6	471.57	83.46

Source: Authors' computations. Analysis based on NBS data set over the period January 2016 to October 2024.

D. Price analysis of selected states based on recent WFP Nigeria and FEWS NET data

The removal of petrol subsidies and the simultaneous devaluation of the Nigerian Naira that began in May 2023 have significantly impacted the prices of essential food items such as maize, rice, beans, and wheat. To fully understand the potential effects, it is important to consider how these factors, eliminating petrol subsidies and the naira devaluation, can influence food prices, and then examine the actual price trends reflected in the provided dataset.

The removal of petrol subsidies led to an increase in fuel prices, which in turn raised transportation costs, as fuel is a key component in the distribution of goods, including food. Additionally, many agricultural inputs, such as fertilisers, machinery, and transportation, depend on petrol, causing the overall cost of agricultural production to rise. This, in turn, resulted in higher food prices. Moreover, the rising costs of goods and services, including food, due to increased fuel prices often contribute to inflation, further driving up food prices, particularly in Nigeria, where many essential items are imported.

Furthermore, the devaluation of the local currency means more Naira is required to purchase foreign goods. Since Nigeria imports a significant amount of food, including rice, wheat, and other staples, the cost of these imported goods increased, even if domestic production costs remained unchanged. As the price of imported goods rises, there may be a greater demand for locally produced food items, which could drive up prices for these goods as well, especially when the local supply is insufficient to meet the increased demand. To evaluate the impact of these policy changes on food prices, we can examine trends in the data set provided, sourced from FEWS NET for 2023 and WFP for 2024. Specifically, we focus on the period before and after May 2023, when the policy changes were implemented

Maize

Maize prices experienced a sharp rise after May 2023. In Abuja, for instance, the price increased from Naira 288.4 per kilogram before May 2023 to Naira 493.3 per kilogram afterward, reflecting a rise of approximately 71 percent. Similarly, in Maiduguri, prices went up from Naira 290.3 per kilogram before May 2023 to Naira 496.80 per kilogram after May 2023, also showing an increase of around 71 percent (see Figure 44). This surge in maize prices aligns with expectations, as higher fuel costs (due to the subsidy removal) and a weaker Naira, which raises the cost of inputs and transportation, contributed to the price hike.

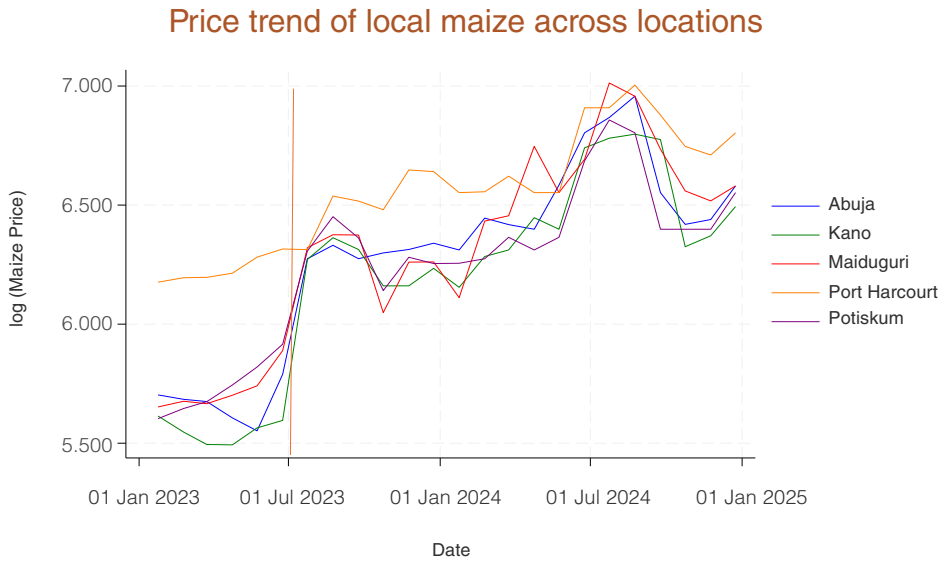


Figure 35: Price trend of maize across locations.

Source: Authors' computations. Analysis is based on WFP Nigeria data and FEWS NET over the period 2023 to 2024.

Rice (imported and local)

Both imported and local rice prices saw significant increases following the policy changes (See Figures 45 and 46). For imported rice, in Abuja, the price surged from Naira 862.3 per kilogram before May 2023 to Naira 1,052.4 per kilogram after May 2023, marking a 22 percent increase. In Maiduguri, prices rose from Naira 649.4 per kilogram before May 2023 to Naira 891.6 per kilogram after May 2023, reflecting a 37 percent increase. In Port Harcourt, the price went up from Naira 1,015.5 per kilogram before May 2023 to Naira 1226.50 per kilogram after May 2023, a 21 percent increase. Local rice prices also experienced notable rises. In Abuja, the price jumped from Naira 462.20 per kilogram before May 2023 to Naira 757.2 per kilogram after May 2023, a 62 percent increase. In Maiduguri, prices rose from Naira 534.30 per kilogram before May 2023 to Naira 706.6 per kilogram after May 2023, representing a 32 percent increase.

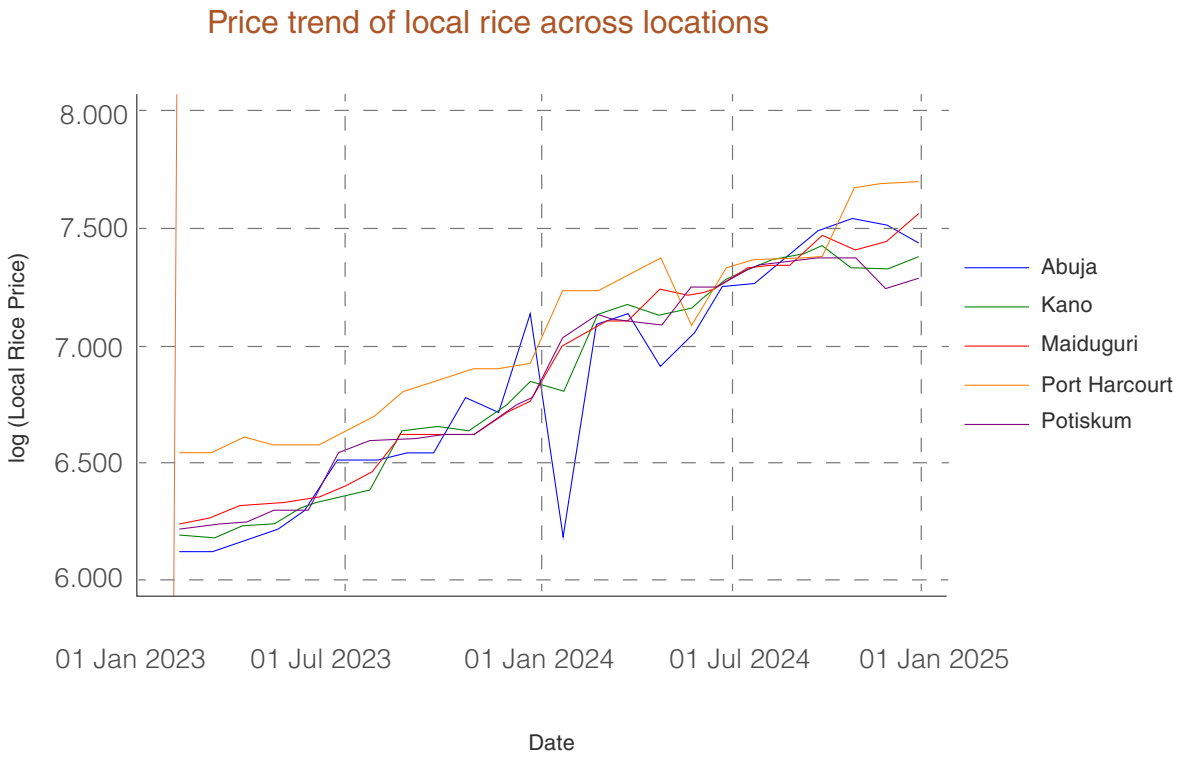


Figure 37: Price trend of local rice across locations.

Source: Authors' computations. Analysis is based on WFP Nigeria data and FEWS NET over the period 2023 to 2024.

Beans and wheat

The price analysis also reveals substantial increases in beans prices, with significant regional disparities. Although beans are primarily grown locally, they depend heavily on extensive transportation networks for distribution. As fuel prices have risen, transportation costs have increased markedly, which has driven up the final consumer price (See Figure 47). Wheat prices also showed an upward trend. In Abuja, the price rose from Naira 691.00 per kilogram before May 2023 to Naira 818.40 per kilogram after May 2024, reflecting an 18 percent increase. In Maiduguri, prices increased from Naira 656.10 per kilogram before May 2023 to Naira 749.7 per kilogram after May 2024, a 14 percent increase (See Figure 48). Other cities such as Kano (14 percent), Potiskum (11 percent), and Port Harcourt (10 percent) experienced price increases within a similar range to Abuja and Maiduguri.

These increases suggest that wheat prices have been influenced by both the devaluation of the Naira and rising local production costs. The Naira's devaluation has made wheat imports more expensive, while the increase in fuel prices has raised local production and distribution costs. The consistent rise in wheat prices indicates a broader trend affecting imported goods, where a weaker currency and higher transportation costs combine to create upward price pressures across the food supply chain.

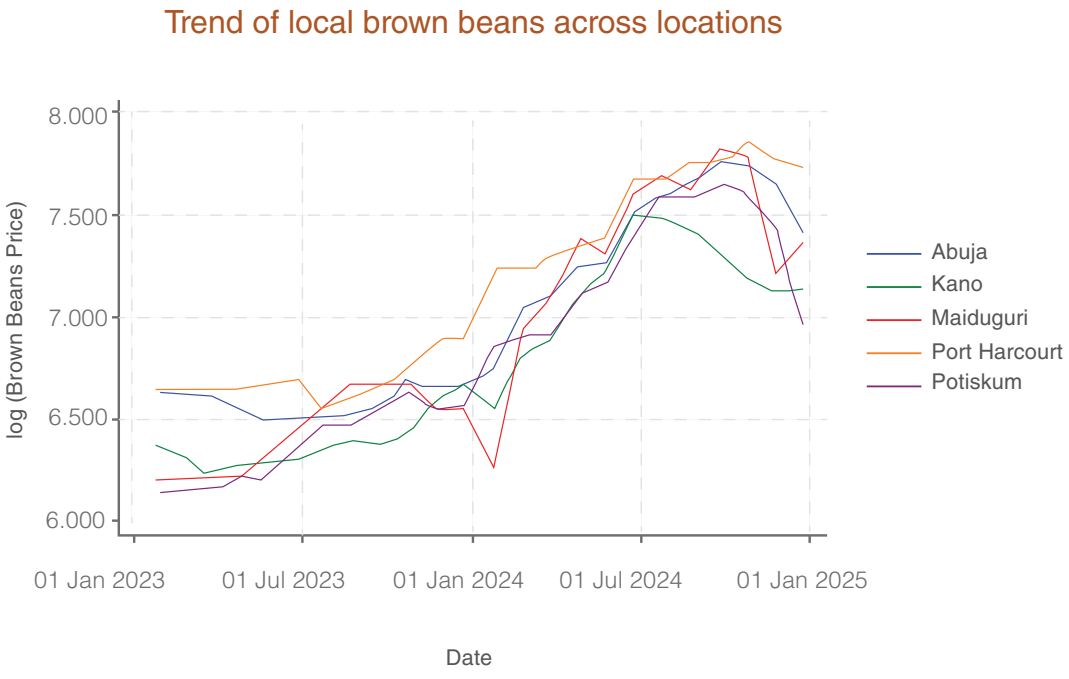


Figure 38: Price trend of brown beans across locations.

Source: Authors' computations. Analysis is based on WFP Nigeria data and FEWS NET over the period 2023 to 2024.

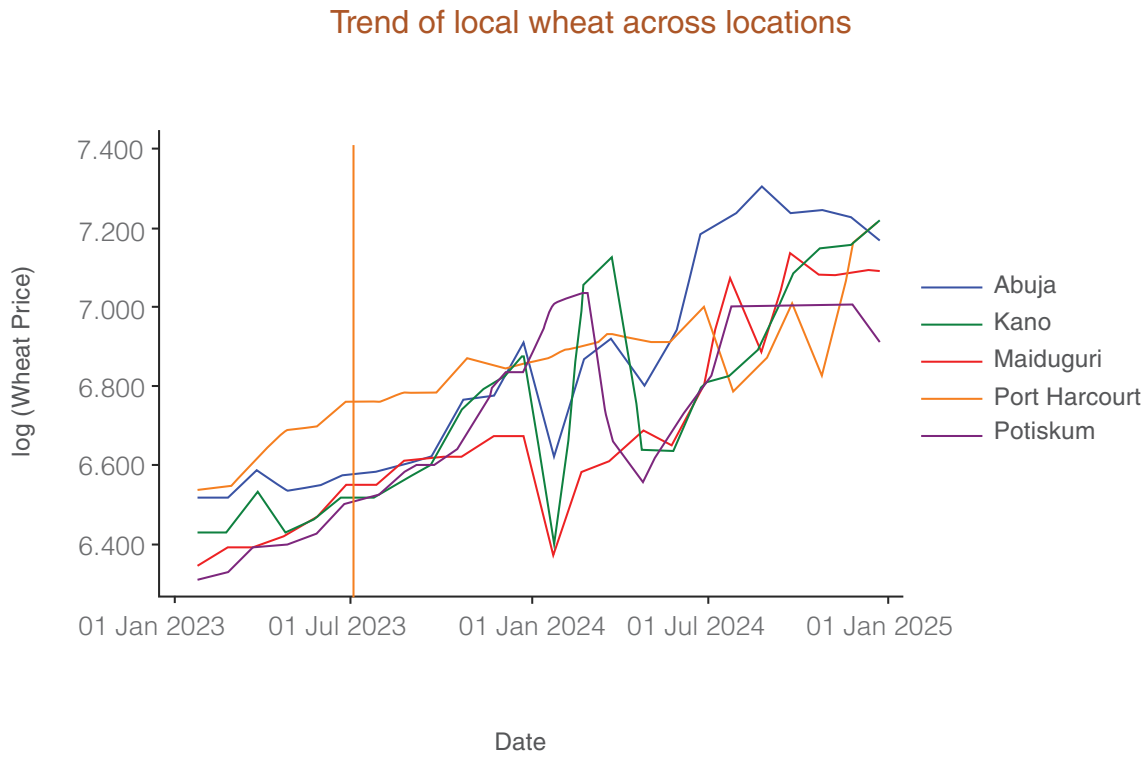


Figure 39: Price trend of wheat across locations.

Source: Authors' computations. Analysis is based on WFP Nigeria data and FEWS NET over the period 2023 to 2024.

In conclusion, the removal of petrol subsidies and the devaluation of the Naira since May 2023 have likely contributed to the significant increase in the prices of essential food items such as maize, rice, beans, and wheat. The sharp price increases across different regions suggest that higher fuel costs have raised transportation and input costs, thereby driving higher food prices. Additionally, the devaluation of the Naira has notably impacted the prices of imported food items (e.g., rice and wheat), but local food prices have also risen due to higher production costs. These macroeconomic changes have led to inflation in food prices, which could have serious implications for food security in Nigeria.

Table 7: Price changes for selected food items

Food item	Location	Average price before May 2023 (Naira/kilogram)	Average price after May 2023 (Naira/kilogram)	Percentage change (%)
Maize	Abuja	288.4	493.3	71.3
	Maiduguri	290.3	496.8	71.3
	Kano	253.3	489.5	93.4
	Potiskum	288.5	520.2	80.3
	Port Harcourt	489.5	634.6	29.6
Rice (imported)	Abuja	862.3	1052.4	22.1
	Maiduguri	649.4	891.6	37.3
	Kano	782.2	962.8	23.1
	Potiskum	672.8	848.1	26.1
	Port Harcourt	1015.5	1226.5	21.0
Rice (local)	Abuja	467.2	757.2	62.0
	Maiduguri	534.3	706.6	32.3
	Kano	495.8	742.7	49.7
	Potiskum	513.4	742.6	44.7
	Port Harcourt	720.2	868.6	20.6
Beans	Abuja	737.3	708.5	-3.9
	Maiduguri	495.2	706.8	42.7
	Kano	539.6	609.5	13.0
	Potiskum	475.2	627.1	31.9
	Port Harcourt	766.0	832.2	8.6
Wheat	Abuja	691.4	818.4	18.4
	Maiduguri	656.1	749.7	14.3
	Kano	625.8	715.5	14.3
	Potiskum	618.3	688.5	11.4
	Port Harcourt	796.3	877.9	10.2

Source: Authors' computations. Analysis is based on WFP Nigeria recent and FEWS NET data set over the period 2023 to 2024. period 2023 to 2024.

