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## FOOD SECURITY AND ENVIRONMENTAL SUSTAINABILITY UNDER SMALL-SCALE FARMING IN NIGERIA

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### ABSTRACT

This study examines the interplay between environmental sustainability and food security within small-scale farming systems in Nigeria. This study was conceived against the background of addressing the concern of ensuring food availability under the predominance small-scale farming practices in Nigeria. A systematic review of recent and relevant literature reveals that environmental degradation significantly threatens food availability, primarily due to unsustainable agricultural practices such as deforestation, soil erosion, and loss of existing arable land to other uses. The findings indicate that while sustainable farming practices, including agroecology and conservation agriculture, can enhance productivity and resilience, their adoption is hindered by financial constraints, limited access to technology, and inadequate farmer education. Furthermore, existing government policies, despite their potential, often fall short in effective implementation and local adaptation, diminishing their impact on promoting sustainable agriculture. This paper highlights the necessity for comprehensive strategies that address both environmental and socio-economic challenges faced by small-scale farmers. Recommendations include strengthening access to finance and technology, improving farmer education, enhancing policy implementation, promoting public-private partnerships, supporting research and development, and expanding climate-smart agriculture initiatives. By adopting these measures, Nigeria can work towards achieving sustainable food security that benefits both the agricultural sector and the environment, ensuring a resilient future for smallholder farmers and their communities.

**Keywords:** Food security, Environmental sustainability, Small scale farming, Nigeria

### INTRODUCTION

Food security and environmental sustainability are critical issues in global development, especially in regions highly dependent on agriculture for livelihoods, such as Nigeria. Small-scale farming, which dominates the agricultural landscape of Nigeria, plays a crucial role in food production and the economy, employing over 70% of the rural population (Oni et al., 2021). However, challenges such as climate change, environmentally challenging agricultural practices, deforestation, and soil degradation threaten both food security and environmental sustainability (Obi et al., 2023). Addressing these intertwined challenges is essential for ensuring long-term agricultural productivity, poverty reduction, and ecosystem health in Nigeria.

Food security, as defined by the Food and Agriculture Organization (FAO), exists when "all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 2022). In Nigeria, food insecurity persists due to factors such as population growth, inadequate infrastructure, and climate variability (Adeyeye et al., 2023). Small-scale farmers, who produce about 80% of the nation's food, face limited access to technology, markets, and inputs like seeds and fertilizers (Adeola et al., 2022). These limitations hinder their capacity to adopt sustainable farming methods and increase their resilience to climate-related risks.

Environmental sustainability refers to the responsible management of natural resources to meet current needs without compromising the ability of future generations to meet their own (Ogunbiyi & Udo, 2022). Small-scale farming in Nigeria is often characterized by practices that degrade the environment, such as slash-and-burn agriculture, overgrazing, and improper use of chemicals (Adebayo & Ojo, 2021). These practices contribute to soil erosion, deforestation, and loss of biodiversity, ultimately reducing agricultural productivity. Sustainable agricultural practices such as agroforestry, crop rotation, organic farming, and conservation tillage offer promising solutions to mitigate environmental degradation while improving yields (Eze et al., 2023).

The intersection of food security and environmental sustainability in the context of small-scale farming in Nigeria presents both challenges and opportunities. According to Obikoya et al. (2023), a shift toward agroecological farming practices can enhance soil health, increase productivity, and improve food security while preserving the environment. However, this transition requires significant investments in farmer education, infrastructure, and access to sustainable agricultural technologies (Enechi et al., 2021). Furthermore, government policies and international development initiatives must prioritize smallholder farmers and promote sustainability as a long-term strategy for food security.

In this paper, we explore the role of small-scale farming in Nigeria's food security and environmental sustainability, examining the challenges, opportunities, and strategies needed to foster a more resilient agricultural system.

#### Statement of the Problem

The research problem centers on how to ensure consistent food availability in Nigeria, where small-scale farming dominates and faces significant environmental sustainability challenges. Small-scale farmers, who produce approximately 80% of the nation's food, are critical to food security but are increasingly vulnerable to environmental degradation, climate change, and unsustainable farming practices (Adeola et al., 2022). The unsustainable use of land, coupled with deforestation, overgrazing, and improper chemical use, has led to severe land degradation, reducing agricultural productivity and threatening long-term food security (Obi et al., 2023).

