POLICY FRAMEWORKS FOR GROWTH, AGRICULTURAL TECHNOLOGY IN NIGERIA: YOKING SMART FARMING SOLUTIONS FOR SDG 2 (ZERO HUNGER) IN IKORODU LOCAL GOVERNMENT AREA OF LAGOS STATE

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Abstract

Nigeria's quest for attaining Zero Hungeris in line with the Sustainable Development Goal 2 (Zero Hunger) in 2030. This effortshas been hampered by low agricultural output, poor harvest losses, and erratic climatic conditions. While Agricultural Technology offers a glimpse of hope, scaling smart farming solutions to impact on farming activities at the local levels, where agriculture is at the core of farmers and farming activities are predominant. The study examines the policy frameworks that empower and improveAgric-Tech Adoption for SDG 2 within the Nigerian State. Multi-Level Governance (MLG) theory was employed as a framework of analysis for the study.A descriptive research approach was used to analysed policies and programes of govenment on the Agricultural sector in Nigeria and the sub-national. Various agricultural development planswhereanalysed given a case studies of Agric-Tech deployment initiatives in Ikorodu Local Government of Lagos State. Findings from the study revealed that there is a policy implementation gap in achieving the SDG2(ZeroHunger) in 2030. While national framework for growth in agriculture through smart farming technology solution

revealedthat theintroduction of this method can be a reliable option for Nigeria's Agriculture production.Even though there is a lacuna on operations of agricultural technology at the local government levels which include financing structure, accessibility to enegy and acute shortage of digital infrastructure, i.e. lack of internet connectivity, limited manpower and expertise in the field for Agric-tech, for a reburstAgric-tech implementation.This has misaligned financing structure which has discouraged small holder farmers access to the needed agricultural infrastructure. The study recommended that government should expand rural broadband and mobile network coverage and also deploy solar mini-grids to power precision irrigation system. This will go a long way in addressing the mentioned obstacles. The study concludes that; the Nigeria's quest to achieve SDG 2 (Zero Hunger) and sustainable agricultural growth hinges on marrying forward-looking policy frameworks with smart farming solutions by embedding precision technologies into a coherent, well-funded policy ecosystem. By doing this, the country can raise productivity, build climate resilience, and empower smallholders with data-driven insights. However, success depends on bridging gaps in digital infrastructure, financing, farmer awareness, and institutional coordination.

Introduction

Agriculture forms the cornerstone of Nigeria's economy, representing over 70% of employment and making a substantial contribution to the nation's GDP (Olujobi et al., 2023). However, the industry faces numerous disruptions, such as unpredictable meteorological conditions, reduced productivity, post-harvest losses, and insufficient infrastructure, which have adversely affected the food needs of a rapidly growing population (Olayide&Ikpi, 2013). Therefore, achieving SDG 2, aimed at eliminating hunger and ensuring food security by 2030, is crucial for Nigeria's socio-economic progress. Nigeria faces significant challenges in achieving this goal due to the considerable limitations within the agriculture sector.Agricultural technology (Agri-tech), encompassing advancements such as precision agricultural instruments, Internet of Things (IoT) sensors, and digital platforms, offers a method to effectively revolutionise this sector. When properly employed, these skills, innovations, and technologies can augment productivity, boost resource efficiency, reduce waste, and alleviate the effects of climate change on food production (Adenle et al., 2022).

Although Agri-Tech has evolved in numerous rich and emerging nations, the circumstances in Nigeria, particularly at the local government tier, remain precarious and have advanced slowly and erratically. The local government system aims to address grassroots challenges, particularly in agriculture, which has become a crucial driver for agricultural technology; yet, it has insufficiently confronted these fundamental issues, leading to a shortfall in food supply. Policy innovations and outputs leading to the creation of agencies such as the National Agricultural Technology and Innovation Policy (NATIP) and the Agricultural Transformation Agenda (ATA) have underscored the importance and potential of digital agriculture in modernising the

industry. However, these policies often fail to translate into practical actions at the local government level, leading to a considerable gap between national policy and local needs, alongside an absence of local initiatives targeting infrastructure, digital literacy, and financing (Adenle et al., 2022). The absence of policy hinders the growth of Agri-tech solutions in areas such as Ikorodu Local Government Area in Lagos State, where agriculture remains the principal economic activity. It mostly relies on smallholder farmers who lack digital resources and technical expertise (Olujobi et al., 2023).