Summary of price volatility of selected commodities

Table 16 summarises the volatility levels for different commodities, highlighting how each respond to price fluctuations across Nigeria. Wheat flour and groundnut show the highest standard deviations (184.62 and 177.96, respectively), indicating frequent and significant price changes. The high coefficient of variation (0.53 for wheat and 0.51 for groundnut) suggests that these commodities are prone to unpredictable price fluctuations, possibly due to their reliance on external supply factors. Maize and cowpeas exhibit moderate price volatility, with coefficients around 0.43 and 0.46, respectively. While these commodities experience seasonal price fluctuations, they are more stable than wheat or groundnut. Millet and sorghum show the lowest volatility levels, with standard deviations below 100 and coefficients of variation around 0.26 to 0.28. This stability indicates that these grains are less affected by external shocks or market changes, likely due to more consistent local production and consumption. The standard deviation and coefficient of variation provide insight into how prices for each commodity respond to changes. Higher volatility in wheat and groundnut reflects greater sensitivity to external factors, while the stability of millet and sorghum may indicate local production resilience.

Table 8. Summary of price volatility (by commodity)

Commodity	Standard deviation	Variance	Coefficient of variation (CV)
Cowpeas	174.72	30,522.47	0.46
Maize grain	142.10	20,205.48	0.43
Wheat flour	184.62	34,064.78	0.53
Groundnut	177.96	31,703.16	0.51
Millet	90.72	8,229.45	0.26
Sorghum	99.68	9,933.65	0.28

Food price evolution of selected commodities in Northeast Nigeria

Figures 49 - 55 highlight the price trends in Northeast Nigeria for various staple foods, offering a closer look at regional dynamics over time. The charts reveal an overall increase in the prices of cowpeas, maize, groundnuts, sorghum, and millet from 2016 to 2024. The steady upward trend for most commodities suggests that inflationary pressures and supply-demand dynamics have driven consistent price growth. During 2020, prices for cowpeas and maize show a noticeable increase across the six Northeast states. This surge aligns with the nationwide COVID-19 disruption period, when supply chains were affected by lockdowns, labour shortages, and transport restrictions, leading to heightened prices in these staples. Groundnut prices appear relatively stable over time compared to sorghum and millet, which exhibit greater price variability. This stability may reflect a more reliable local production and demand structure for groundnuts, whereas sorghum and millet prices respond more to seasonal and climatic factors. Each state in the Northeast shows similar trends for a given commodity, with cowpea and maize prices rising in tandem.

However, there are minor variations between states, suggesting that localised factors, such as differing access to markets, crop production levels, or conflict intensity, can slightly alter price trajectories within the region. While cowpea and maize prices reflect steady increases with fewer fluctuations, the prices of millet and sorghum in Figure 40 show more pronounced peaks and valleys. These fluctuations may stem from regional-specific supply disruptions or climatic conditions that particularly impact millet and sorghum cultivation. In a region experiencing regular conflict, the Northeast shows susceptibility to periodic price surges. The prices of cowpeas, maize, and millet spike notably in specific periods, which may correlate with intensified conflict, affecting supply chains and market access.

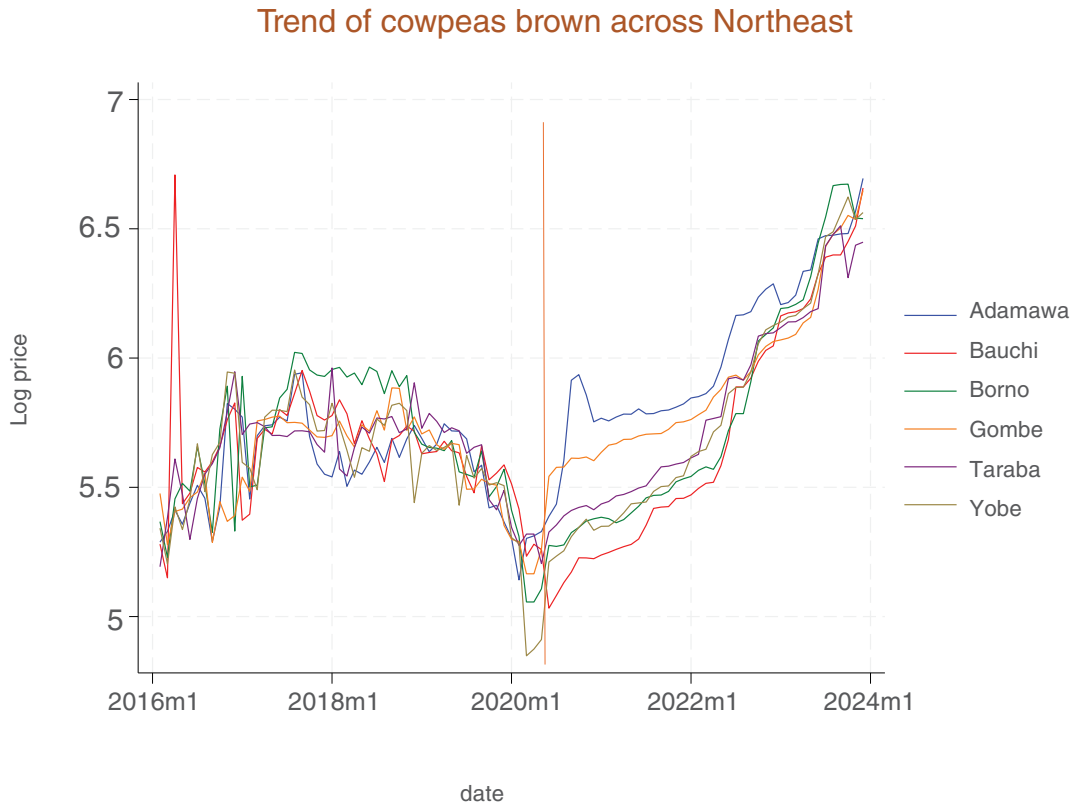


Figure 40: Dynamics of brown cowpeas in Northeast Nigeria.

Source: Authors' computations. Analysis of NBS over the period January 2016 to October 2024.

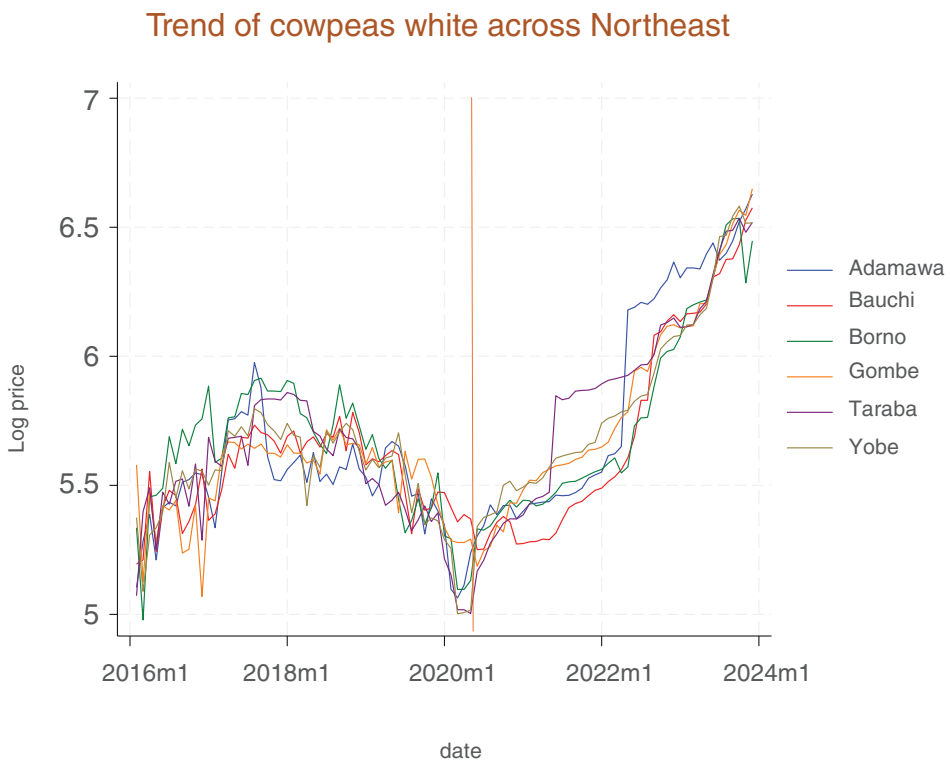


Figure 41: Dynamics of white cowpeas in Northeast Nigeria.

Source: Analysis of NBS over the period January 2016 to October 2024.

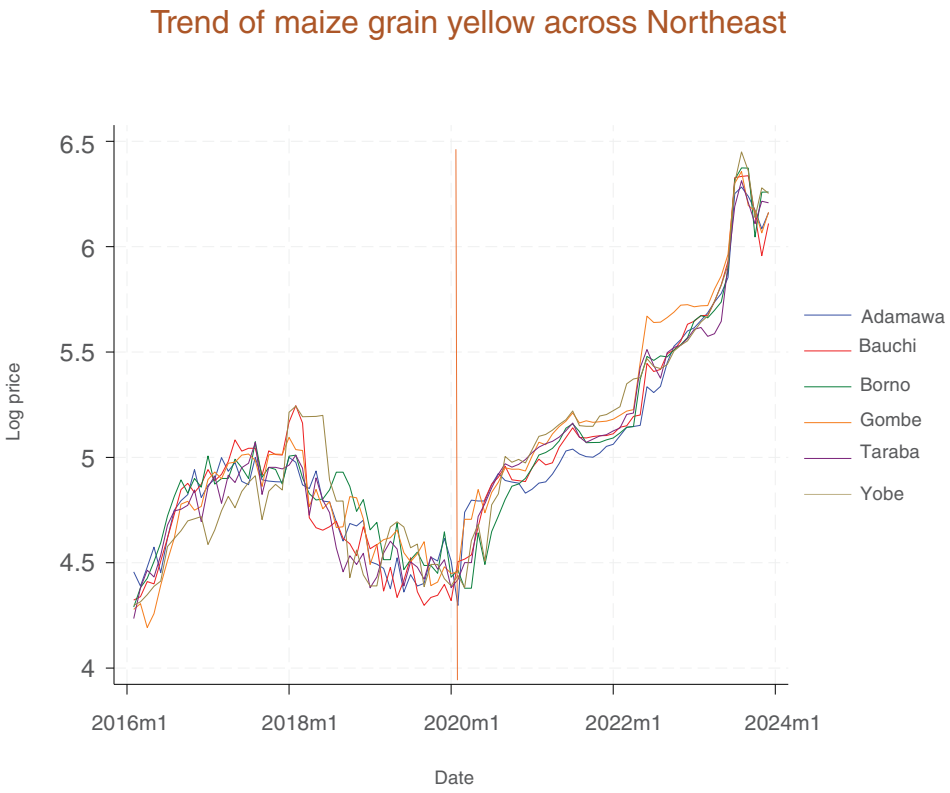


Figure 42: Dynamics of maize grain (yellow) in Northeast Nigeria.

Source: Authors' computations. Analysis of NBS over the period January 2016 to October 2024.

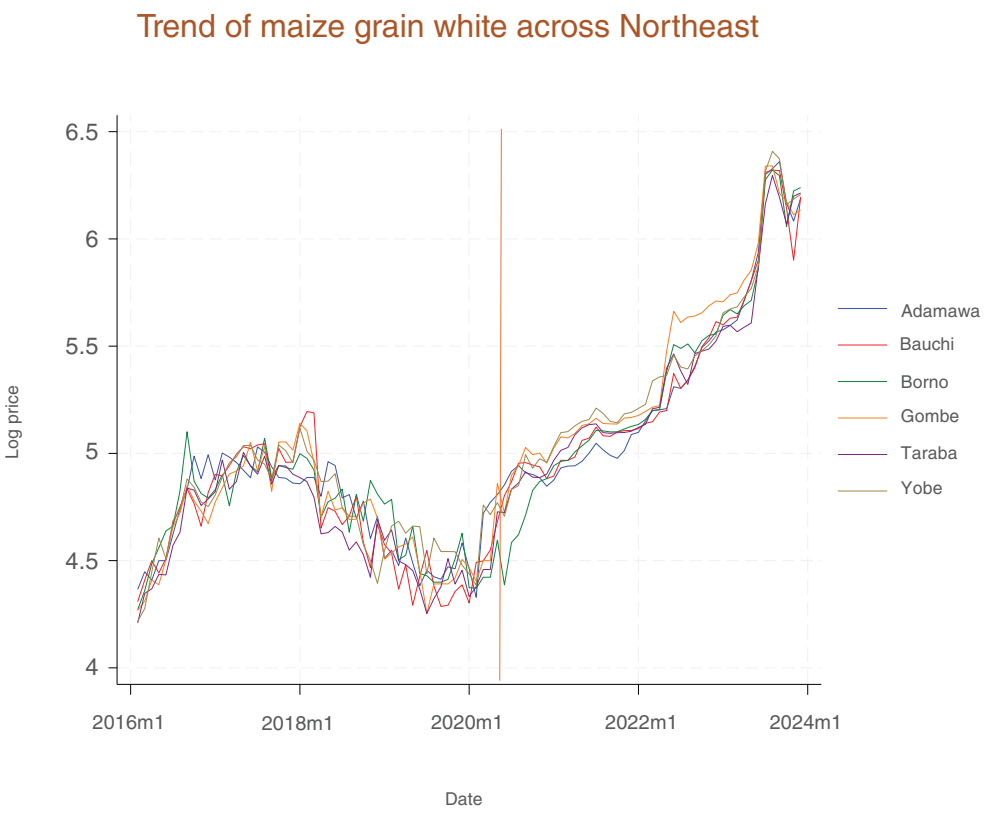


Figure 43: Dynamics of maize grain (white) in Northeast Nigeria.

Source: Authors' computations. Analysis of NBS over the period January 2016 to October 2024.

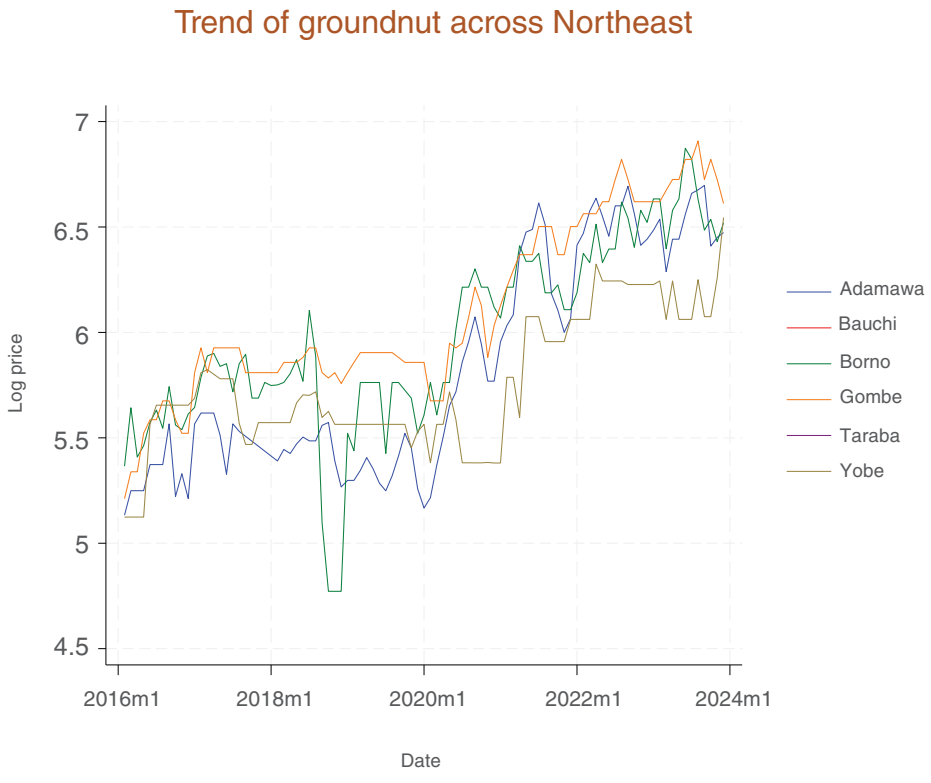


Figure 44: Dynamics of groundnut in Northeast Nigeria.