The challenge is exacerbated by limited access to sustainable farming technologies, poor infrastructure, and inadequate farmer education, which restrict smallholder farmers from adopting environmentally sound practices (Eze et al., 2023). Consequently, these farmers struggle to increase yields without further depleting the natural resources they depend on, leading to a vicious cycle of low productivity and environmental decline (Ogunbiyi & Udo, 2022). Furthermore, the effects of climate change, such as erratic rainfall and extreme weather events, have made farming even more unpredictable, further threatening food availability (Adeyeye et al., 2023).

Thus, this paper brings to the fore how relevant stakeholders including farmers in Nigeria can ensure sustainable food availability in the face of the small-scale farmers' daunting environmental sustainability challenges. Addressing this problem requires exploring strategies that integrate sustainable farming practices, improve farmers' access to resources, and create policies that support long-term environmental health alongside agricultural productivity (Obikoya & Oguntade, 2023). Solving this issue is crucial for maintaining food security and protecting the ecosystems that smallholder farmers depend on.

#### Objectives of the Study

The general objective of the study focuses on food security and environmental sustainability under small-scale farming in Nigeria. The specific objectives of the study are to:

- i. Highlight the effect of environmental sustainability challenges on food availability in Nigeria.
- ii. Identify the barriers small-scale farmers face in adopting sustainable agricultural practices to improve productivity and food security.
- iii. Examine the role of government policies and international development initiatives in supporting smallholder farmers to achieve food security while maintaining environmental sustainability.
- iv. Generate actionable strategies for integrating sustainable farming practices that can enhance food availability and environmental conservation in small-scale farming communities.

Theoretical Framework: This study is grounded in the intersection of food security theory and environmental sustainability theory, both of which offer a conceptual basis for understanding the challenges and opportunities faced by small-scale farmers in Nigeria.

1. Food Security Theory: Food security theory provides a framework for understanding the availability, accessibility, utilization, and stability of food within a given population. According to the Food and Agriculture Organization (FAO), food security exists when "all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food" (FAO, 2022). This theory emphasizes that food security is multidimensional, involving both the supply side-food production and availability-and the demand side, which includes factors such as income, market access, and food distribution (Adeyeye et al., 2023). This paper focuses on the supply side and policies that engender environmentally sustainable supply side practices. For small-scale farmers in Nigeria, ensuring food availability is directly linked to their ability to produce sufficient food, which is often compromised by environmental degradation, poor infrastructure, and climate variability (Obi et al., 2023). Food security theory thus provides a lens through which to analyze how small-scale farming practices can be improved to ensure sustainable food production while addressing challenges related to resource scarcity and economic constraints (Ogunbiyi & Udo, 2022).

2. Environmental Sustainability Theory: Environmental sustainability theory focuses on the responsible use of natural resources to meet present needs without compromising the ability of future generations to meet theirs. This theory highlights the importance of balancing economic, social, and environmental goals to achieve long-term sustainability. In the context of small-scale farming, environmental sustainability theory stresses the need for agricultural practices that conserve natural resources, such as soil, water, and biodiversity, while also supporting agricultural productivity (Adebayo & Ojo, 2021). Unsustainable farming methods, such as slash-and-burn agriculture, overgrazing, and improper chemical use, contribute to environmental degradation, which ultimately threatens food production (Eze et al., 2023). This study draws on environmental sustainability theory to explore how small-scale farmers can adopt

sustainable agricultural practices such as agroforestry, crop rotation, organic farming, and conservation tillage to preserve the environment while enhancing food security. The theory also underscores the importance of government and international interventions in supporting sustainable farming practices through policies, education, and access to technology (Obikoya & Oguntade, 2023).

3. Agroecological Framework: Agroecology provides an additional theoretical perspective for this study by integrating the ecological and social aspects of agriculture. This framework emphasizes the use of ecological principles in farming practices to promote biodiversity, regenerate natural resources, and reduce dependence on chemical inputs. Agroecology also promotes the involvement of local communities in decision-making and values traditional knowledge (Obikoya & Oguntade, 2023). By adopting agroecological principles, small-scale farmers can improve their resilience to environmental challenges while contributing to food security.

Integration of Theories: By combining food security theory, environmental sustainability theory, and agroecology, this study develops a comprehensive framework for examining the relationship among small-scale farming, food availability, and environmental sustainability in Nigeria. The framework helps explain the multifaceted challenges small-scale farmers face and the necessity of integrating sustainable practices to ensure long-term food security. It also highlights the critical role of policy, education, and technology in addressing the dual goals of increased food production and environmental conservation.