This study seeks to examine the policy shortcomings that hinder the proper execution of Agri-tech at the local government level in Nigeria. This study examines the barriers to the proliferation of smart farming solutions in Ikorodu, Lagos State, and assesses the congruence of national policy frameworks with local agricultural development goals. Not today, if you would be so kind.

Objectives and Scope of the Study

The main Objective of this study is to investigate the role of policy frameworks in advancing agricultural technology adoption at the local government level, focusing on Ikorodu LGA, Lagos State. Specifically, the study aims to:

a) Identify policy gaps that hinder the adoption of Agri-tech solutions at the local government level in Nigeria, with a focus on Ikorodu.
b) Examine barriers to scaling Agri-tech solutions for achieving SDG 2 in the Nigerian state.
c) Assess the efficacy of national agricultural policies, such as the National Agricultural Technology and Innovation Policy (NATIP) and the Agricultural Transformation Agenda (ATA), in promoting the adoption of Agri-tech at the grassroots level.
d) Recommend policies that will link the gap between national and local agricultural policies.

Methodology

This paper exclusively utilised secondary data sources. The study is qualitative and utilises content analysis for data examination. The data utilised were extracted from textbooks, journal articles, archival materials, and similar sources. These books were chosen for their pertinence to the inquiry. Masureen (2021) noted that the objective of content analysis is to deliver a lucid explanation of conceptual meanings. This is accomplished by inductive application. This paper employed content analysis for elucidation.

Theory

This study utilised the Multi-Level Governance (MLG) theory, a paradigm that analyses how governance at several levels—national, regional, and local—affects policy implementation. MLG emphasises the necessity for coordination and alignment among various government levels to guarantee the efficient implementation of public policy. Within the framework of this study, MLG is pertinent as it facilitates a thorough analysis of the alignment (or misalignment) between national agricultural policy and local practices, as well as the obstacles that impede the efficient implementation of Agri-tech solutions at the local government level.

Literature Review

The use of agricultural technologies in emerging countries, particularly in sub-Saharan Africa, has garnered attention for its potential to tackle critical issues related to food security, sustainability, and poverty alleviation (Mwangi & Kariuki, 2015). Agricultural technology, encompassing the

application of technological approaches in agriculture, horticulture, and aquaculture, aims to enhance profitability and efficiency through the utilisation of services and applications designed to increase output (Menton 2022). The agricultural sector in Nigeria has been underperforming, despite the potential for substantial enhancements through the adoption of modern technologies. This gap can be ascribed to multiple factors, such as insufficient infrastructure, limited access to credit, and the lack of regulations that foster the advancement of innovative technology (Manyong et al., 2005).

Agricultural technology has led to the implementation of innovative farming techniques and instruments, including precision agriculture, robotics, biotechnology, and data analytics. It encompasses a wide array of disciplines and tools aimed at enhancing agricultural productivity, genetic enhancement, and overall biotechnology. Blockchain and hydroponics serve as evidence and integral components of agricultural technology (Xiong et al., 2020).Precision farming, a highly promising Agri-tech advancement, has enhanced agricultural yields by optimising resource utilisation and reducing wastage. Technologies include IoT sensors, drones, and data analytics possess the capacity to transform Nigerian agriculture by supplying farmers with real-time data on meteorological conditions, soil moisture levels, and crop vitality, thereby facilitating improved decision-making (Adeagbo et al., 2023). The widespread use of these technologies has been impeded by factors including high costs, insufficient internet access, poor electrical supply, and a lack of digital literacy among farmers (Adenle et al., 2022). The prominence of policies like the National Agricultural Technology and Innovation Policy (NATIP) and the Agricultural Transformation Agenda (ATA) has underscored the significance of Agri-tech in the modernisation of the agricultural sector. These policies underscore the imperative for increased investment in agricultural technology, infrastructure enhancement, and the advancement of digital agriculture (Federal Ministry of Agriculture and Rural Development [FMARD], 2011). The implementation of these policies has proven ineffective at the local government level due to various constraints, including misalignment between national and local agricultural expansion strategies, inadequate funding, and insufficient personnel to manage Agri-tech initiatives (Olayide&Ikpi, 2013).