Source: Authors' computations. Analysis of NBS over the period January 2016 to October 2024.

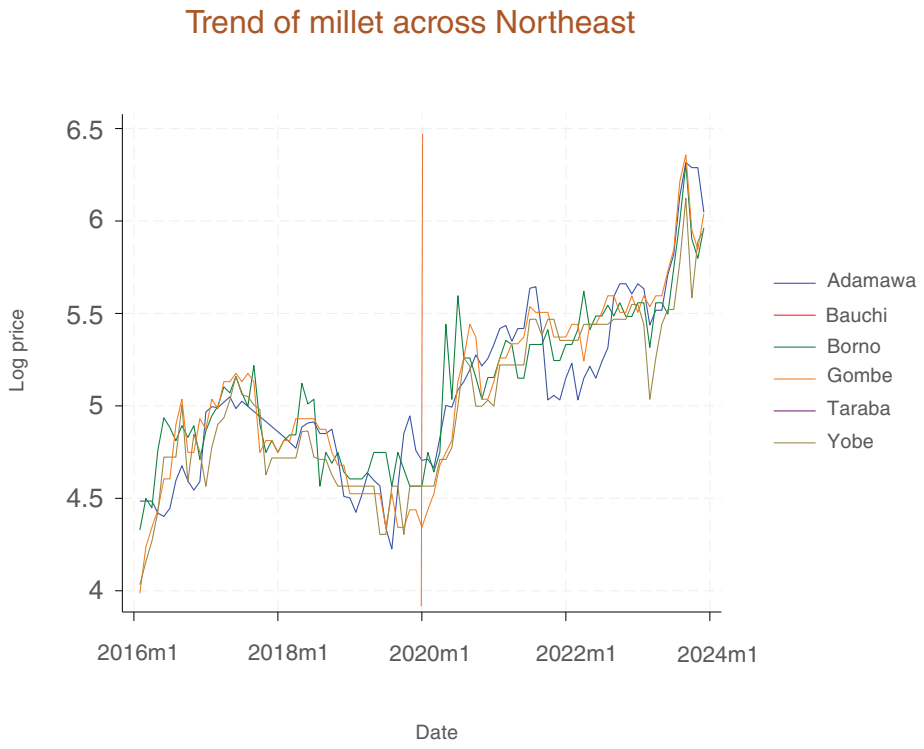


Figure 45: Dynamics of millet in Northeast Nigeria.

Source: Authors' computations. Analysis of NBS over the period January 2016 to October 2024.

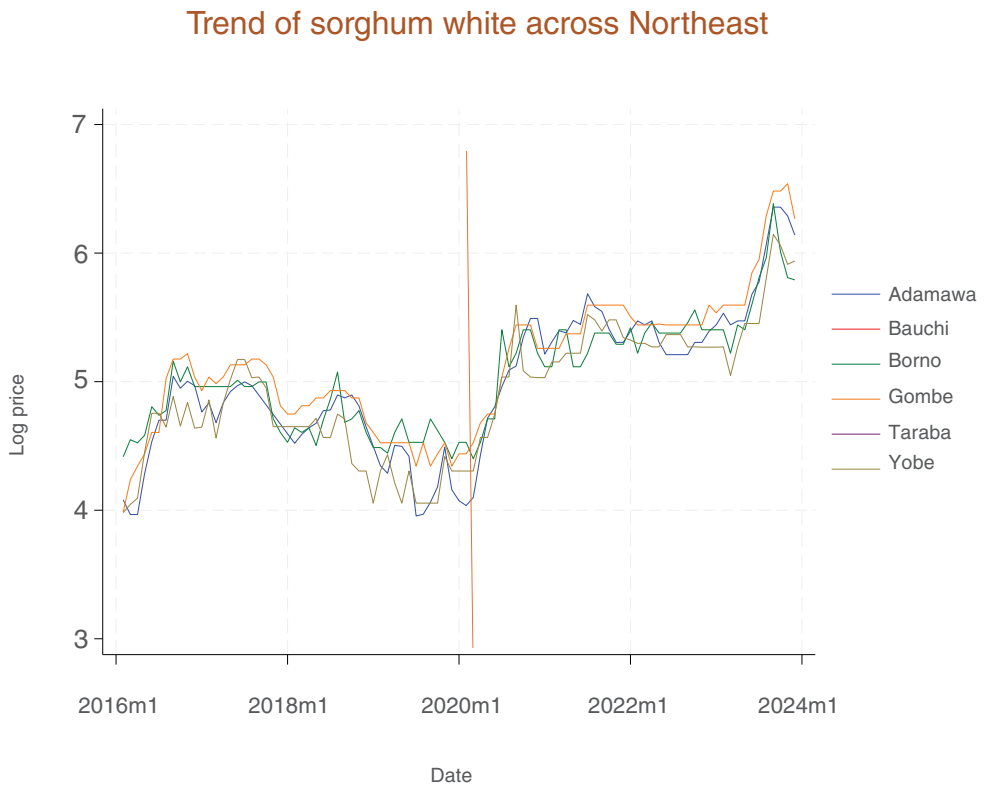


Figure 46: Dynamics of white sorghum in Northeast Nigeria.

Source: Authors' computations. Analysis of NBS over the period January 2016 to October 2024.

In summary, the price analysis highlights clear trends and regional differences in food prices across Nigeria's geopolitical zones, showing a steady increase in prices for all commodities between 2016 and 2024. Price variability across states has also increased, particularly following major disruptions such as the COVID-19 pandemic, the war in Ukraine, and the removal of fuel subsidies, which collectively amplified price volatility (Amare et al., 2024a). These shocks led to substantial price hikes, while additional factors — such as gaps in market information, high transportation costs, ongoing conflicts, and inadequate storage facilities — further contributed to inflation and regional price disparities. Efforts to stabilise prices and reduce these disparities could focus on enhancing infrastructure, such as transportation and storage, establishing community exchange markets, improving communication networks, and addressing regional conflicts.

Impacts of food prices increases on lower-income households

Lower-income households in Nigeria experienced a higher incidence of food insecurity when food prices increase significantly from 2023 - 2024. We conducted an illustrative analysis using IFPRI's Food Price Simulator for Nigeria.[7] The tool allows for estimates of the impacts of food price increases and other shocks (Ecker and Comstock, 2021). We use the price increases recorded in Table 14 for maize, rice (local), beans, and wheat for the simulation. The simulation tool reports results of these shocks on food poverty rates, prevalence of under-nourishment, food consumption expenditure per capita, and calorie intake per capita. The results are reported in Table 15. The simulation yields some relevant findings for this study.

First, we find that the food poverty rate increases by 9.1 percent from 42.9 to 52.0 percent, while the prevalence of under-nourishment increases by 11.6 percent from 40 to 51.6 percent. We also find that the price increases lead to lower food consumption expenditure per capita for all household income quintile groups. On average, the national expenditure reduces by 10.5 percent. The amount of calorie consumption per adult equivalent also reduced by 13.7 percent. Importantly, lower-income households experience these shocks more severely than wealthier households. Table 15 presents the food consumption expenditure per capita and the calorie consumption amount per adult equivalent by household income quintile groups. The lowest household income quintile group reduces food consumption expenditure per capita by 12.7 percent compared with the highest household income quintile group which reduces by 9.5 percent. Similarly, the calorie consumption amount per adult equivalent for the lowest versus the highest income quintile group reduces by 16 percent and 11 percent respectively. These differences are similar for both rural and urban households, though slightly larger in rural areas.

This illustrative analysis demonstrates firstly the exacerbated food insecurity across Nigeria for both rural and urban, and higher and lower income households, arising from the food price increases over the period 2016 to 2024 and especially for 2023 to 20254. The analysis also indicates that lower-income households are likely to be reducing their food expenditure and calorie intake more than higher-income households. This is a worrying trend, especially considering the existing high food poverty rates in the country, especially for poorer households.

Table 9: Simulated impacts of price increases of selected commodities on food consumption and calorie consumption.

	Baseline (percentage)	**Simulation effect**	
		Total (percentage)	*Percentage change from baseline*

	Baseline	**Simulated impact**		
		Total	*Percentage change from baseline*	
			Food consumption expenditure per capita	*Calorie consumption amount per adult equivalent*

Source: Authors' computations based on price increases for maize, local rice, beans, and wheat in WFP Nigeria and FEWS NET data set over the period 2023 to 2024.

[7]The Food Security Simulator is an MS-Excel-based tool for assessing the potential short-term impacts of food price or household income shocks on food security and people's diets. The tool provides evaluations of direct, household-level outcomes. For this illustrative analysis we focused on food security (consumption expenditure and caloric intake). The underlying data include estimates from representative household survey data and rigorous, sophisticated food demand models to capture consumer behavior

Barriers to efficient trade in key food supply chains in Northern Nigeria

Barriers in food production

This section highlights factors limiting farmers' productivity based on the cost analysis and feedback from focus group discussions (FGDs).

a. Quality of inputs is a key concern.

Farmers believe that seeds, fertilisers, and herbicides often do not match the quality claimed on packaging. This perception impacts productivity as low-quality inputs can lead to reduced yields, increasing the need for costly reapplications. Ensuring input quality through government inspection and quality control could build farmers' confidence. Improved access to high-yield, climate-resilient seed varieties would also be beneficial (Michelsen et al., 2023).

"WE NEED GOVERNMENT INSPECTIONS ON ALL THE SEEDS AND FERTILISERS SOLD TO US." – FGD, SORGHUM FARMERS, KANO STATE.

b. High land rental costs add significant financial strain

Farmers face high fixed costs for land, with rental rates ranging from Naira 31,000 to Naira 100,000 per 2 hectares. This cost burden limits smallholder farmers' ability to expand or sustain production. Insecurity further compounds this issue, as it restricts land access and adds to the challenges of acquiring farmland (Amare et al., 2024).

WE MUST RENT FARMLANDS, AND THE RENT IS VERY EXPENSIVE. TWO HECTARES OF LAND COST ABOUT 100,000 NAIRA." – FGD, COWPEA FARMERS, ADAMAWA STATE.

c. Climate challenges threaten crop yields.

Unpredictable weather, including droughts and floods, has become a significant barrier to stable production. While farmers are trying to adapt by using early-maturing crops and irrigation, these climate issues still reduce yields and overall revenue potential.

THIS YEAR, WE HAD 13 DAYS WITHOUT RAIN, WHICH AFFECTED OUR CROPS AND REDUCED OUR YIELD, ESPECIALLY FOR MAIZE AND RICE – FGD, COWPEA FARMERS, ADAMAWA STATE.

d. Manual processing limits product quality and value.

. Limited access to mechanised tools for post-harvest processes, particularly in millet and sorghum production, affects the quality and price of produce. Manual threshing, for example, can lower product quality, impacting market prices. High labour costs (e.g., Naira 278,482 per hectare for sorghum) reflect the manual nature of these post-harvest activities.

"IF THE THRESHING IS NOT PROPERLY DONE, IT WILL AFFECT THE QUALITY AND PRICE OF THE PRODUCE, ESPECIALLY WHEN DONE MANUALLY." – FGD, MILLET AND SORGHUM FARMERS, KANO STATE.

e. Small-scale mechanisation and processing equipment can enhance productivity.

Providing small-scale mechanisation services and access to processing equipment for key crops like sorghum, millet, cowpea, tomato, groundnut, and soybeans can significantly boost productivity. By implementing rental or pay-per-use models, these technologies become affordable and accessible for smallholder farmers who may not have the capital to invest in machinery. Access to efficient processing equipment, especially those designed to handle mixed grain sizes, would also reduce post-harvest losses, particularly in the processing of cowpea, where quality sorting is essential. Investment in efficient processing equipment particularly for handling mixed grain sizes — would also reduce post-harvest losses, especially in cowpea processing.

f. Middlemen dominate pricing reducing farmers' bargaining power.

Farmers report that middlemen often dictate prices, purchasing at low rates and reselling at much higher prices. This arrangement limits farmers' revenue and discourages them from engaging directly with larger buyers.

"THE MIDDLEMEN ARE THE ONES WHO DETERMINE THE PRICE, WHICH SOMETIMES DISCOURAGES US THEY ALSO BREAK THE PRICE LOWER SO THAT THEY CAN GET SOMETHING WHEN THEY RESELL IT. FOR EXAMPLE, THEY BUY IT AT 7,000 OR 8,000, AND WHEN THEY RESELL IT, THEY SELL IT FOR 15,000." – FGD, MILLET AND SORGHUM FARMERS, KANO STATE.

g. Strengthening market linkages through forward and backward integration will guarantee buyers for farmers, helping them manage market risks.

This approach has proven effective for traders in Northern Nigeria, who provide farmers with inputs (e.g., seeds, fertilisers) or loans with agreements to buy back the harvest at market prices or higher. Adopting similar schemes by buying commodities from traders who source directly from farmers in conflict-affected areas will stabilise supply chains and enhance farmers' resilience.

"IN 2019, WE DECIDED TO DIVERSIFY BY DOING FORWARD INTEGRATION. BECAUSE WE SELL SEEDS TO FARMERS, WE FOUND OUT THAT GIVING THEM A MARKET WILL ALSO IMPROVE THE SALES OF OUR SEEDS. SO, WHEN THEY BUY OUR SEEDS, WE GO BACK FOR THEIR GRAINS." KII, MILLET TRADER, KANO STATE.

h. Conflict and insecurity disrupt farming activities.

Persistent farmer-herder conflicts and general insecurity create significant challenges. Farmers sometimes sleep in their fields to guard their crops, and destruction during the harvest period due to livestock encroachment is common.

"THERE IS A DRASTIC DROP IN THE QUANTITY OF FOOD PRODUCED FROM BORNO STATE, AND THIS HAS CONTRIBUTED TO THE INCREASE IN FOOD PRICES." – KII, SORGHUM TRADER, KANO STATE.

i. Inadequate storage facilities lead to post-harvest losses.

Poor storage infrastructure causes substantial losses, with farmers reporting up to 50 percent of their produce lost, especially in perishable goods. Without access to storage, farmers are forced to sell at lower prices to avoid spoilage.

"WE LOSE MORE THAN HALF OF OUR PRODUCE AFTER HARVEST BECAUSE WE DON'T HAVE PROPER STORAGE FACILITIES." – FGD, TOMATO FARMERS, KANO STATE.

Investment in storage facilities for grains is an important opportunity to reduce farmers' costs and raise their returns. For instance, during a discussion with farmers in Kano state, they recommended participation in the 'warehouse receipt financing system.' This system will allow farmers to store crops and access finance by using their commodities as collateral to secure loans. In a typical warehouse receipt financing approach, a farmer stores commodities at a certified independent warehouse. In this model, farmers deposit crops at certified warehouses and receive a receipt they can use to access credit. This financing supports ongoing production and provides a direct link to buyers like aggregators, warehouse operators, and government agencies (FMARD and AGRA, 2023). To enhance accessibility, establishing local storage centres would make the WRS more convenient and affordable for small farmers.

"ANOTHER SUGGESTION IS FOR THE GOVERNMENT TO INTRODUCE A PROGRAMME LIKE WAREHOUSE RECEIVING FINANCE WHERE FARMERS CAN STORE THEIR CROPS FOR AS LONG AS THEY WANT UNTIL THEY ARE READY TO SELL IT FOR PROFIT."

– FGD, MILLET AND SORGHUM FARMERS, KANO STATE.

Commodity-specific issues in production

This section highlights commodity-specific barriers in food production, summarised from the focus group discussions (FGDS) with farmers. Later sections describe gender differences in production.