Conceptual Framework: The conceptual framework for this study illustrates the relationships between small-scale farming, environmental sustainability, and food security in Nigeria. It is developed to guide the investigation of how environmental challenges affect food availability among small-scale farmers, and how sustainable agricultural practices can be implemented to address these issues. The framework is composed of three key variables: small-scale farming practices (independent variable), environmental sustainability (mediating variable), and food security (dependent variable). Each variable interacts to shape the outcomes of the agricultural system in Nigeria.

**Independent Variable: Small-Scale Farming Practices:** Small-scale farming practices form the central component of this study, as smallholders produce the majority of Nigeria's food supply. These practices include traditional farming methods such as slash-and-burn, monocropping, use of chemical inputs, and limited mechanization (Adebayo & Ojo, 2021). While these practices can provide short-term agricultural yields, they are often unsustainable and contribute to environmental degradation, reducing long-term productivity (Obi et al., 2023).

Sustainable farming practices such as agroforestry, organic farming, crop rotation, and conservation tillage are potential alternatives to unsustainable practices. The framework posits that adoption of these sustainable practices by small-scale farmers can mitigate negative environmental impacts while improving agricultural productivity (Eze et al., 2023). However, adoption of these methods is influenced by factors such as access to education, technology, inputs, and government support (Ogunbiyi & Udo, 2022).

**Mediating Variable: Environmental Sustainability:** Environmental sustainability is the critical mediating variable in the relationship between small-scale farming practices and food security. Unsustainable practices lead to environmental degradation, including soil erosion, loss of biodiversity, and deforestation, which reduce the long-term productivity of farms (Obikoya & Oguntade, 2023). This degradation limits farmers' ability to produce enough food, directly impacting food availability. Conversely, sustainable practices contribute to the conservation of resources such as soil, water, and forests, which are essential for maintaining agricultural productivity over time (Adeola et al., 2022).

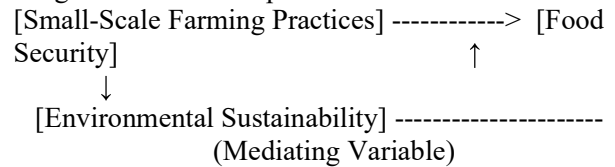
Thus, the framework highlights the need for sustainable farming practices to achieve environmental sustainability, which in turn supports food security. Without environmental sustainability, food production becomes unsustainable, leading to persistent food insecurity (Adeyeye et al., 2023).

**Dependent Variable: Food Security:** The ultimate goal of the study is to ensure food security, defined by the Food and Agriculture Organization (FAO, 2022) as the condition where "all people, at all times, have access to sufficient, safe, and nutritious food." In the context of Nigeria, food security is influenced by the availability of food

produced by small-scale farmers. When environmental sustainability is compromised, agricultural productivity declines, leading to food shortages and heightened food insecurity (Obi et al., 2023).

The framework proposes that improving small-scale farming practices through sustainable agricultural techniques will lead to greater environmental sustainability, which will, in turn, enhance food availability and security in Nigeria. Additionally, the framework recognizes the role of external factors such as climate change, market access, policy support, and international interventions in shaping the overall food security outcomes (Obikoya & Oguntade, 2023).

**Diagram of the Conceptual Framework**



**Explanation of Relationships:**

**Small-Scale Farming Practices → Food Security:** Small-scale farmers' practices directly affect food availability.

Unsustainable practices can lead to reduced yields, while sustainable practices can enhance productivity and food security (Ogunbiyi & Udo, 2022).

**Small-Scale Farming Practices → Environmental Sustainability:** Farming practices significantly impact environmental conditions. Unsustainable farming leads to environmental degradation, while sustainable practices help preserve the environment (Adeola et al., 2022).

**Environmental Sustainability → Food Security:** Environmental sustainability is crucial for long-term food production. When the environment is degraded, food security is jeopardized, but when resources are conserved, food production becomes more stable (Obi et al., 2023).

This conceptual framework helps guide the analysis of the challenges faced by small-scale farmers in achieving food security while maintaining environmental sustainability in Nigeria.

## METHODOLOGY

This study adopts a systematic review methodology to examine the relationship among small-scale farming, environmental sustainability, and food security in Nigeria. The systematic review approach is chosen to synthesize recent and relevant empirical studies, policy reports, and scholarly articles that address the impact of environmental sustainability on food availability under the predominance of small-scale farming. The process follows a structured and transparent procedure to ensure the comprehensive collection and evaluation of literature, with an emphasis on recent publications (2019–2024) that reflect the current state of research.