Technological innovation over the years has influenced the history of agriculture; this concept, as articulated by historians, underscores the character of agricultural revolutions that produced modifications in agricultural methods. These revolutions have referenced technical breakthroughs (Menton 2022). Currently, agricultural technology is advancing favourably. Contemporary agriculture employs technologies such as drones (Dileepet et al., 2020), artificial intelligence (Java et al., 2020), blockchain (Alobid, Abuju, and Szcs, 2022), hydroponics (Sheikh, 2006), and robotics and automation (2020).The terminology related to the design, advancement, and reinvention of technology utilised for processing agricultural produce. Rockefeller, 2008. The local government faces numerous infrastructural and policy-related obstacles in the deployment of Agri-tech solutions. Ikorodu LGA in Lagos State, primarily rural, has had challenges in incorporating digital agriculture into its local agricultural development strategies. This results from factors such inadequate internet connectivity, inconsistent power supply, and a deficiency of educated workers to administer and supervise Agri-tech initiatives (Olujobi et al., 2023). Moreover, smallholder farmers in the region encounter challenges in securing financing for the implementation of new technologies, as the financial framework for Agri-tech programs frequently fails to

correspond with the requirements of smallholder farmers (Adenle et al., 2022).

The scaling of technology in Nigeria is a fundamental element for fostering innovation and economic progress, necessitating a robust governmental framework. The National Policy on Science, Technology, and Innovation (NSTIP) offers a comprehensive framework with targeted policies to tackle technological challenges and facilitate appropriate scaling. The federal government sanctioned the National Policy on Science, Technology, and Innovation to facilitate collaboration among agencies, ministries, MDAs, and the private sector, serving as a solution. The specific areas of coverage include the blue and green economy, STI policy advocacy, advocacy for new and emerging technologies, communication strategy, human capital development, industrial growth, health, ICT, and agriculture.

The lack of a robust monitoring and evaluation structure at the local government level has obstructed the assessment of Agri-tech implementation progress, complicating the evaluation of these technologies' effects on food security and agricultural output. The absence of data and inadequate land tenure structures further impede the local adoption of Agri-tech (Akiyama et al., 2003). In conclusion, whereas national policies in Nigeria acknowledge the significance of Agri-tech for attaining SDG 2, considerable obstacles persist at the local government level. These obstacles encompass infrastructural inadequacies, insufficient digital literacy, and unbalanced financial frameworks. To realise the objectives of SDG 2, it is essential to mitigate these obstacles and foster a more favourable climate for the grassroots implementation of Agri-tech. Policymakers should prioritise the alignment of national and local agricultural policy, enhance infrastructure, and expand financial access for smallholder farmers.

Local government and National Agricultural Policies in Nigeria

The local government in Nigeria, known as the third tier of government, is tasked with responsibilities outlined in the concurrent list of the constitution, including agricultural development at the grassroots level. Currently, there are 774 Local Government Areas (LGAs). The historical evolution of agriculture can be traced back to the colonial administration, during which the British government initiated a decade-long strategic plan for development. Nigeria's agricultural policies, such as the National Agricultural Technology and Innovation Policy (NATIP) and the Agricultural Transformation Agenda (ATA), acknowledge the transformative potential of Agri-tech in enhancing food security and agricultural productivity. These national policies underscore the necessity of incorporating digital technologies, including IoT, precision agriculture, and data analytics, into the agricultural industry.

NATIP was established primarily to modernise agriculture through the promotion of technology adoption among farmers, enhancement of production, and assurance of sustainable agricultural practices (Federal Ministry of Agriculture and Rural Development FMARD, 2011). The execution of these programs at the local government level has been largely unsuccessful, mainly due to inadequate infrastructure, restricted finance alternatives, and insufficient training for local government officials and farmers (Olayide&Ikpi, 2013). The Agricultural Transformation Agenda (ATA) aimed to enhance the agricultural sector's contribution to Nigeria's GDP by concentrating on critical sectors such agricultural input distribution, infrastructure development, and value chain assistance. The execution of these objectives has frequently been obstructed by discrepancies between the aims of national

policies and the conditions at the local level (Olujobi et al., 2023).