Table 10: Summary of barriers in food production by commodity

Comodity	Barriers	Supporting quotes
Wheat	Higher production costs and input access	"WHEAT REQUIRES UREA, BUT IT'S BANNED IN OUR STATE DUE TO SECURITY CONCERNS. NOW, A BAG COSTS NAIRA 45,000, WHICH IS VERY EXPENSIVE." "OUR MAIN CHALLENGE IN PLANTING WHEAT IS SEEDS, THEY'RE ONLY AVAILABLE THROUGH GOVERNMENT INTERVENTION, WHICH IS DELAYED."
	High cost of irrigation	"WE DO NOT GROW WHEAT DURING THE WET SEASON, ONLY DURING THE DRY SEASON. HENCE, FUELLING (FOR IRRIGATION) IS A MAJOR CHALLENGE, ALONG WITH PEST AND DISEASE MANAGEMENT."
	Low local demand and market constraints	"MANY FARMERS ARE ABANDONING WHEAT FARMING DUE TO THE LACK OF LOCAL BUYERS. OUR STAPLE FOODS ARE RICE, MAIZE, SORGHUM, AND GUINEA CORN."
Groundnut	Lack of access to improved seeds	"SAMNUT24 WAS INTRODUCED WITH TRAITS LIKE INCREASED YIELD, EARLY HARVEST, AND MORE OIL CONTENT, BUT IT'S NOW DIFFICULT TO ACCESS. WE NEED BETTER ACCESS TO IMPROVED SEEDS."
	Market access constraints	"FARMERS LACK ACCESS TO MAJOR BUYERS. LARGE-SCALE PRODUCTION OFTEN LEADS TO SELLING AT LOW PRICES BECAUSE THE POPULATION CONSUMES FEWER OILY FOODS COMPARED TO GRAINS."
	Inadequate post-harvest handling and drying technology	"WE NEED AFFORDABLE DRYERS, SMALL-SCALE HARVESTERS AND THRESHERS FOR GROUNDNUT AND SOYBEANS TO IMPROVE PRODUCTION."
Soybeans	Pod shattering	"SOYBEAN PODS OFTEN SHATTER WHEN MATURE, CAUSING GRAIN LOSS. WE NEED SEED VARIETIES WITH HEAT-RESISTANT TRAITS TO PREVENT THIS."
Maize	Pests and diseases	"NEW PESTS LIKE FALL ARMYWORM AND NEMATODES, DRIVEN BY CLIMATE CHANGE, ARE DESTROYING MAIZE AND SORGHUM CROPS."
Sorghum	Insecurity	"A LOCAL SORGHUM VARIETY THRIVES DURING THE DRY SEASON IN EASTERN BORNO WITHOUT IRRIGATION, BUT FARMERS NO LONGER GROW IT DUE TO CONFLICT IN THE AREA."
Millet	Postharvest losses and handling	"A BAG OF MILLET COSTS AROUND NAIRA 80,000, BUT THE MOISTURE CONTENT CAUSES WEIGHT LOSS OVER TIME, REDUCING PROFITABILITY."
Cowpeas	Pests and excessive pesticide use	"WE BUY PESTICIDES LOCALLY, BUT IT'S HARD TO VERIFY THEIR AUTHENTICITY."
	Storage	"COWPEAS SPOIL IF NOT STORED PROPERLY. MANY FARMERS SELL EARLY BECAUSE THEY DON'T KNOW HOW TO PRESERVE THEM."
Tomatoes	Seasonality and pest challenges	"TOMATO PRODUCTION SUFFERS DURING THE RAINY SEASON AND FROM PEST OUTBREAKS LIKE TUTA ABSOLUTA."
	Insufficient water supply	"IN THE DRY SEASON, WELLS OFTEN RUN LOW, MAKING IT HARD TO DRAW WATER FOR IRRIGATION."
	Post-harvest handling and	"GETTING CRATES FOR TRANSPORTING TOMATOES IS VERY DIFFICULT." "WE ALSO NEED BETTER PRESERVATION EQUIPMENT."

Gender differences in production

The FGDs further revealed significant differences between men and women in agricultural production. These differences span various aspects of farming, from participation to resource access and labour costs, and are explained in detail below.

a. Women's participation in farming varies by region.

In some areas, women's involvement in farming is limited or non-existent due to cultural norms that dictate gender roles. However, in other regions, both men and women participate equally in crop production, showing that gender roles in agriculture are not uniform across Northern Nigeria.

"YES, IT DIFFERS, IN OUR AREA WOMEN DON'T FARM. IT IS ONLY MEN THAT DO IT BECAUSE MEN ARE THE ONES WHO TAKE CARE OF THE WOMEN." – FGD, MILLET AND SORGHUM FARMERS, KANO STATE.

b. Women face major barriers in accessing land and credit.

Women often require male endorsement or representation to access land or credit, making it challenging for single or widowed women to engage in farming independently. This restriction limits their ability to expand operations or invest in improved inputs.

"WOMEN HAVE MORE ISSUES THAN MEN IN ACCESSING FARMLANDS AND CREDIT. WHEN WE GO TO ACCESS ANYTHING, WHETHER CREDIT OR LAND, THEY INSIST THAT YOU COME WITH YOUR HUSBAND. AND IF YOU DON'T HAVE A HUSBAND, THEY WILL TELL YOU THAT YOU MUST LOOK FOR SOMEONE ELSE THAT WILL STAND FOR YOU." – FGD, COWPEA FARMERS, ADAMAWA STATE.

c. Land rental costs are higher for women in some communities.

In certain areas, women are charged more than men to rent farmland, which may stem from limited options or local norms. This disparity places an additional financial burden on women farmers, impacting their profitability and sustainability.

WHERE A MAN WILL PAY 10,000 TO RENT A FARM, A WOMAN CAN PAY ABOUT 15,000 TO RENT THE SAME FARM." – FGD, MILLET AND SORGHUM FARMERS, KANO STATE.

d. Women are often paid less for labour but make up a significant portion of the workforce.

In some regions, women receive lower wages for farm labour compared to men, though they constitute a substantial part of the agricultural workforce. This lower pay could reduce overall labour costs for farm owners but limits women's earning potential.

DURING HARVEST, IT IS ALWAYS CHEAPER TO HIRE WOMEN THAN MEN. HOWEVER, THIS DEPENDS ON THE AREA. FOR EXAMPLE, IN CHIROMAWA, ABOUT 80 PERCENT OF THE AGRICULTURAL WORKFORCE CONSISTS OF WOMEN." – FGD, MILLET AND SORGHUM FARMERS, KANO STATE.

Barriers in food transportation

Agricultural transportation in Northern Nigeria faces severe challenges, impacting cost and efficiency across commodities. Transporters, dealing with multiple goods, encounter common obstacles that hinder food distribution, especially in the Northern region, as revealed through focus group discussions and key informant interviews.

a. Insecurity remains the most critical barrier to agricultural transportation.

Violence disrupts routes and deters traders from states like Zamfara and Sokoto, who now seek safer markets. Transporters face direct threats, such as Boko Haram attacks, where drivers report being stopped, robbed, and sent away without cargo. These dangers have pushed transport costs as high as Naira 1.5 million on routes that once cost significantly less. Insurance costs have also surged, with premiums reaching 90 percent of the goods' value in high-risk areas, making coverage unaffordable for many businesses.

"BOKO HARAM FREQUENTLY TARGETS TRUCKS CARRYING FOOD ITEMS, ATTACKING, AND SEIZING THE CARGO. AS A RESULT, MANY DRIVERS ARE RELUCTANT TO TRAVEL THESE ROUTES. THOSE WILLING TO MAKE THE JOURNEY NOW CHARGE NAIRA 1.5 MILLION FOR A TRIP THAT WOULD NORMALLY COST NAIRA 1 MILLION DUE TO THEIR AWARENESS OF THE RISKS INVOLVED IN TRANSPORTING FOOD ITEMS IN THE REGION." – KII, TRANSPORTER, KANO STATE.

b. Cargo theft during transportation is commonplace.

In addition to large-scale attacks, transporters also face issues with smaller-scale theft, often by drivers themselves, leading to direct losses.

"WE FACE THEFT FROM DRIVERS, ESPECIALLY. JUST LAST MONTH ONE OF THE DRIVERS STOLE ABOUT SEVEN CARTONS." – KII, TRANSPORTER, KANO STATE.

c. Duties and taxes on heavy trucks are high and numerous.

The heavy loads carried by trucks accelerate road deterioration, leading to frequent breakdowns and maintenance needs, and highlighting the role transporters play in road wear due to the weight and frequency of trips. Additionally, transporters must pay multiple taxes and fees, such as loading fees and daily charges. These cumulative costs tighten profit margins in the agricultural transportation sector, reducing profitability and sustainability.

"WE PAY A LOT OF TAXES, EVEN FOR LOADING OUR TRUCKS IN DAWANAU, WE PAY NAIRA 2,000 PER TRUCK. AND THERE IS KANO STATE ROAD TRANSPORT AGENCY (KAROTA) WE PAY NAIRA 2,500 DAILY. THAT IS NAIRA 4,500 PER TRUCK EVERY DAY." KII, TRANSPORTER, KANO STATE.

d. The increasing cost of diesel has led to a sharp rise in transportation expenses.

This increase in fuel prices directly affects the profitability of agricultural businesses and contributes to higher food prices for consumers. Improving transportation networks and subsidising fuel costs are critical.

"LOCAL TRANSPORTATION TOO HAS DRASTICALLY INCREASED BECAUSE OF THE COST OF DIESEL. IF THIS GOVERNMENT CONTINUES LIKE THIS, A LOT OF BUSINESSES WILL CONTINUE TO SHUT DOWN." – KII, TRANSPORTER, KANO STATE.

e. Poor road conditions pose a significant challenge for transporters, often leading to longer travel times and increased vehicle maintenance costs.

Better road infrastructure to reduce transportation time and vehicle maintenance costs will be beneficial to all actors along the supply chain.

"FROM HERE TO MAIDUGURI, TWO BRIDGES HAVE COLLAPSED NOW. WE CAN NO LONGER FOLLOW THE NORMAL WAY, WE HAVE TO GO ROUND LIKE WE ARE GOING TO JOS, THEN BAUCHI STATE BEFORE WE GET TO MAIDUGURI." KII, TRANSPORTER, KANO STATE.

Barriers in food marketing

Most traders operate primarily in Kano state because of its established infrastructure for bulk aggregation, ample warehousing, strategic market design, and its strong purchasing power and processing capacity, making it a key distribution hub for goods moving to various regions, including Maiduguri.

"EVERYTHING WE TAKE FROM KANO GOES TO MAIDUGURI. THERE IS PURCHASING POWER. KANO HAS A LOT OF PROCESSING AREAS, SO A LOT OF GOODS ARE MOVED TO KANO." – KII, TRANSPORTER, KANO STATE.

This section focuses on the barriers faced by traders (wholesale suppliers) in Northern Nigeria. Most of the challenges discussed are macroeconomic and describe the disabling business environment in the country.

a. Unpredictable price fluctuations undermine traders' profitability and planning.

Inadequate market structures lead to frequent price changes and seasonal oversupply, leaving bulk buyers vulnerable to profit losses if prices drop before they can sell, often forcing sales at a loss during market slumps, and making it difficult to plan purchases.

"WE CAN'T PREDICT THE PRICES, AND SOMETIMES WE CAN'T SELL EVEN AT A LOSS." – KII, SORGHUM TRADER, KANO STATE.

b. High interest rates set have driven up borrowing costs.

Frequent hikes in the Monetary Policy Rate (MPR) have driven borrowing costs to nearly 30 percent, making financing difficult for traders. New capital requirements for banks have further limited loan availability.

"THE FEDERAL GOVERNMENT, THROUGH CBN, HAS INCREASED THE MPR RATE ABOUT 3 TO 4 TIMES THIS YEAR." – KII, MILLET TRADER, KANO STATE.

c. Inflation, especially rising fuel costs, has heavily impacted all participants in the value chain, by increasing operational expenses and reducing purchasing power.

As inflation drives up maintenance costs for essential equipment like trucks, it also drastically reduces the buying capacity of traders; where Naira 50 million once loaded 10 trucks, it now barely covers one and a half, significantly diminishing the volume of goods that can be supplied.

"SOME YEARS BACK, IF YOU HAD NAIRA 50 MILLION, YOU COULD LOAD 10 TRUCKS. NOW YOU CAN ONLY DO ONE AND A HALF TRUCKS WITH THAT MONEY. THIS MEANS THAT INFLATION HAS REALLY TAKEN A TOLL ON THE VOLUME OF SUPPLIES." – KII, SORGHUM TRADER, KANO STATE.

d. The government's cashless policy in 2023 created significant disruptions for traders, particularly when dealing with smallholder farmers who rely on cash transactions, forcing traders to manage payments in cash despite policy changes. This shift led to slowed transactions, ultimately causing major financial losses for many businesses reliant on these sales.

"OUR FARMERS DO NOT TRANSFER MONEY; THEY PREFER CASH. EVEN IF YOU SAY YOU ARE NOT BUYING FROM THE SMALLHOLDER FARMERS, THE AGGREGATORS WILL STILL HAVE TO PAY THEM IN CASH." – KII, MILLET TRADER, KANO STATE.

Barriers in food processing

a. Operational disruptions and supply constraints.

Maiduguri Flour Mills, established in 1983, exemplifies the challenges faced by food processing facilities in Northern Nigeria. Initially designed to process 400 metric tons of wheat daily from the Lake Chad Basin, operations were disrupted between 2012 and 2015 due to insurgency related instability. This led to a shift from wheat to maize processing, with current production running below capacity. Although the plant features advanced infrastructure, including multiple generators and storage silos, the wheat section remains idle, and maize operations are under-utilised. With government entities as the primary shareholders, decision-making is constrained, hindering agility in addressing operational challenges. Reviving the facility requires strategic reforms — such as exploring privatisation, expanding product lines to include fortified foods like "Tom Brown", and building partnerships with organisations like WFP and UNICEF. These efforts, coupled with stronger market linkages, could enable the plant to enhance regional food security and nutrition.

b. Energy costs have emerged as a major challenge for processors, with electricity expenses rising sharply due to an increase in the tariff.

This surge in energy expenses has prompted processors, particularly those with high consumption needs like tomato processing plants, to consider alternative solutions such as solar energy, both to manage costs and reduce reliance on carbon-intensive diesel.

"WITH THE POWER ISSUES THAT HAVE BEEN FOR YEARS, AND INCREASING PRICES, OUR PROCESSING PLANT CONSUMES A LOT OF ENERGY WHICH IS ONE OF OUR MAJOR CHALLENGES. OUR FUTURE PLAN IS TO INTRODUCE SOLAR ENERGY AND REDUCE CARBON EMISSIONS FROM DIESEL AND ALL THAT." KII, TOMATO PROCESSOR, KANO STATE.

c. Processors face significant financial challenges from overlapping taxes and regulatory costs imposed by both federal and state governments,

leading to a heavy taxation burden that impacts profitability. Additionally, regulatory fees, such as those required by the National Agency for Food and Drug Administration and Control (NAFDAC), lack scalability, requiring small and medium enterprises to pay the same renewal costs as large corporations, which places smaller processors at a distinct financial disadvantage.

"THERE IS DOUBLE TAXATION, AND THAT AFFECTS US NEGATIVELY AND THEY DO NOT DIFFERENTIATE BETWEEN SMALL, MEDIUM, OR LARGE SCALE. WE PAY THE SAME PRICE. IMAGINE PAYING THE SAME PRICE AS DANGOTE." KII, TOMATO PROCESSOR, KANO STATE.

Emergent investment opportunities for food systems transformation

Illustrative high-potential investment opportunities

The analysis highlights the range and depth of pressing challenges facing the food system in Northeast Nigeria. The development of targeted investment cases is essential to guide effective interventions and attract support for transformative change. Investment cases provide concrete, data-driven examples of high-impact opportunities within the food supply chain, helping to prioritise resources where they can yield the greatest benefits. The analysis points to two illustrative high-potential areas for investment to overcome first-order challenges: (i) improved on-farm storage to reduce post-harvest losses; and (ii) revitalising milling capacity to offer strategic pathways to strengthen local economies and enhance food security.