**Study Design:** The methodology is designed to systematically review the available literature to address the following research problem: How can Nigeria ensure food availability under the predominance of small-scale farming that faces environmental sustainability challenges? The study will involve identifying, selecting, and synthesizing relevant studies that examine the intersection of small-scale farming, environmental sustainability, and food security.

The systematic review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure a comprehensive and methodologically sound review process (Moher et al., 2009). The review includes literature published between 2019 and 2024 to reflect recent research developments and contemporary challenges in Nigerian agriculture.

**Data Sources and Search Strategy:** The systematic review utilizes various electronic databases, including but not limited to: Google Scholar JSTOR, ScienceDirect, Scopus, and Web of Science.

The search strategy includes keywords and phrases related to small-scale farming, food security, environmental sustainability, Nigeria, and sustainable agricultural practices. The search focuses on peer-reviewed articles, policy reports, and conference papers published within the last five years. Search terms include combinations of the following: "Small-scale farming" OR "smallholder farming" AND "Nigeria" "Food security" AND "Nigeria" OR "food availability" "Environmental sustainability" AND "agriculture" "Sustainable farming practices" OR "agroecology" AND "Nigeria" "Climate change" AND "food production"

AND "Nigeria" To ensure comprehensiveness, the search also involves screening references of identified articles to locate additional relevant studies.

**Inclusion and Exclusion Criteria:** To maintain focus and ensure that only relevant studies are reviewed, the following inclusion and exclusion criteria are applied:

**Inclusion Criteria:** Articles published between 2019 and 2024.

Studies that focus on small-scale farming and environmental sustainability in Nigeria. Literature that examines the link between sustainable farming practices and food security. Peer-reviewed articles, policy reports, and conference papers.

Studies that provide empirical data, case studies, or theoretical analyses relevant to the research question.

**Exclusion Criteria:** Studies focusing on large-scale industrial agriculture.

Articles that do not provide direct insights into Nigeria or smallholder agriculture.

Literature published before 2019 unless referenced for foundational theories.

Grey literature or non-peer-reviewed content, except for reputable policy reports.

**Data Extraction and Synthesis:** Once relevant articles are identified, data extraction involves systematically collecting information from each study, including: Author(s) and year of publication Study location and focus (e.g., Nigeria, small-scale farmers, environmental sustainability) Key findings related to the challenges and solutions for small-scale farming, food security, and environmental sustainability.

Methodology used in each study (e.g., empirical study, case study, theoretical analysis) Policy recommendations or strategies proposed for sustainable farming and food security The extracted data is analyzed and synthesized to identify common themes, trends, and gaps in the existing literature. The synthesis groups studies by thematic areas, such as environmental challenges facing small-scale farming, adoption of sustainable farming practices, and policy frameworks for food security in Nigeria.

**Quality Assessment:** To ensure that only high-quality studies are included, a quality assessment tool is applied. The Critical Appraisal Skills

Programme (CASP) checklist is used to evaluate the methodological rigor and relevance of each study. The checklist assesses elements such as: Study design, Sampling methods, Data collection and analysis techniques, Theoretical grounding and coherence, Relevance to the research objectives. Only studies that meet the quality threshold are included in the final review.

**Data Analysis and Interpretation:** The data collected from the systematic review is analyzed through qualitative synthesis, focusing on identifying: Key challenges related to environmental sustainability in small-scale farming, Effective sustainable agricultural practices that enhance food availability, Policy interventions that support both environmental sustainability and food security. The analysis involves comparing findings from different studies, identifying patterns, and interpreting how sustainable farming practices can address food security challenges in Nigeria.

**Limitations:** The main limitation of this methodology is the reliance on secondary data, which may limit the depth of analysis on specific regional variations within Nigeria. Additionally, the exclusion of grey literature may omit relevant government reports or local NGO studies. However, these limitations are mitigated by ensuring that a wide range of peer-reviewed and high-quality policy documents are included.

## LITERATURE REVIEW

This literature review is organized based on the specific objectives of the study, which focus on the effect of environmental sustainability on food availability in small-scale farming, the barriers to sustainable practices, the role of government policies, and strategies for improving sustainability in Nigerian agriculture.

**Environmental Sustainability and Food Availability** Research shows that environmental degradation, particularly soil erosion, deforestation, and climate change, severely impacts food availability in small-scale farming (Obi et al., 2023). These factors reduce agricultural productivity and limit the ability of small-scale farmers to produce enough food. As Adebayo and Ojo (2021) highlight, unsustainable practices such as overgrazing and excessive use of chemical inputs contribute to long-term land degradation, which directly threatens food security.