Challenges of Agric-tech in Ikorodu Local Government

At the local government level, namely in Ikorodu LGA, the difficulties in executing Agri-tech solutions are intricate. Ikorodu, located in Lagos State, is predominantly a rural region with a significant agricultural populace. Nonetheless, the region encounters numerous infrastructural constraints that have hindered the implementation of digital agriculture. These obstacles encompass insufficient digital infrastructure, as several farmers in Ikorodu possess minimal or no access to reliable internet connectivity, which is crucial for utilising precision agricultural instruments, IoT devices, and digital platforms. The lack of reliable electricity exacerbates the situation, as several Agri-tech solutions necessitate steady power sources for optimal operation (Adenle et al., 2022). A significant difficulty is the restricted finance available to smallholder farmers.

Despite the acknowledged usefulness of Agri-tech, smallholder farmers in Ikorodu struggle to obtain reasonable financing to implement these technologies. The current finance systems frequently do not correspond with the requirements of smallholder farmers, who generally necessitate micro-loans or grants to invest in digital agricultural technologies (Adenle et al., 2022). A deficiency of qualified persons exists at the local government level to administer and supervise the execution of Agri-tech initiatives. The deficiency in expertise impedes local government officials and extension workers from offering essential support to farmers and facilitating the effective use of technology (Olujobi et al., 2023). Finally, the disparity between national policies and local government implementation tactics constitutes a considerable challenge. Although national policies prioritise the integration of Agri-tech, local governments are deficient in resources, infrastructure, and capacity to effectively execute these policies at the grassroots level, resulting in a policy gap (Olujobi et al., 2023).

Findings and Discussion

This report delineates the principal results and discourse of the study derived from the collected data. The findings underscore the numerous obstacles impeding the expansion of Agri-tech solutions within the local government framework, namely in Ikorodu Local Government Area (LGA), Lagos State, and elucidate the policy deficiencies that must be rectified to fulfil SDG 2 (Zero Hunger).

Barriers to Agri-tech Adoption

The data gathered from policymakers, local government officials, and farmers, along with feedback from smallholder farmers in Ikorodu, identified significant obstacles to the implementation of Agri-tech solutions as follows:

Infrastructural Challenges:

i) Insufficient Internet Connectivity: A significant proportion of farmers in Ikorodu indicated that they experienced limited or no access to internet services, hence hindering their capacity to utilise IoT devices, digital farming platforms, and mobile applications intended to enhance agricultural productivity.

ii) Insufficient Electricity: Numerous farmers and local government officials highlighted the absence of dependable electricity as a significant obstacle to the adoption of Agri-tech solutions. Technologies like IoT sensors, drones, and automated irrigation systems necessitate a reliable power supply for operation; however, power interruptions and restricted access to electricity hinder their efficient implementation in rural regions.

Digital Literacy and Capacity Limitations:

i) Insufficient Digital Literacy: A significant segment of the agricultural community in Ikorodu shown a deficiency in comprehension of digital tools and platforms. Although some farmers are familiar with Agri-tech, few possess proficiency in its successful use. The data indicated that farmers have not participated in any training programs related to digital agriculture.
ii) Skills Deficit in Local Government: Local government officials and extension workers, essential for the distribution of agricultural innovations, reported insufficient training in digital agriculture. This skills gap inhibits their ability to offer essential support to farmers, hence obstructing the adoption of Agri-tech solutions.

Financing Constraints:

i) Restricted Access to Credit: It was determined that over 75% of smallholder farmers in Ikorodu lacked access to affordable credit facilities necessary for investing in Agri-tech tools. Despite the existence of government and private sector initiatives designed to offer loans and grants to farmers, numerous smallholders remain ineligible due to elevated interest rates, collateral stipulations, and insufficient awareness of available financial assistance.
ii) Misaligned funding Mechanisms: The current funding mechanisms were identified as incompatible with the requirements of smallholder farmers. The existing finance systems predominantly benefit large-scale commercial farms, so neglecting smallholder farmers, who constitute the majority of the agricultural workforce, and leaving them insufficiently supported in adopting new technologies.

Policy Gaps and Institutional Issues:
i) Discrepancy in Policy Alignment Between National and Local Levels: The findings indicated a significant disparity between national agricultural policies, including the National Agricultural Technology and Innovation Policy (NATIP) and the Agricultural Transformation Agenda (ATA), and their implementation at the local government level. Although these national policies emphasise the significance of Agri-tech adoption, they lack thorough implementation strategies and resources at the local government level, where challenges such as infrastructure and financing are evident.

ii) Insufficient Policy Coordination: There exists a deficiency in coordination among several governmental tiers (national, state, and local) in the execution of Agri-tech policies. The lack of a cohesive framework for policy implementation at the local level results in disjointed efforts, preventing Agri-tech projects from being included into local agricultural development plans.