By focusing on practical solutions that address specific bottlenecks, these illustrative cases highlight the potential for targeted investments to generate substantial, measurable improvements in farmer incomes, food availability, and resilience. These investment cases, which spring directly from the field-based research, are vital not only for understanding the immediate impacts of specific projects but also for shaping a cohesive, long-term vision for a more self-reliant and prosperous Northern Nigeria. They serve as foundational elements in strategising for the region's agricultural future, bridging the gap between high-level policy goals and actionable, ground-level interventions.

The two investment cases highlight distinct pathways for addressing key constraints in Northern Nigeria's food systems, each with unique implications for public and private sector involvement. The on-farm storage initiative targets dispersed smallholder farmers who face significant post-harvest losses due to inadequate storage infrastructure. Given the high cost of reaching these widely dispersed farmers and the relatively low returns per individual farmer, the private sector alone is unlikely to invest in this area. Therefore, this intervention would require public resources or public-private partnerships to bridge the gap, enabling smallholders to access affordable, airtight storage solutions. Such investment would have far-reaching social benefits by enhancing food security, reducing waste, and increasing incomes for small-scale farmers who are integral to the region's agricultural base.

In contrast, the investment case for milling capacity offers a more attractive opportunity for private investors, particularly if peace and stability return to the region. Revitalising local milling not only has the potential for strong economic returns but also supports regional market development and value addition within Northern Nigeria. This type of investment, while benefiting from public support, such as infrastructure, policy incentives, or initial co-financing, could be largely driven by private capital, attracted by the profitability of processing locally sourced wheat and the potential to serve growing regional demand. Together, these cases illustrate a strategic blend of public and private investment approaches, each tailored to the specific needs and economic realities of the region and underscore the importance of aligning resources to unlock the full potential of Northern Nigeria's food systems

Investment case 1:
Airtight grain silos in Yobe state, Nigeria

In Yobe state, Nigeria, post-harvest losses of staple crops such as sorghum significantly impact farmers' incomes and food security. The field survey confirmed several findings that these losses can reach up to 30 percent of total production for key cereals and legumes. These losses are primarily due to inadequate on-farm storage, leading to distress sales during harvest and missed opportunities for farmers to benefit from seasonal price increases.

Investing in airtight grain silos offers a proven solution to drastically reduce post-harvest losses to as low as 2 percent. By adopting this technology, farmers can retain more of their produce, avoid selling during times of oversupply, and benefit from better prices later in the year. This investment not only promises higher returns for smallholder farmers but also strengthens food security in a region where agricultural productivity is crucial to livelihoods. The following analysis demonstrates the financial viability of investing in airtight silos for sorghum storage in Yobe state, assuming a 6 percent discount rate.

Table 11: Key assumptions: Case 1

Parameter	Value
Annual sorghum production in Yobe state	220, 000 metric tons
Volume held on-farm (subject to losses)	110, 000 metric tons
Current loss rate without silos	30% (33, 000 metric tons)
Loss rate with silos	2% (2, 200 metric tons)
Market price of sorghum	USD 400 per metric ton
Silo sizes and costs	1, 000 litres – USD 75 3, 000 litres – USD 190 10, 000 litres – USD 700
Adoption rates by silo size	1, 000 litres – 80% 3, 000 litres – 15% 10, 000 litres – 5%
Discount rate	6%

Table 13: Financial returns with 6 percent discount rate

Year	Net returns (USD)	Discount factor (6 percent)	Present value of returns (USD)
1	11, 981, 667	0.9434	11, 303, 418
2	12, 320, 000	0.8900	10, 969, 600
3	12, 320, 000	0.8396	10, 342, 272
4	12, 320, 000	0.7921	9, 761, 032
5	12, 320, 000	0.7473	9, 206, 976
	Total NPV of returns		**28, 976, 462**

Table 12: Cost and benefit analysis

Silo size (litres)	Share of farmers (%)	Volume held by farmer group (MT)	No. of silos needed	Total cost of silos (USD)	Grain loss without silos (MT/year)	Grain loss with silos (MT/year)	Volume of Grain Saved (MT/year)	Value of grain saved per year (USD per year)
1, 000	80	88, 000	266, 667	20, 000, 000	26, 400	1, 760	24,640	9, 856, 000
3, 000	15	16, 500	16, 500	3, 135, 000	4, 950	330	4,620	1, 848, 000
10, 000	5	5, 500	1, 667	1, 166, 667	1, 650	110	1,540	616, 000
Total	**100**	**110, 000**	**284, 833**	**24, 301, 667**	**33, 000**	**2, 200**	**30,800**	**12, 320, 000**

Investing in airtight silos to reduce post-harvest losses in sorghum for Yobe state demonstrates clear economic and social benefits. With an initial cost of USD 24.3 million, the investment enables significant reductions in post-harvest losses from 30 percent to 2 percent, preserving an additional 30,800 metric tons of grain each year. This translates to an annual value of USD 12.32 million in saved grain, providing smallholder farmers with a larger harvest volume to consume at home or sell at higher prices, thereby increasing their income from farming.

Assuming a 6 percent discount rate, the net present value (NPV) of the investment over five years is USD 28,976,462, indicating a return on investment of 19.24 percent. This NPV reflects the strong financial viability of the initiative, even when considering the cost of capital. By the second year, the cumulative net returns turn positive, and the investment continues to yield increasing returns, underscoring its sustainability.

In the likely event that it is not possible to raise over USD 24 million for the full investment, a gradual scale up would be appropriate. In the case of USD 5 million up-front investment, the NPV would be USD 6,004,079, resulting in a positive net gain of over USD 1 million, with a rate of return of over 20 percent. Such a gradual increase would also allow flexibility to expand and adapt the silo programme over time.

Beyond the financial returns, this investment enhances food security in a vulnerable region, reduces the need for distress sales, and contributes to poverty reduction among smallholder farmers. Given these benefits, the investment in airtight silos is not only financially sound but also strategically aligned with broader development goals for resilience and income stability in rural communities. This initiative represents a critical step forward in improving agricultural outcomes and securing livelihoods in Northern Nigeria.

Investment case 2: Milling locally produced wheat in Maiduguri

The northeastern region of Nigeria, particularly around the Lake Chad Basin, has a rich history of wheat production. For decades, this area supplied a significant share of Nigeria's wheat needs, supported by favourable climatic conditions and fertile soils in the plains of Borno and Yobe states. In recent years, local wheat production has declined due to factors such as insecurity, limited access to improved seeds, and inadequate infrastructure. This decline has forced millers such as Maiduguri Flour Mills (MFM) to rely increasingly on imported wheat, diminishing local economic opportunities and driving up costs. Revitalising wheat production in northeastern Nigeria presents a unique opportunity to restore the region's historical role as a breadbasket, reduce reliance on imported wheat, and revitalise local economies. Investing in local wheat milling capacity, combined with initiatives to boost wheat production, can reignite this important segment of the region's food system. It can also enhance food security and provide employment and income for smallholders and other actors in the food system.

This investment case for milling locally produced wheat in Maiduguri in Northern Nigeria has been developed with these potential benefits in view. Given its presence in Maiduguri and significant installed capacity, MFM is central to the case.

Maiduguri Flour Mills established in 1983, is a milling plant located in the Northern part of Maiduguri Metropolitan City. The company's primary shareholders include the Chad Basin Development Authority, the state governments of Borno and Yobe, the Northern Nigeria Development Company, Flour

Mills of Nigeria (FMN), cooperative societies from Borno and Yobe states, as well as a few individual investors. Most of these stakeholders are government entities.

This multi-million-dollar facility, now in a state of disrepair, was originally designed with the capacity to mill 400 metric tons of wheat per day. According to the information received, the initial plan was to process wheat produced in the Lake Chad Basin area (including Marte, Kukawa, Monguno, and Ngala). The plant operated relatively well for some years following its installation, processing imported wheat through Lagos port, as well as locally sourced wheat. However, from 2012 to 2015, operations were significantly scaled back due to insurgency-related disruptions. In 2015, the plant resumed operations but shifted its focus to maize processing due to a lack of wheat supply.

The facility is equipped with large power generators, including three units of 875 kilovolt amperes, one unit of 1,000 kilovolt amperes, and a 500 kilovolt amperes generator. It also has six silos, each with a 1,000 metric tons capacity, and it can sort, mill, sieve, fortify, and package high-quality flour. Currently, half of the milling plant is dedicated to maize processing sourced from local suppliers, while the wheat processing section remains unused. Even maize production is operating at a reduced pace. The company has rebranded its products under the name “Dinar Foods”, and these maize products (maize meal and maize grits) are sold in Northern Nigeria as well as in neighbouring countries such as Chad and Niger. The plant also produces animal feed from processing residues. Despite these challenges, the facility presents strong potential for revitalisation if local wheat production is sufficiently scaled up.

This investment case seeks to further inform decision-making on the future of Maiduguri Flour Mills and wheat production and milling in Northeast Nigeria more broadly. The analysis examines the cost competitiveness of milling locally produced wheat in Maiduguri compared to importing flour milled in the south of Nigeria.

The questions addressed in the analysis are:

01 Does it pay to invest in milling capacity in the north when there is ample wheat flour coming into the region, with milling having been undertaken in the south of the country (near the port)?

02 If wheat production were to be boosted in the north, would it pay to mill it in Maiduguri?

03 Would this wheat flour compete favourably with wheat flour originating in the south?

04 Would this wheat flour be competitive in southern cities like Lagos?

05 What does the analysis suggest would be a reasonable way forward, given the installed capacity to mill over 400 metric tons of wheat per day?

06 What is the volume of wheat production per year required to keep it functioning at no less than 50 percent capacity utilisation?

Table 14: Key assumptions: case 2

Cost element	Milling in the south (USD/MT)	Milling in Maiduguri current (USD)	Milling in Maiduguri - with investment (USD)
CIF landed price (import)	265	N/A	N/A
Farmgate price (local)	N/A	319	319
Port fees	7.95	N/A	N/A
Milling cost	53	53	30
Handling fees	3.06	4.76	4.76
Transport to Maiduguri	72.35	5.35	5.35
Storage and handling in Maiduguri	N/A	4.76	4.76
Price of flour in Maiduguri	401.36	383.24	360.24
Transport to Lagos	N/A	71.7	71.7
Milled Price in Lagos	401.36	838.18	792.18

Table 15: Cost and price comparison

Scenario	Milled price in Maiduguri (USD/MT)	Milled price in Lagos (USD/MT)
Imported flour from the south	401.36	401.36
Milled locally in Maiduguri	383.24	838.18
With improved milling	360.24	792.18

Key insights from the analysis

01 Local milling advantage in Maiduguri

Milling locally grown wheat in Maiduguri provides a marginal cost advantage over imported flour from the south in the Maiduguri market, with a price of USD 383.24 per metric ton (without investment in improved milling) and USD 360.24 per metric ton (with improved milling), compared to USD 401.36 per metric ton for imported flour. This cost advantage supports the case for local milling to serve Northern markets.

02 Competitiveness in southern markets

The cost of transporting locally milled wheat flour from Maiduguri to Lagos makes it significantly more expensive than flour milled in the south, even with improved milling costs. Thus, locally milled flour would not be competitive in southern markets.

02 Capacity utilisation requirements

With a milling capacity of 400 metric tons per day, Maiduguri Flour Mills could operate at 50 percent capacity by processing 200 metric tons of wheat per day. Over a year (assuming 300 working days), this would require a minimum annual wheat supply of 200 metric tons per day × 300 days = 60,000 metric tons per year. For Maiduguri Flour Mills to operate at no less than 50 percent capacity, annual wheat production in the region would need to be at least 60,000 metric tons.

04 Investment in improved milling technology

Lowering the milling cost from USD 53 to USD 30 per metric tons through an investment in improved technology and more effective management could bring this cost more in line with benchmarks in other parts of Africa and further enhance MFM's competitiveness in the local Maiduguri market, further lowering the cost of locally milled flour to USD 360.24 per metric ton. This investment would strengthen the economic case for MFM to focus on serving Northern markets, where it maintains a cost advantage over southern-imported flour.

The analysis suggests that milling locally produced wheat in Maiduguri offers a cost advantage in the local market compared to importing flour from southern Nigeria. However, this advantage does not extend to markets in southern cities like Lagos, where transportation costs diminish competitiveness. Therefore, focusing on supplying Northern markets, including neighbouring regions, is a more viable strategy for MFM.

The following keys are recommended as the way forward for Maiduguri Flour Mills.

01 Focus on Northern markets

MFM should prioritise serving the Northern Nigerian market and neighbouring countries where locally milled wheat flour can be competitive. This approach aligns with MFM's strategic location and can help reduce reliance on costly imports from the south.

02 Investment in improved milling technology and management

MFM should prioritise serving the Northern Nigerian market and neighbouring countries where locally milled wheat flour can be competitive. This approach aligns with MFM's strategic location and can help reduce reliance on costly imports from the south.

03 Expand wheat production

To ensure consistent operations at MFM and achieve at least 50 percent capacity utilisation, it is essential to boost local wheat production to a minimum of 60,000 metric tons per year. This requires partnerships with local farmers, government agencies, and possibly development partners to increase wheat yields in the region. A return to peace and stability in the region is vital.

04 Consider diversification of product offerings

MFM could explore the production of additional wheat-based products that cater to local dietary preferences or high-demand nutritional products, such as fortified flours. Partnerships with organisations such as WFP, FAO, and UNICEF could facilitate this diversification, making MFM a key player in addressing food security and nutritional needs in Northern Nigeria.

05 Maintain training and capacity-building initiatives

MFM's ongoing engagement with university interns contributes to local capacity building. Expanding this training programme could further strengthen regional skills in food processing and agribusiness management, contributing to the local economy.

The ongoing insurgency in the Northeast continues to severely limit agricultural production, as insecurity prevents farmers from accessing their fields and disrupts value chains. This persistent challenge must be carefully considered when developing investment cases, as success will depend on designing interventions that can operate effectively in conflict-affected areas while also contributing to long-term stability and recovery. But there is evidence that these two types of investment have significantly enhanced food security and economic resilience in other parts of Africa (Box 1).

Box 1: Learning from similar investments in Africa

Community-based grain storage in Malawi. In Malawi, post-harvest losses have been a major challenge, with studies indicating losses of up to 30 percent in six months due to pests and inadequate storage facilities. To combat this, initiatives have introduced improved storage technologies, such as the Purdue Improved Crop Storage (PICS) bags and metallic silos. These technologies create hermetic storage conditions, significantly reducing pest infestations and preserving grain quality. For instance, the use of PICS bags in community grain banks has led to a reduction in post-harvest losses to nearly zero, increasing the quantity and quality of grain available for sale or consumption. Additionally, the adoption of metallic silos has been associated with a decrease in losses, though factors such as cost and accessibility have influenced adoption rates.

Rehabilitation of milling facilities in Mozambique. In Mozambique, the rehabilitation and expansion of milling facilities have revitalised local grain value chains. For example, Olam Agri has announced plans to expand wheat milling and pasta production in the country, aiming to meet the growing demand for wheat products, which has tripled over the past two decades to approximately 700,000 tons annually. Similarly, investments in the Beira Corridor have prioritised the development of integrated mills to support agricultural growth and improve market opportunities for locally grown produce. These interventions have improved access to affordable processed products, created employment opportunities, and strengthened local economies

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06 Major findings and recommendations

-Major findings
-Recommendations

CHAPTER 06

Major findings and recommendations

This section details the key findings from the study, accompanied by targeted recommendations aimed at addressing the challenges identified. Each of the three components of the study is considered: (i) food supply chain mapping; (ii) cost build-up analysis; and (iii) market price analysis. Together, these findings and recommendations suggest a roadmap for strengthening Northern Nigeria's food supply chain and improving food security across the region.

Major findings

Each component of the study yields significant findings. Together the findings cover critical aspects of the supply chain, from production potential and infrastructure gaps to the impact of conflict and market volatility. Each finding is discussed in detail below, highlighting specific areas where the food system faces constraints and where opportunities for improvement lie.

Food supply mapping analysis

There is high potential for grain production in the region. The mapping exercise revealed substantial production capacity across Northern Nigeria for all eight focus commodities. These products thrive in diverse agroecological zones, from semi-arid to more temperate regions, each providing unique growing conditions that ensure year-round availability. If this broad geographic distribution of production potential is well utilised, it can reduce the risk of localised crop failure affecting supply and allow for resilience against regional climate variations. With high production levels, Northern Nigeria can continue to contribute not only to national food security but also to regional food markets, creating export opportunities to neighbouring countries.