Without addressing environmental sustainability, small-scale farmers will continue to struggle with declining yields, exacerbating food insecurity in rural Nigeria.

**Barriers to Adopting Sustainable Agricultural Practices:** Despite the known benefits of sustainable farming practices, small-scale farmers face several barriers to adopting them. Ogunbiyi and Udo (2022) identify financial constraints, lack of access to modern technology, limited knowledge, and inadequate government support as key challenges. Farmers often lack the resources to implement more sustainable methods such as agroforestry, organic farming, or water conservation techniques. Eze et al. (2023) further note that cultural practices and risk aversion also prevent the adoption of sustainable innovations.

**Role of Government Policies and International Initiatives:** Government policies play a critical role in either supporting or hindering small-scale farmers' efforts to achieve food security through sustainable practices. According to Adeola et al. (2022), policy frameworks in Nigeria have been inconsistent in promoting sustainable agriculture. While some initiatives, such as the Agricultural Promotion Policy (APP), aim to improve productivity, their implementation often falls short due to corruption, insufficient funding, and lack of local-level support. International development agencies are beginning to address these gaps through initiatives aimed at promoting climate-smart agriculture (Obikoya & Oguntade, 2023).

**Strategies for Integrating Sustainable Farming Practices:** To enhance food availability and environmental sustainability, scholars propose strategies such as the adoption of agroecological practices, improved farmer education, and better access to financial resources (Adebayo & Ojo, 2021). These strategies focus on balancing agricultural productivity with resource conservation, ensuring long-term food security in Nigeria.

## RESULTS AND DISCUSSION

This section presents and discusses the findings of the systematic review, structured according to the specific objectives of the study: the effect of environmental sustainability on food availability,

barriers to adopting sustainable agricultural practices, the role of government policies and international initiatives, and strategies for improving sustainability in Nigerian agriculture.

**Effect of Environmental Sustainability on Food Availability:** The review reveals a strong link between environmental sustainability and food availability in small-scale farming systems. Unsustainable farming practices, such as deforestation, soil erosion, and the inappropriate use of agrochemical inputs, contribute to the degradation of arable land and water resources, which in turn reduces food production (Obi et al., 2023). For instance, Adebayo and Ojo (2021) found that continuous land degradation due to unsustainable farming methods has led to a decrease in crop yields, worsening food insecurity, especially in rural areas. The evidence suggests that without sustainable practices, small-scale farmers will continue to experience declining productivity, jeopardizing food availability in Nigeria. This finding aligns with broader global trends where sustainable practices are shown to improve long-term agricultural output.

**Barriers to Adopting Sustainable Agricultural Practices:** The findings indicate that several barriers impede the adoption of sustainable agricultural practices among small-scale farmers in Nigeria. The most significant of these barriers include financial constraints, lack of access to appropriate technology, and inadequate knowledge about sustainable practices (Ogunbiyi & Udo, 2022). For example, Eze et al. (2023) report that many farmers are unable to afford the initial costs of adopting innovations like organic farming or agroecology. In addition, poor access to credit, inadequate infrastructure, and limited training on sustainable methods further inhibit adoption. The findings also point to cultural factors and risk aversion, where farmers prefer to stick to traditional practices rather than adopting new methods with uncertain outcomes. This highlights the need for targeted interventions to address these barriers, such as providing access to affordable credit, technology, and capacity-building programmes.

**Role of Government Policies and International Initiatives:** The review of policy frameworks reveals mixed results. While there are policies aimed at

supporting small-scale farmers and promoting environmental sustainability, their implementation is often in fits and starts and ineffective. Adeola et al. (2022) argue that while policies like the Agricultural Promotion Policy (APP) and the Green Alternative Initiative were designed to boost agricultural productivity and sustainability, weak governance, corruption, and poor local-level support have hindered their effectiveness. Moreover, Obikoya and Oguntade (2023) highlight the growing role of international initiatives, such as climate-smart agriculture programmes, which provide external support to Nigerian farmers. These initiatives are beginning to bridge some of the policy gaps by promoting practices that mitigate the effects of climate change while improving agricultural productivity. However, these programs often lack sufficient scale and local adaptation to have a wide-reaching impact.