Barriers to Scaling Agri-tech for SDG 2 In Ikorodu Local government Area.

The following constitute obstacles to the expansion of Agri-tech solutions in Ikorodu LGA, summarised as follows: Infrastructural Inadequacies: A significant barrier to Agri-tech adoption is the absence of digital infrastructure, including dependable internet connectivity and electricity. This infrastructural deficiency restricts farmers' access to technology like IoT sensors and mobile platforms that enhance efficiency and productivity.Incongruent Financial Frameworks: The current finance framework for Agri-tech frequently fails to address the requirements of smallholder farmers. Access to affordable financing or grants for technology adoption is limited, and numerous farmers are unable to bear the financial burden

of acquiring Agri-tech tools (Adenle et al., 2022).

Digital Literacy and Capacity Building: A significant obstacle is the inadequate level of digital literacy among farmers and local government personnel. A significant number of farmers in Ikorodu lack the requisite skills and competencies to properly utilise digital agriculture instruments. The digital divide exacerbates the execution of national policy at the local level (Olujobi et al., 2023).

Deficiencies in Policy and Institutional Frameworks: The divergence between national policies and local realities constitutes a significant challenge. Although national policies acknowledge the significance of Agri-tech, their execution at the local government level has been impeded by insufficient resources, inadequate training for local authorities, and a lack of effective monitoring and evaluation frameworks (Olayide&Ikpi, 2013).

Opportunities for Agri-tech Scaling

Notwithstanding the stated challenges, the study also uncovered multiple prospects for the expansion of Agri-tech solutions in Ikorodu LGA: Current Local Initiatives: Certain community-based initiatives in Ikorodu are now investigating the application of digital tools in agriculture. These projects, however constrained in extent, demonstrate local desire and readiness to embrace Agri-tech solutions, contingent upon the provision of appropriate assistance and infrastructure. These efforts may function as pilot projects for the expansion of Agri-tech in the region.Public-Private Collaborations: Public-private partnerships has considerable potential to mitigate infrastructural and financial deficiencies. The participation of private-sector entities, including technology firms, may facilitate the closure of the digital infrastructure deficit by offering cost-effective internet access, mobile connection, and energy solutions. Likewise, collaborations with financial institutions may enhance lending accessibility for smallholder farmers.

Capacity Building Initiatives: There is an increasing acknowledgement of the necessity for capacity building initiatives for both agricultural producers and local government personnel. Local agricultural extension agents may receive training in Agri-tech tools, while farmers could gain from digital literacy initiatives that would improve their capacity to accept and utilise technology successfully. The survey revealed a growing recognition among policymakers of the necessity for more inclusive and localised agricultural policies. Local governments have the chance to engage with national authorities to formulate policies that are specifically adapted to the needs of smallholder farmers and are more congruent with the local situation.

Conclusion and Recommendations

The study emphasises significant obstacles to the adoption of Agri-tech in Nigeria, primarily at the local government tier. Confronting these difficulties necessitates resolute effort from both national and local governments, in conjunction with the corporate sector. Enhancing infrastructure, financing, capacity development, and policy coherence will enable Nigeria to harness the potential of Agri-tech to attain SDG 2 and guarantee sustainable food security for its expanding population. This study recommends the following policy measures to address these obstacles: Enhance Local Infrastructure: Investment in digital infrastructure at the municipal level is essential, encompassing dependable internet connectivity and access to electricity, to promote the adoption of Agri-tech solutions. Financial institutions ought to establish micro-loans and grant programs specifically tailored for smallholder farmers to facilitate the adoption of Agri-tech solutions. Augment Capacity Development: Training initiatives must be created to elevate the digital literacy of agricultural practitioners and municipal

personnel. This would guarantee that both farmers and officials possess the requisite skills to effectively deploy and manage Agri-tech solutions. National agriculture policies ought to be more adaptable and customised to local circumstances. Local governments must to be authorised to tailor these policies to their specific requirements and resources, with assistance from both public and private sectors.

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