The commodity transport and distribution system are extensive and complex but fraught with inefficiencies. A notable aspect of the supply chain is the highly developed transport and distribution network, which connects farms to urban centres and processing facilities. This network enables the movement of raw produce and processed products across vast distances. However, in Nigeria in general and in the Northeast in particular, there are significant gaps in transport infrastructure, food distribution channels and market linkages, particularly in conflict-prone areas where roads and transport routes are often unsafe or damaged. The effectiveness of this system also varies seasonally, as some roads become impassable during the rainy season.

The demand for processed products is rising. The study found a clear trend toward higher consumer demand for processed grains, driven by urbanisation, changing dietary preferences, and a growing middle class. Products like flour, pasta, and animal sourced food are increasingly sought after, providing an opportunity for agro-processors to diversify offerings and meet market needs. A well-developed processing industry could not only enhance food security by adding value to locally produced crops but also generate inclusive jobs for women and youth, and increase incomes of various actors along the food value chain.

Post-harvest losses are significant and damaging. Despite high production levels, post-harvest losses undermine the benefits of agricultural output. Losses for grains can reach up to 30 percent due to pest infestations, inadequate drying facilities, lack of storage options, and poor handling practices. For perishables like tomatoes, post-harvest losses are even higher up to 50 percent due to the absence of cold storage, quick/cool transportation, and processing. These losses diminish the market supply, inflate prices, and reduce farmers' earnings. The impact is particularly severe in remote rural areas where market linkages are weak, storage facilities, and cold chains are non-existent.

Farmers face considerable challenges in accessing improved/ modern inputs, particularly fertilisers, improved seeds, and equipment. Input costs are inflated due to limited local production, dependence on imports, and logistical challenges in distribution. Seeds, fertilisers, and pesticides are often adulterated and delivered irregularly. Conflict exacerbates these restrictions on access to inputs by disrupting input supply chains. These factors limit production potential and discourage investment, resulting in stagnant yields and higher food costs for consumers.

In general, conflict, climate change, and development challenges have combined to present a multiple crisis scenario for the food system in Northern Nigeria. There is an urgent need to address conflict-related food insecurity, which is exacerbated by the underutilisation of land's productive potential. Second, the long-term consequences of conflict on land investments and community institutions require careful attention. If not addressed, ongoing conflicts risk derailing efforts to achieve key Sustainable Development Goals (SDGs).

Cost build-up analysis

Labour costs dominate farm production costs, partially due to conflict-induced shortages. Labour shortages in rural areas are exacerbated by high levels of conflict and insecurity. Many conflict-impacted rural areas are often deserted as residents fled to urban centres in large numbers, seeking safety and alternative livelihoods. This conflict-induced rural-to-urban migration has reduced the labour force available for agricultural activities, particularly during critical times like planting and harvesting seasons. Those who remain face heightened risks, as insecurity discourages travel and fieldwork, especially in areas close to conflict zones. The shortage of labour raises wages, contributing to rising production costs. This trend is particularly concerning for labour-intensive crops, which cannot easily be mechanised.

Costs of improved inputs are high and increasing rapidly. Fertiliser and seed costs are prohibitively high for many farmers, largely due to Nigeria's foreign exchange policies, which make imported fertilisers expensive and subject to currency fluctuations. Domestic production is growing but reliance on imports remains high. These high input costs discourage the use of fertilisers and improved seeds, contributing to relatively low yields.

Insecurity negatively impacts input and output distribution by disrupting supply chains. Inputs and outputs that need to be transported through insecure routes face higher transport costs due to risk premiums. In many cases, trucks carrying these inputs are rerouted or delayed, which leads to higher costs and decreased availability. On several occasions, trucks carrying food commodities across the Northeast were vandalised, truck drivers threatened, and trucks damaged. Such incidences were more severe in conflict-prone Northeast states such as Borno.

Poor road quality reduces access and raises cost. The study highlights significant deficiencies in the road infrastructure across Northern Nigeria, especially in rural and conflict-affected areas. Many roads are unpaved, poorly maintained, and become impassable during the rainy season, which restricts market access and raises transport costs. Poor infrastructure disrupts the flow of goods from farms to markets, particularly for perishable items, which deteriorate during long and unpredictable journeys.

Storage capacity is limited and rudimentary, especially on-farm. Limited access to modern storage facilities compounds the problem of weak transport infrastructure. Without adequate warehousing, cold storage, or processing facilities, significant output is wasted or sold immediately after harvest when prices are at their lowest. The absence of reliable storage further impacts food quality and restricts farmers' bargaining power, as they are forced to accept low prices due to the lack of storage options.

Processing capacity is limited and inefficient. Northern Nigeria faces a shortage of agro-processing facilities, limiting the potential to add value to locally grown crops. Processing facilities for grains, fruits, and vegetables are sparse, forcing farmers to sell raw produce at lower prices rather than higher-value processed goods. This gap restricts employment opportunities, reduces incomes for producers, and limits the availability of locally processed foods in the market. Additionally, processing facilities that do exist are often located far from production areas, increasing transport costs and further eroding profit margins for both farmers and processors. Frequent interruptions in power introduce major inefficiencies.

Formal taxes and duties are high and duplicative. The formal tax system in Northern Nigeria is complex, with multiple layers of federal, state, and local government taxes that are often duplicated. This system creates a high tax burden on farmers and agribusinesses, discouraging investment and blunting competitiveness.

Informal "taxation" along transport routes is rampant. Along major transport routes, traders face frequent checkpoints where informal payments are imposed to allow the movement of goods. These unofficial "taxes" increase transport costs and reduce profit margins for traders and farmers. The unpredictable nature of these payments adds uncertainty to the cost of moving goods, impacting overall market efficiency. High informal taxation along transport routes limits access to markets, particularly for smaller traders who struggle to pay these additional costs.

Interest rates are high, leading to high borrowing costs. High interest rates and borrowing costs make it difficult for farmers and agribusinesses to access credit. Financial institutions view agriculture as a high-risk sector in Northern Nigeria, especially in conflict-prone areas, resulting in higher interest rates and stricter loan conditions. Smallholder farmers and small businesses are disproportionately affected, as they lack the collateral needed to secure loans at reasonable rates. The high cost of borrowing limits farmers' ability to invest in improved seeds, fertilisers, and modern equipment. Traders' incentives to expand and upgrade their business are also dulled.

Price analysis

Food price inflation is persisting and is affecting lower-income households. As is the case across Nigeria, food prices in the north have been on a steady upward trajectory. Starting from mid-2020, prices have steadily increased for all eight focus commodities, with significant spikes particularly noticeable in the last quarter of 2020 and continuing through 2021 and 2022. This price escalation is observed across all regions in the north, with some variation in the degree of increase between states such as Adamawa, Bauchi, and Borno. The trends suggest ongoing market pressures, potentially influenced by factors such as supply chain disruptions, regional conflicts, and other socio-economic factors that have contributed to the rising cost of essential food commodities. The food insecurity impacts of food price inflation fall disproportionately on lower-income households, who are unable to purchase staples and tend to reduce their calorie intake.

Prices vary significantly across regions, with indications of market fragmentation. Prices for given commodities vary significantly across states due to inconsistent storage capacity, disparities in market access, and the fragmented nature of Nigeria's food markets. In conflict-affected areas, prices tend to be significantly higher due to restricted market access and supply disruptions. These variations in price across regions undermine national food security efforts, as they limit equitable access to affordable food.

Price instability creates contracting difficulties. Data reveals notable variability in commodity prices across Northern Nigeria, with certain commodities experiencing more fluctuations than others. For example, cowpeas (both brown and white) show frequent price fluctuations, with visible peaks and troughs, especially in early 2020 and late 2021, suggesting a sensitivity to seasonal factors or supply shocks. Maize prices also exhibit some degree of variability, though their overall upward trend is steadier compared to cowpeas. Wheat flour shows the least variability, with a relatively smooth and consistent price increase over time, indicating possibly stronger market stability or more consistent supply chains for this commodity. The variations between states, particularly in the case of cowpeas, suggest localised factors influencing price volatility, such as regional demand, transportation issues, and differing levels of market accessibility across the Northeast. This price instability is greatly complicating contracting, with buyers increasingly reluctant to enter long-term contracts with suppliers. Farmers are facing increasing difficulties in securing stable income streams.

Recommendations

The recommendations below are aimed at enhancing access to agricultural inputs and outputs, building resilience, reducing production costs, and helping to stabilise food markets. The recommendations are divided into short-term (within two years), medium term (3 - 5 years), and longer-term actions.

Short-term actions (1 – 2 years)

01 **Leverage humanitarian food assistance to strengthen food systems.** High potential investment areas include local sourcing and supply chain strengthening, infrastructure investment to support resilience, and tailored cash and voucher programmes.

02 **Facilitate access to affordable, high-quality inputs through digital platforms.** Develop mobile-based platforms that enable farmers to purchase authentic seeds, fertilisers, and pesticides directly from trusted suppliers. These platforms should incorporate features like price transparency and user reviews to build trust. Simultaneously, launch awareness campaigns to educate farmers on using these platforms and provide support for those without smartphones to ensure inclusive access.

03 **Improve road and transport networks.** Prioritise the repair and maintenance of existing roads, particularly those connecting rural production areas to urban centres and markets. Focus on roads that become impassable during the rainy season, as these are critical for reducing post-harvest losses and lowering transport costs. Community-led road improvement programmes, supported by government funding and local labour, can deliver rapid results.

04 **Provide training and tools for post-harvest handling techniques to reduce losses.** Organise training workshops focused on best practices for drying, storage, and handling of grains and perishables like tomatoes. Distribute affordable post-harvest tools such as drying sheets, hermetic storage bags, and low-cost moisture metres to reduce spoilage and improve food quality.

05 **Introduce aflatoxin control measures and affordable testing kits.** Promote the use of bio-control products like Aflasafe to reduce aflatoxin contamination in groundnuts and other crops. Make affordable aflatoxin testing kits available at rural cooperative centres, accompanied by training provided to farmers on their use. These measures will improve food safety and unlock export opportunities.

06 **Streamline checkpoints and reduce informal taxation along transport routes.** Establish a government-led task force to monitor transport checkpoints and eliminate illegal fees. Introduce a hotline for traders and transporters to report harassment, backed by strict enforcement and penalties for offenders. These actions will reduce costs and improve the predictability of transporting goods.

Medium-term actions | 3 – 5 years

01 **Develop decentralised storage facilities and cold chains close to production areas.** Construct small and medium-scale storage units, such as silos and refrigerated warehouses, in rural areas to reduce post-harvest losses. Cold chain infrastructure for perishables, like tomatoes should also be developed to ensure a steady supply of fresh produce. Public-private partnerships can mobilise the necessary investment while ensuring efficiency in facility management. Investing in post-harvest storage solutions, such as hermetic storage bags and temperature-controlled warehouses, will help reduce spoilage and stabilise market supplies. Scaling up these interventions will ensure greater resilience against climate-induced disruptions.

02 **Expand skill development programmes targeting women and youth in agriculture.** Establish training centres offering courses in modern farming practices, agribusiness management, and agro-processing. These programmes should also include mentorship and financial literacy training to help women and youth in accessing credit and managing successful agricultural enterprises, thereby fostering inclusivity and economic empowerment.

03 **Leverage farmer cooperatives for shared access to mechanised tools and machinery.** Promote cooperative-based models that enable farmers pool resources to access machinery such as motorised seeders, sprayers, and tractors. Government subsidies or private grants can help lower costs, while cooperative members should receive training on equipment maintenance and optimal use.

04 **Introduce contract farming arrangements with risk-sharing mechanisms.** Facilitate partnerships between farmers, agro-processors and buyers through contract farming schemes that provide guaranteed markets, inputs, and technical assistance. Contracts should include risk-sharing mechanisms like price floors, input loans, and crop insurance to protect both farmers and buyers from market fluctuations.

05 **Promote research and adoption of climate-resilient crop varieties.** Collaborate with agricultural research institutions to develop and disseminate high-yield, drought-tolerant, and pest-resistant crop varieties suited to the diverse agroecological zones of Northern Nigeria. Distribute these seeds through extension services and ensure they are affordable and accessible to smallholder farmers.

06 **Strengthen climate-smart resilience in Northern Nigeria's food systems through adaptation strategies that prioritise climate-smart agricultural practices.** This includes digital innovations to sustain yields under climate stress, expanding climate risk insurance, adoption of drought-tolerant crop varieties, agroforestry techniques to reduce soil erosion, and improved irrigation systems such as solar-powered drip irrigation.

Long-term actions over 5 years

01 **Address the complex insecurity challenge in Northern Nigeria through a multi-pronged approach** including strengthened security systems, expanded job opportunities, particularly for youth, investment in infrastructure, expanded social services, and governance and institutional strengthening.

02 **Expand agro-processing capacity with renewable energy integration.** Build modern processing facilities near production hubs to reduce transport costs and increase value addition. Integrating renewable energy solutions like solar power will lower operational costs and improve the reliability of these facilities, reducing their dependence on Nigeria's unstable power grid.

03 **Foster public-private partnerships for large-scale Storage infrastructure development.** Mobilise long-term investments to develop large-scale storage facilities such as silos and cold warehouses in key agricultural zones. These facilities will stabilise prices and ensure consistent supplies for domestic and export markets. Partnerships with private companies will bring technical expertise and ensure efficiency.

04 **Reform land rights and ensure equitable access to resources for women and youth.** Advocate for land reforms that grant women and youth secure ownership or leasehold rights to farmland. These reforms should be accompanied by financial incentives, such as reduced registration fees, to encourage formal land registration and investment by women and youth.

05 **Strengthen enforcement of food safety standards and quality inspections.** Set up regional laboratories equipped to test food products for aflatoxins and other contaminants. Train and certify farmers and processors in good agricultural and manufacturing practices (GAP and GMP) to enhance compliance with domestic and export market requirements

06 **Build robust infrastructure networks to enhance market connectivity and reduce regional disparities.** Invest in major infrastructure projects, including highways, bridges, and railways, to connect Northern Nigeria's agricultural zones with urban centres and export hubs. These investments will facilitate trade, lower transport costs, and promote regional economic integration.

07 **Foster low carbon and sustainable practice** in tandem with adaptation efforts. This entails mainstreaming practices like conservation agriculture, agroforestry, and efficient land use, farming can curb its carbon footprint even as it becomes more productive. Also prioritised should be promotion of organic agriculture and efficient water management as part of climate-smart farming to protect ecosystems while boosting output.

07 Summary and conclusion

- Major findings
- Food supply mapping analysis
- Cost build-up analysis
- Price analysis

Recommendations

CHAPTER 07

Summary and conclusion

This report has provided a comprehensive analysis of the food system in Northern Nigeria, examining its challenges, opportunities, and potential for transformation. Amid a backdrop of conflict, displacement, climate change, and economic instability, the region remains a critical yet fragile cornerstone of Nigeria's agricultural sector. The findings of this study have highlighted significant constraints, ranging from post-harvest losses and inadequate infrastructure to high input costs and limited processing capacities, while also underscoring the immense potential of Northern Nigeria to reclaim its historical role as the nation's breadbasket.

Through extensive research and stakeholder consultations, this report has mapped the pathways for revitalising the region's food systems. It has identified practical and scalable interventions to address systemic issues, such as improving road networks, building modern storage and processing facilities, enhancing access to affordable inputs, and reducing inefficiencies in transport and taxation.

The recommendations outlined here aim to achieve three core objectives:

01 Strengthen local food systems to improve productivity, reduce losses, and enhance resilience.

02 Create inclusive opportunities, particularly for women and youth, by fostering participation in agricultural value chains.

03 Promote market integration and competitiveness by addressing structural barriers and investing in infrastructure and governance.

Taken together, these recommendations provide a roadmap for transforming the food system of Northern Nigeria. They call for coordinated action across government, private sector actors, development partners, and civil society to address immediate needs while laying the foundation for long-term recovery and sustainable growth.

Yet, as this report concludes, it is vital to recognise the broader lessons that emerge from this study, offering insights not only for Northern Nigeria but for humanitarian and development actors globally as they respond to similar crises.