**Strategies for Integrating Sustainable Farming Practices:** The findings underscore the importance of integrating sustainable agricultural practices to ensure food security and environmental sustainability. Several studies emphasize the potential of agroecological practices, such as agroforestry, conservation agriculture, and organic farming, to enhance both productivity and resource conservation (Adebayo & Ojo, 2021; Eze et al., 2023). These practices have been shown to improve soil health, increase water retention, and reduce the need for agrochemical inputs. However, the successful implementation of these practices requires not only knowledge dissemination and financial support but also community-driven approaches that engage local farmers in decision-making processes. Additionally, the review identifies improved farmer education, access to modern farming technologies, and stronger policy frameworks as essential components for scaling up sustainable practices. A collaborative approach between government agencies, local communities, farmer groups and international development partners is critical for addressing the challenges faced by small-scale farmers in Nigeria.

The review highlights the interdependence between environmental sustainability and food availability in small-scale farming systems in Nigeria. The widespread degradation of environmental resources due to unsustainable farming practices poses a

serious threat to food security. While sustainable practices can mitigate these challenges, barriers such as financial limitations, poor policy implementation, and lack of farmer education impede their adoption. To overcome these challenges, we look to a multifaceted approach that includes better policy enforcement, international support, and locally driven strategies to improve the adoption of sustainable practices. Sustainable agriculture has the potential to significantly improve food security in Nigeria if these challenges are addressed at multiple levels.

## CONCLUSION

The findings from this systematic review underscore the critical role of environmental sustainability in ensuring food security within Nigeria's small-scale farming sector. Environmental degradation, largely driven by unsustainable farming practices, continues to reduce agricultural productivity, directly threatening food availability. While sustainable farming methods present viable solutions to these challenges, widespread adoption is hindered by financial, technological, and knowledge-related barriers. Furthermore, although some government policies and international initiatives aim to promote sustainable agriculture, weak implementation and lack of local adaptation have limited their effectiveness. To achieve sustainable food security, there is a pressing need for holistic, multi-level strategies that address both the environmental and socioeconomic challenges faced by smallholder farmers.

## RECOMMENDATIONS

**Strengthening Access to Finance and Technology:** Governments and financial institutions should enhance small-scale farmers' access to affordable credit and sustainable agricultural technologies. Microcredit programmes, subsidized loans, and grants should be tailored specifically to small-scale farmers, enabling them to invest in sustainable practices such as agroforestry, organic farming, and conservation agriculture. In addition, introducing simple, low-cost farming technologies can ease the adoption of sustainable methods.

**Farmer Education and Capacity Building:** Comprehensive farmer education programmes should be developed by relevant and development institutions to raise awareness of the benefits of sustainable farming practices. These programmes

should be delivered through local agricultural extension services and involve hands-on training, farmer-to-farmer knowledge exchanges, and community-based initiatives. Topics such as soil management, water conservation, and climate-smart agriculture should be prioritized to help farmers adapt to changing environmental conditions. **Improving Policy Implementation and Local Adaptation:** While policies like the Agricultural Promotion Policy (APP) aim to promote sustainability, their implementation must be improved through increased government accountability and local-level adaptation. There should be stronger enforcement mechanisms, clear incentives for sustainable practices, and targeted programmes for regions most affected by environmental degradation. Policymakers should work closely with local communities to ensure that policies align with the specific needs and conditions of small-scale farmers. **Promoting Public-Private Partnerships (PPP):** Public-private partnerships should be fostered to support sustainable farming initiatives. Private sector companies, non-governmental organizations, and international development agencies can collaborate with government bodies to provide resources, training, and infrastructure necessary for scaling sustainable practices. These partnerships could also help small-scale farmers gain better access to markets, further incentivizing the shift towards sustainable production.

**Supporting Research and Development (R&D):** Continuous investment in research and development should be made to identify innovative, region-specific solutions for sustainable agriculture. Research institutions should focus on improving the resilience of smallholder farming systems to environmental stressors such as climate change, soil degradation, and water scarcity. The findings from these studies should be communicated effectively to policymakers and farmers for practical application. **Enhancing Climate-Smart Agriculture Initiatives:** Expanding climate-smart agriculture (CSA) programmes to more regions in Nigeria will help mitigate the impact of climate change on small-scale farming. These initiatives, backed by international organizations, should focus on practices that simultaneously increase productivity, enhance resilience, and reduce greenhouse gas emissions.

By implementing these recommendations, Nigeria

can move towards a more sustainable agricultural system that not only enhances food availability but also protects the environment for future generations.

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