Over the past decade, food systems in Northern Nigeria have come under immense strain, as conflict and displacement have intersected with climate shocks to create a complex set of challenges that have devastated local economies and livelihoods. While humanitarian interventions such as in-kind and cash-based assistance have been essential in addressing immediate needs, this report reveals how such responses could have been more strategically designed to strengthen local food systems and support long-term economic recovery.

Had these insights been available in 2015, at the onset of the conflict and the beginning of WFP's humanitarian operations in the region, the response might have taken a more transformative approach.

By overlooking these opportunities, the food assistance response often channelled benefits to markets far beyond the region, with cash transfers being spent on imported goods or products sourced from distant parts of the country. While this approach addressed immediate needs, it did little to strengthen the local food economy or lay the foundation for recovery.

Food assistance programmes could have been leveraged to achieve both humanitarian and developmental goals. For example:

01

Local sourcing and supply chain strengthening: Food assistance could have been linked to local production, incentivising farmers and processors to meet demand while simultaneously building their capacity.

02

Infrastructure investments for resilience: Early investments in storage, processing, and transport infrastructure could have reduced losses and stabilised food supply chains, amid disruptions.

03

Tailored cash and voucher programmes: Cash-based transfers could have been tied to local commodities, ensuring that the economic benefits of assistance remained within the region, supporting smallholders and local enterprises.

Emergent illustrative investment opportunities. The analysis identifies two high-impact investment opportunities within the food system of Northeast Nigeria: improving on-farm storage to reduce post-harvest losses and revitalising local milling capacity in Maiduguri to enhance food security and stimulate regional economies activities. These investment cases are examples of existing opportunities rather than definitive guides to specific investments. They aim to high potential benefits incentives associated with addressing two major challenges identified in the analysis namely—on-farm post-harvest losses and limited wheat milling capacity.

The proposed investment to reduce post-harvest losses features the introduction of airtight grain silos for sorghum in Yobe state. This intervention could reduce post-harvest losses from 30 percent to just 2 percent, enabling smallholder farmers to preserve their produce and sell at more favourable prices later in the year. A projected USD 24.3 million investment could save an additional 30,800 metric tons of sorghum annually, valued at USD 12.32 million. The investment is estimated to yield a Net Present Value (NPV) of USD 28.98 million over five years and a 19.24 percent return. A phased investment approach, starting with USD 5 million, could still deliver strong returns with an NPV of USD 6 million, 20 percent rate of return. Beyond financial gains, this intervention would contribute to improved food security, reduce poverty, and provide a more sustainable solution to post-harvest challenges faced by smallholder farmers in the region.

Revitalising local wheat milling in Maiduguri presents a strategic opportunity to reduce reliance on imported wheat, boost regional economies, and support food security in Northeast Nigeria. Investments would focus on processing locally grown wheat, leveraging existing infrastructure to lower production costs and increase competitiveness in Northern markets. With improved milling technology, production costs could decrease to USD 360.24 per ton compared to USD 401.36 for imported flour. An annual supply of 60,000 metric tons of locally grown wheat would enable the mill to operate at no less than 50 percent capacity, driving local economic growth and job creation. Public-private partnerships and diversification into new product offerings could further amplify the impact, making local milling a sustainable and profitable investment to strengthen the region's food system.

The ongoing insurgency in the Northeast continues to constrain agricultural production, as insecurity limits farmers' access to their fields and disrupts value chains. This persistent challenge must be carefully considered when evaluating investment opportunities such as those outlined above. The success of these interventions will depend on their ability to operate effectively in conflict-affected areas while also contributing to long-term stability and recovery.

Opportunities to leverage humanitarian food assistance to reinforce local food systems and support economic recovery have not been fully seized. These include: linking food assistance to local production and incentivising farmers and processors to meet demand while simultaneously building capacity; investing early in storage, processing, and transport infrastructure to reduce losses and stabilise food supply chains, even during disruptions; and designing tailored cash-based transfers tied to local commodities, ensuring that a greater share of the economic benefits remains within the region, thereby supporting smallholders and local enterprises.
Recognising these opportunities, WFP has developed the Food System Influence Index (FSII), a tool to assess the systemic impacts of WFP's interventions on food systems. FSII addresses critical gaps in market and food system analysis, and serves as a robust complement to existing tools, such as market assessments and nutrition-sensitive data.

The FSII has been developed to assess the systemic impacts of WFP's interventions on food systems, focusing on localisation, farmer income, and investment in sustainable practices. This tool aligns with WFP's existing Transfer Modality and Mechanism Selection (TMMS) framework by addressing critical gaps in market and food system analysis, offering a robust complement to tools such as the Market Functionality Index (MFI), the Fill the Nutrient Gap (FNG) Minimum Expenditure Basket (MEB), and Financial Sector Intelligence (FSI).

The FSII functions as an analytical layer within the TMMS, complementing existing tools and metrics such as the Market Functionality Index (MFI), Fill the Nutrient Gap (FNG), and Minimum Expenditure Basket (MEB) by focusing on upstream and systemic food system dynamics The FSII is not a standalone tool; rather, it serves as an additional layer that will be integrated into the TMMS process, offering a more nuanced and holistic perspective to transfer modality selection, thereby avoiding duplication of processes. FSII will be a critical component of a broader analytical framework that includes other tools, such as market assessments and nutrition-sensitive data. This approach ensures that transfer modalities are grounded in comprehensive, multi-dimensional evidence.

For future interventions in similar contexts, the following principles should guide action:

01 **Align humanitarian response with local economic systems.** Food assistance programmes must be designed to not only provide relief but also stimulate local economies. Integrating local sourcing, supply chain support, and infrastructure investments into humanitarian operations can create a dual benefit: addressing immediate needs while fostering resilience.

02 **Invest in stability where it exists.** Even in regions affected by conflict, there are pockets of relative stability. These areas represent opportunities for targeted investments in production, storage, processing, and transport, which can serve as anchors for broader recovery efforts. Ignoring these stable areas risks allowing them to decline further, missing critical opportunities for transformation.

03 **Build crisis-resilient food systems.** The experience of Northern Nigeria underscores the importance of embedding resilience into food systems before crises occur. This includes investments in infrastructure, market linkages, and governance that allow local economies to absorb shocks and recover faster.

04 **Embed long-term thinking in humanitarian action.** Humanitarian responses must go beyond immediate relief to consider their long-term impact on local systems. A crisis response that builds local capacity, supports livelihoods and integrates with the broader development goals is not just more effective, it is essential for breaking cycles of dependency.

05 **Learn and apply lessons proactively.** The lessons from Northern Nigeria are not unique. Similar challenges and opportunities are likely to emerge in other contexts. Development and humanitarian actors must use insights such as these to design forward-looking responses that leave communities stronger than they were before the crisis.

This study aligns with AfDB's broader commitment to fostering partnerships and leveraging synergies among public, private, and development actors. The collaboration with WFP, IFPRI, and other stakeholders reflects the Bank's emphasis on integrated approaches to solving complex challenges. Strengthening food systems in Northern Nigeria requires coordinated, multi-stakeholder efforts to overcome systemic bottlenecks and unlock their full potential. This report represents a significant step towards advancing that collective vision, providing actionable insights to inform AfDB's ongoing and future investments in the region.

This study underscores the immense agricultural potential of Northern Nigeria and highlights the urgent need for transformative investments to unlock this potential in the face of persistent conflict, structural challenges, and climate change. For AfDB, these findings reaffirm the importance of targeted, scalable interventions in line with its Feed Africa and High Five priorities, particularly those addressing food security, resilience, and inclusive economic growth.

Central to AfDB's vision is the recognition that achieving agricultural transformation requires more than incremental changes. Rebuilding the breadbasket potential of Northern Nigeria demands bold, systemic interventions, including investments in rural infrastructure, transport networks, storage facilities, and agro-processing industries. In the medium-term these investments align with AfDB's commitment to addressing inefficiencies across the food value chains and fostering regional integration, enabling Northern Nigeria to contribute to broader West African food systems and markets.

The findings also highlight opportunities to harness pockets of stability within the region as entry points for AfDB investments. These relatively stable areas can serve as anchors for recovery, where investments in climate-smart practices, value chain development, and digital solutions could drive rapid and sustainable growth. AfDB's experience in designing resilience-focused, regionally integrated programmes positions it well to take advantage of these opportunities and support long-term transformation in the region's food systems.

Moreover, this study emphasises the critical need for inclusivity in food system transformation. Women and youth, who represent the backbone of Northern Nigeria's agricultural labour force, must be at the centre of AfDB's interventions. Inclusive financing models, skills development, and entrepreneurship programmes tailored to their needs are essential to achieving equitable and sustainable growth.

Finally, the study's focus on leveraging humanitarian food assistance to strengthen local food systems offers a compelling case for greater collaboration between development and humanitarian actors, such as AfDB and WFP. Integrated approaches that align short-term relief with long-term resilience-building can maximise the impact of investments and accelerate progress toward food security and economic recovery. By addressing the structural challenges highlighted by this study, promoting climate-smart and inclusive growth, and leveraging regional synergies, AfDB can help unlock the agricultural potential of Northern Nigeria, contributing to both national recovery and regional food security. This report provides a valuable evidence base to guide such efforts, offering actionable insights for strategic planning and implementation.

This report demonstrates that while the challenges facing Northern Nigeria's food systems are immense, so too is the potential for transformation. By synthesising key findings, presenting actionable recommendations, and drawing critical lessons, the study offers a clear pathway not only rebuild the region's food systems but to make them more resilient, inclusive, and sustainable in the long-term. Achieving this requires not just investment, but a fundamental shift in how crises are approached: one that views humanitarian action as a bridge to long-term development. If the lessons and recommendations outlined in this report are acted upon, they can help restore Northern Nigeria's position as a vital contributor to national and regional food security, even in the face of future challenges.

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Appendix 1: Field Instrument for Cost Build-Up Fieldwork

WFP food system mapping and analysis

Data collection form

****Cost build-ups from farm level production (farm budgets)** (farm producer --- typical farm)****

The table below provides a template to collect data required to construct cost-build ups for producers/farmers of the eight WFP food commodities (sorghum, millet, maize, wheat, soybeans, cowpea, groundnuts, and tomatoes). The cost-build ups summarise data on quantities, costs, and prices of each of these commodities, and identify the major cost components and financial feasibilities for actors along the value chain.

Key questions WFP interested in to know in this study include:

- What are the principal sources of food supply and demand in Northern Nigeria?
- Through which channels/corridors and by which actors are food commodities moved from major supply areas to major demand areas in and beyond the region?
- What are the costs and returns associated with key activities along the corridors for selected food commodities (production, transport, storage and handling, processing, retailing/marketing)?

Serial No.	Questions	Responses/data
1	Producer/farmer name	
2	Education level (years of schooling)	
3	Sex	Male ☐ Female ☐
4	Age (in years)	
5	State	
6	LGA/community	
7	Crop type grown (choose one of the eight): 1. Sorghum 2. Millet 3. Maize 4. Wheat 5. Soybeans 6. Cowpea 7. Groundnuts 8. Tomatoes	
8	Farm size/land area cultivated of the crop (ha)	
9	How was land acquired to grow the crop?	Owned ☐ Rented ☐
9.1	If rented, how much paid in your production season?	Naira_____
10	Which season do you grow this crop?	Wet season ☐ Dry season ☐
11	Seed used	Quantity (kilogram) Total cost (Naira) ☐

11.1	Does the cost of seed vary significantly in different locations?	Yes ☐ No ☐
12	Chemical (inorganic) fertiliser used	Quantity (kilogram) ☐ Total cost (Naira) ☐
13	Organic fertiliser used	Quantity (kilogram) ☐ Total cost (Naira) ☐
14	Agrochemical used (pesticides, herbicides) per production season	Total cost (Naira) ☐
15	Irrigation cost - machine rent, fuel (if irrigated)	Total cost (Naira)
16	Hired labour cost (details) for:	
16.1	Land preparation	Naira_____
16.2	Planting/sowing	Naira_____
16.3	Fertiliser application	Naira_____
16.4	Irrigation	Naira_____
16.5	Weeding	Naira_____
16.6	Harvesting	Naira_____
17	Total family labour cost per production season (assume if it were hired)	
18	Cost of agricultural machinery (Even machine is owned; assume what would be machine rental value had it been rented):	
18.1	Tractor	Naira_____
18.2	Plough	Naira_____
18.3	Planters	Naira_____
18.4	Harvesters	Naira_____
18.5	Fuel cost	Naira_____
18.6	Maintenance costs	Naira_____
18.7	Other machines cost (total)	Naira_____
19	Total quantity of harvest (kilogram) or (ton)	kilogram_____; or ton_____
20	Total quantity of post-harvest loss (if any)	kilogram_____; or ton_____
21	Total quantity sold (kilogram) or (ton)	kilogram_____; or ton_____
22	Sale prices per unit (kilogram or ton)	_____Naira/kilogram _____Naira/ton
23	Total sales revenue (Naira)	Naira_____

WFP food system mapping and analysis

Data collection form

****Cost build-ups for food transport service provider (i.e., transport company) ****

The table below provides template to collect data required to construct cost-build ups for transporters of the eight WFP food commodities (sorghum, millet, maize, wheat, soybeans, cowpea, groundnuts, and tomatoes). The cost-build ups summarise data on quantities, costs, and prices of each of these commodities, and identify the major cost components and financial feasibilities for actors along the value chain.

Key questions WFP interested in to know in this study include:

- What are the principal sources of food supply and demand in Northern Nigeria?
- Through which channels/corridors and by which actors are food commodities moved from major supply areas to major demand areas in and beyond the region?
- What are the costs and returns associated with key activities along the corridors for selected food commodities (production, transport, storage and handling, processing, retailing/marketing)?

Serial No.	Questions	Responses/data
1	Transporter's name (company name)	
2	Education level (years of schooling) owner	
3	Sex (owner)	Male ☐ Female ☐
	Age (owner) (years)	
3	State	
4	LGA/town	
5	Which crop do you transport (one or more of the WFP 8 commodities) 1. Sorghum 2. Millet 3. Maize 4. Wheat 5. Soybeans 6. Cowpea 7. Groundnuts 8. Tomatoes	_____ _____ _____ _____
6	**Dry season**: what is the normal frequency (cycle/round) of your transport business in dry season?	1. Weekly _____ 2. Bi-weekly _____ 3. Monthly _____ 4. Others _____
7	**Wet season**: What is the normal frequency (cycle/round) of your transport business in wet season?	1. Weekly _____ 2. Bi-weekly _____ 3. Monthly _____ 4. Others _____
8	Where do you mainly source the agricultural product, you transport?	Which state? _____ Which LGA? _____ Which market centre? _____ Which s upplier? _____
8	Who is your main client (to whom you mainly provide transport service)?	1. WFP _____ 2. Other International NGOs _____ 3. Other local organisations _____

9	If you provide transport services to WFP; how do you classify yourself?	1. Only transporter (not involved in supply and distribution): _____ 2. Supplier(vendor) and transporter: _____
10	If you only provide transport services to WFP; what is your major transport route (source anddestination)?	From _____ Destination _____
11	If you are a supplier(vendor) as well as a transporter to WFP, where do mainly source the agricultural commodity supply/transport to WFP?	Which State? _____ Which LGA? _____ Which market centre? _____ Who is your supplier? _____
12	On average, what is the total quantity of commodity (food items) you transport in one cycle/round (if only transporter to WFP):	_____ tons
13	Full load capacity of one transport lorry	_____ tons
	On average, what is the total quantity of commodity (food items) you supply/vendor andtransport in one round/cycle (if your service includes supply andtransport to WFP):	_____ tons
14	Major costs of your business operation (transport) (and or vendor /supply)	
	Total purchase cost of food commodity as a vendor (if you are supplier/vendor to WFP) in one round:	Naira _____
	Loading and unloading (labour)	Naira _____
	Packaging/handling (labour)	Naira _____
	Storage cost (if any)	Naira _____
	Fuel (petrol/diesel) cost	Naira _____
	Driver(s)	Naira _____
	Road tax (any fee on the road)	Naira _____
15	Any other cost related to your transport (supply vendor) provision per round	Naira _____
17	Total revenue from transport service provision per cycle (round)	Naira _____
18	Is there any other revenue stream you generate linked to this business? If yes, how much per your business round?	Naira _____

WFP food system mapping and analysis

Data collection form

****Cost build-ups food process** (typical food processing firm)**

The table below provides a template to collect data required to construct cost-build ups for food processor of the eight WFP food commodities (sorghum, millet, maize, wheat, soybeans, cowpea, groundnuts, and tomatoes). The cost-build ups summarise data on quantities, costs, and prices of each of these commodities, and identify the major cost components and financial feasibilities for actors along the value chain.

Key questions WFP interested in to know in this study include:

- What are the principal sources of food supply and demand in Northern Nigeria?
- Through which channels/corridors and by which actors are food commodities moved from major supply areas to major demand areas in and beyond the region?
- What are the costs and returns associated with key activities along the corridors for selected food commodities (production, transport, storage and handling, processing, retailing/marketing)?

Unit of analysis (typical transport service providing induvial operator or business entity)

Serial No.	Questions	Responses/data
1	Processor's name (company name)	
2	Education level (years of schooling) processor/owner	
3	Sex (owner/processor)	Male ☐ Female ☐
4	Age (owner) (years)	
5	State	
6	LGA/town	
	Which crop do you process (one or more of the WFP eight commodities) 1. Sorghum 2. Millet 3. Maize 4. Wheat 5. Soybeans 6. Cowpea 7. Groundnuts 8. Tomatoes	_____ _____ _____ _____
7	What is the normal frequency (cycle/round) of your process business?	1. Weekly _____ 2. Bi-weekly _____ 3. Monthly _____ 4. Others _____
8	From which location do you mainly source the agricultural product you process?	Which state(s)? _____ Which LGA(s)? _____ Which market centre(s)? _____

9	From whom/where do you purchase the crops/grain for your processing business?	1. From farmers (farm-gate) 2. Local markets 2. Contract farmers 3. Local aggregators 4. Others _____
10	Total quantity of raw product (crop) you purchase and process in one cycle (round)?	_____kilogram; or _____tons
11	What is the total cost of the raw materials you processed per cycle? (Naira)	Naira _____
12	Who is your major client buying your processed product?	(1) WFP. (2) Other NGOs (3) Wholesalers (supper market) (4) Retailers (5) Other processors as inputs (6) Exporters (7) Public institutes (schools, university) (8) WFP (9) Others
13	Where do you sell your processed product?	
14	Major processing and marketing cost of your business in one round of processing:	
14.1	Transportation cost raw materials	Naira _____
14.2	Cleaning cost	Naira _____
14.3	Milling cost	Naira _____
14.4	Packaging cost	Naira _____
14.5	Quality control (testing or certification)	Naira _____
15.6	Water cost	Naira _____
14.7	Cost of storage (if any)	Naira _____
14.8	Energy/electricity cost	Naira _____
14.9	Labour cost (hired labour)	Naira _____
14.10	Waste management (disposal or recycling) cost	Naira _____
14.11	Government tax	Naira _____
14.12	Rental expenses (premises), if any	Naira _____
14.13	Utility expenses (water, phone)	Naira _____
14.14	Transportation cost finished product to the market	Naira _____
14.15	Commission fee (if any)	Naira _____
15	What is the unit of measurement of your processed product?	_____ units
16	What quantity do you process (produce) per cycle (round)?	_____ units
17	What is the price of your processed product per unit?	Naira_____/unit
18	What is the total sales revenue from sale of processed product per cycle (processing round)?	Naira _____

WFP food system mapping and analysis

Data collection form

****Cost build-ups food suppliers, traders, marketers** (typical agric. commodity trader/supplier)**

The table below provides a template to collect data required to construct cost-build ups for food supplier/trader of the eight WFP food commodities (sorghum, millet, maize, wheat, soybeans, cowpea, groundnuts, and tomatoes). The cost-build ups summarise data on quantities, costs, and prices of each of these commodities, and identify the major cost components and financial feasibilities for actors along the value chain.

Key questions WFP interested in to know in this study include:

- What are the principal sources of food supply and demand in Northern Nigeria?
- Through which channels/corridors and by which actors are food commodities moved from major supply areas to major demand areas in and beyond the region?
- What are the costs and returns associated with key activities along the corridors for selected food commodities (production, transport, storage and handling, processing, retailing/marketing)?

Serial No.	Questions	Responses/data
1	Trader's name (company name)	
2	Education level (years of schooling) trader	
3	Sex (owner/trader)	Male ☐ Female ☐
4	Age (trader) (years)	
5	State	
6	LGA/town	
7	Which crop do you trade (one or more of the WFP eight commodities) 1. Sorghum 2. Millet 3. Maize 4. Wheat 5. Soybeans 6. Cowpea 7. Groundnuts 8. Tomatoes	_____ _____ _____ _____
8	What is the normal frequency (cycle/round) of your process business?	1. Weekly _____ 2. Bi-weekly _____ 3. Monthly _____ 4. Others _____
9	From which location do you mainly source the agricultural product, you trade?	Which state(s)? _____ Which LGA(s)? _____ Which market centre(s)? _____
10	From whom/where do you purchase the crops/grain for your trading business?	1. From farmers (farm-gate) 2. Local markets 2. Contract farmers 3. Local aggregators 4. Others _____

11	How often (how many round) do you purchase of the agric. commodity you trade?	1. Weekly _____ 2. Bi-weekly _____ 3. Monthly _____ 4. Others _____
12	On average, what is the total quantity of grain/crop you purchase per month?	
13	What is your monthly average expenditure on the following costs associated to your grain/crop trade business?	
13.1	Total cost of the agricultural commodity you purchase from different sources per month.	Naira _____
13.2	Transportation cost	Naira _____
13.3	Commission fee	Naira _____
13.4	Cost of storage (rental) cost	Naira _____
13.5	Labour cost	Naira _____
13.6	Packaging cost (hired)	Naira _____
13.7	Government tax	Naira _____
13.8	Rental expenses (premises)	Naira _____
13.9	Utility expenses (electricity, water, telephone)	Naira _____
13.10	Other costs	
11	Who is/are your major client (who are the major buyers of your grain/crops?	(1) WFP (2) Other NGOs (3) Wholesalers (supper market) (4) Retailers (5) Other processors as inputs (6) Exporters (7) Public institutes (schools, university) (8) WFP (9) Others
12	On average, what is the total quantity of grain (crops) do you sell per month?	_____ tons
14	What the price per unit?	Naira _____ /kilogram; or Naira _____ /ton
15	Total sales revenue from sale of grain (cops) per month (Naira)?	Naira_____

Appendix 2: Survey instrument for qualitative fieldwork

WFP foods system mapping and analysis

Objectives of the study

01 Understand the structure and functioning of the food system in Northern Nigeria, including in conflict-affected areas

02 Identify major actions (i.e., policies, institutional innovations, and investments) that can strengthen the food system in the region and thereby contribute to agriculture-based recovery of conflict-affected areas in Northern Nigeria

03 Ascertain the actual and potential food system-level influences of WFP's food assistance modalities (cash transfers, e-vouchers, in-kind food transfers, local food purchases).

WFP food-system mapping and analysis

Focus group discussions with producers

Facilitator (Do not read out loud):

Prior to beginning the focus group discussion, you must first obtain voluntary consent from each of the individuals participating. If consent is not granted, you may not proceed with the interview, or that person cannot participate in the focus group. It is very important that you avoid yes/no responses and probe for in-depth answers.

Background [Fill out prior to beginning interview]

A1	Name of community/village	
A2	Name of ward	
A3	Name of state and LGA	
A4	Date (dd, mm,yyyy)	
A5	Name of facilitator	

Characteristics of the respondents

Code	Name	Sex	Age	Commodity produced

WFP food system mapping and analysis

Producers interview guide

Production-related issues

1. How do you source your inputs (seed, fertiliser, pesticides, and labour)? What are the main obstacles you ` experience in sourcing inputs?
2. Do you have access to improved crop varieties? Why or why not?
3. Do you have access to credit? What barriers do you face in accessing credit for crop production?
4. Do you experience climate-related problems such as low/high rainfall, low/high temperature, drought, flood ing, etc. How do these affect crop production?
5. What are the major barriers you face in [mention the name of crop] production? Do these barriers differ by gender or location?
6. Is there any farm innovation or technology that could improve your production?

Post-harvest issues:

7. What challenges do you encounter in handling, and storing, your crops after harvest?
8. How do these post-harvest issues impact the quality and marketability of your produce?
9. Are there any opportunities or strategies you have identified to reduce post-harvest losses?

Marketing issues:

10. Where (state/LGA/market) do you sell your produce to and how? And what challenges do you face in accessing markets?
11. How do you determine the prices of your products?
12. What are the main barriers to selling your produce at favourable prices?
13. How do market conditions (such as supply and demand fluctuations, transportation costs, and seasonal variations) affect your ability to sell your produce profitably?
14. Which government policies have affected your production/marketing of your products in recent years?
15. Any suggestions for improvement?

Transportation issues:

16. How do you transport your products to the market?
17. What determines the market where you take your products? Can you name and describe the channels through which you transport your produce to major demand areas?
18. What transportation-related challenges do you face, such as costs, infrastructure, or security concerns?
19. How do these transportation issues impact your overall production costs and returns?

Conflict/insecurity issues:

20. How do conflicts and insecurity most especially in Northern Nigeria affect your production and ability to sell your produce?
21. How do you mitigate this challenge? What possible suggestions can you provide on how this should be addressed?

Government/policy related issues

22. Are there any policy reforms and/or institutional innovations that would help you reduce production costs and increase returns? How effective are they?
23. What concerns do you have about the future of cultivating this crop? What opportunities exist in your current value chain that could improve future production activities?

Processors interview guide

Information of respondent (for each category)

Name of respondent:……..……..……

Gender:……

State:……..……

LGA/community:……..……

Crop type processed:……..……

Information of respondent (for each category)

1. What processing activities do you engage in?
2. Where (state/LGA/community/market) and from whom (gender/type of business) do you source raw materials for your processing activities?
3. Are there any challenges in sourcing of raw materials? Please elaborate

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Issues on processing technologies and activities

4. What available infrastructure and technologies (for storage and processing) do you have at your facility?
5. What challenges do you encounter with your current processing technologies, such as maintenance, efficiency, or scalability?
6. Have you identified any technological upgrades or innovations that could improve your processing operations?
7. Do you face challenges with product spoilage? If so, how do you manage this?
8. Are you able to maintain the quality of processed goods until they reach the market?

Issues on Utilities (especially access s to energy)

9. How do energy-related issues impact your production costs and the overall profitability of your processing business?
10. What are the main challenges you face regarding access to reliable energy sources for your processing needs?

Issues on marketing and distribution

11. Through which channels do you distribute your processed goods?
12. Can you describe in detail the transportation challenges you face in sourcing raw materials and distributing finished products?
13. How does the current insecurity and conflict in the country affect your marketing and distribution activities?
14. How often do you experience disruptions in the supply chain, and what are the typical causes?
15. How do storage issues, such as capacity, quality control, and preservation, affect your ability to maintain product quality and meet market demand?
16. Who are the key stakeholders you sell to, and what are their roles and locations? Where do you sell your processed products?
17. How do you determine pricing for processed goods versus raw agricultural products?
18. What challenges do you face in marketing and distributing processed products?

Issues on government policies

19. What current policies affect your processing activities?
20. What policy reforms would you suggest improving value addition for agricultural commodities in Nigeria?
21. What institutional innovations and investment opportunities (e.g., improved market information, better contract enforcement) would benefit your processing activities and your current supply chain?

Transporters interview guide

Information of respondent (for each category)

Name of respondent:……..……..…….

Gender:……

State:……..…..

LGA/community:……..……

Crop type processed:……..…..

Sourcing commodities (if they are supplier as well as transporters)

1. Where (location- state/LGA/market) and from whom (gender/type of business) do you normally source your transported food commodities (the 8-food commodities)?
   Logistics issues (operational challenges including vehicle standard, costs, fuel, etc)
2. Which routes do you mainly use for transporting food in Northern Nigeria?
3. Do you know other corridors/routes through which this commodity moves often? Are you aware of transporters that travel along these routes?
4. Who are the key stakeholders you provide transportation services to, and what are their roles and locations?
5. How do fluctuations in the availability of commodities affect your transportation and supply operations?
6. What strategies do you use to ensure a steady supply of commodities for transportation, and how effective are these strategies?

Infrastructure (road)

7. How would you rate the road infrastructure situation along the corridor? How does it affect your activities in terms of travel time, cost, delivery, losses?
8. Which other infrastructure are connected to the business and how do they affect your activities?
9. What are the common practices for storage and handling of food commodities during transportation to maintain quality and reduce losses?
10. What are the major barriers you face in transporting food commodities?

On government policy issues (multiple taxes, etc.)

11. Are there any government policies enabling or disenabling your activities? What are they? Discuss issues around taxes -formal/informal, border closures)
12. Are there specific policy changes or reforms that would improve the functioning of the sector?
    On insecurity/conflict
13. How do conflict and insecurity affect your transportation activities?
14. What suggestions do you have for improving the conflict and insecurity situation in the country as it affects your line of work/activities?

15. What institutional innovations (e.g., improved logistics management, transport cooperatives) would benefit your transportation activities?
16. What types of investments (e.g., road infrastructure, vehicle upgrades) would enhance your transportation efficiency and profitability?
17. What opportunities do you see in your entire food supply chain?

On finance (payments mechanisms)

18. How do you source credit?
19. What challenges do you experience in financing your business?
20. What policy options could help improve access to credit in facilitating your activities?

Traders interview guide

Information of respondent (for each category)

Name of respondent:……..

Gender:……

State:……

LGA/community:……

Crop type sold:……

Type/category of marketer (Retailers/Wholesalers/aggregators:……

r w

On supply chain issues (backward and forward linkages)

1. Where (location/state/LGA/market) and from whom (gender/type of business) do you normally source the eight food commodities you sell?

On quality assurance and wastages/losses

2. What measures do you take to ensure the quality of the commodities you trade?
3. What challenges do you face in maintaining product quality, especially during transportation or storage, and how do these challenges affect your profitability?
4. How do you manage wastage or losses during the trading process, and what are the main causes of these losses?

On transportation

6. How do transportation costs, road conditions, and logistical issues impact your ability to deliver goods on time and maintain product quality?
7. In what ways does transportation-related insecurity affect your trading activities, and how do you mitigate these risks?
8. What other transportation challenges do you face in moving goods from suppliers to markets, and how do these affect your business operations?

On storage and handling/packaging

9. What types of investments (e.g., storage facilities, transportation infrastructure) would enhance your marketing efficiency and profitability?

On marketing (trading)

10. Who are your major buyers? Which forms do purchases take place? Who are the key stakeholders in your marketing chain, and what are their roles and locations?
11. How would you describe the marketing of these food commodities? (keeping in mind the peak and off-peak periods) Do price fluctuations/inflation affect the marketing of these food commodities?

On insecurity/conflict

12. Does insecurity and conflict affect your business? How do you address these issues?
13. How do the recent price fluctuations in the country affect your business activities? How do you think these issues can be addressed?

On government policy

14. What opportunities and challenges do you see in the current supply chain?
17. What policy directions/regulations currently affect your business activities?
18. What policy reforms would you suggest to improve your business performance?
19. What institutional innovations (e.g., market information systems, marketing cooperatives) would benefit your marketing activities?

Appendix 3: Sampling strategy for qualitative field work

Sampling strategy for KIIs and focus group discussions with producers

Value chain activity	Instrument	Sample size	Location
Transporters	Key informant interviews	4	Kano, Borno, Abuja
Processors	Key informant interviews	2	Kano, Adamawa
Traders/marketers	Key informant interviews	9	Kano, Kaduna/Zaria, Borno, Abuja
Total		**15**	
Producers (tomato)	Focus group discussions	10 tomato farmers	Kano
Producers (wheat)	Focus group discussions	10 wheat farmers	Adamawa
Producers (cowpea)	Focus group discussions	10 cowpea farmers	Adamawa
Producers (sorghum)	Focus group discussions	5 sorghum farmers	Kano
Producers (millet)	Focus group discussions	5 millet farmers	Kano
Producers (soybeans)	Focus group discussions	5 soybean farmers	Kano
Producers (groundnuts)	Focus group discussions	5 groundnut farmers	Kano
Total		**50 farmers**	