

Leveraging Agricultural Extension Services to Enhance Food Security and National Development through the National Agricultural Development Programme in Bayelsa State

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Abstract

This paper examines the Leveraging Agricultural Extension Services to Enhance Food Security and National Development through the National Agricultural Development Programme in Bayelsa State, with a focus on food security and national development in Bayelsa State, Nigeria. The study is anchored in the Diffusion of Innovations Theory and Systems Theory, which jointly explain how information dissemination, institutional coordination, and behavioural change contribute to agricultural transformation. The paper conceptualises agricultural extension services as pivotal in translating policy frameworks into actionable strategies at the grassroots level through farmer education, advisory support, and participatory learning. The review reveals that inadequate funding, poor logistics, and limited digital integration have constrained extension performance in Bayelsa, thereby impeding the realization of NADP objectives. It further highlights that effective extension utilization strengthens local food systems, enhances productivity, reduces rural poverty, and fosters national economic stability. The study advocates for improved governmental investment in extension workforce development, the digitalization of advisory systems, and the institutionalization of community-based participatory models. It also calls for future empirical studies to validate the proposed conceptual relationships between extension services, programme implementation, and food security outcomes across Nigeria's ecological zones. In essence, this paper advances the argument that strengthening agricultural extension systems remains fundamental to achieving sustainable food security and inclusive national development within the framework of the NADP.

Keywords: Agricultural Extension Services, National Agricultural Development Programme, Food Security, Bayelsa State, National Development, Nigeria.

Introduction

Agricultural extension services refer to structured mechanisms through which agricultural knowledge, innovations, and best practices are disseminated to farmers and rural communities, to enhance productivity, resource use efficiency, and rural welfare. These services typically encompass training, advisory support, demonstration trials, farm visits, and information outreach using both interpersonal and mass media techniques (Abdulhamid et al., 2025). Effective extension acts as a bridge between research institutions and farmers, translating scientific breakthroughs into

practical field applications and facilitating feedback flows (Alhassan, 2024). Within the context of national development, extension services are crucial because they ensure that agricultural policies and programmes achieve intended outcomes at the grassroots level, thereby contributing to food security, rural incomes, and sustainable economic growth.

The National Agricultural Development Programme (NADP) is a government-sponsored agricultural intervention initiative designed to revitalize the agricultural sector through infrastructural support, input provision, capacity building, and institutional strengthening. In Nigeria, such development programmes are launched to increase crop yields, reduce food import dependence, and stimulate rural economic activity (Nwankwo et al., 2024). However, the success of NADP depends heavily on how well its policy instruments are translated into actionable field strategies. In several states, the gap between policy and practice has been attributed to weak coordination, inadequate funding, and ineffective extension linkages (Nwankwo et al., 2024; Alhassan, 2024).

Food security denotes a state in which all people, at all times, have access to sufficient, safe, and nutritious food that meets their dietary needs for an active and healthy life. It encompasses dimensions of availability, access, utilization, and stability (FAO, 2023). Meanwhile, national development refers to the broader economic, social, and institutional progress of a country—often captured in measures such as poverty reduction, human capital improvement, infrastructure enhancement, and equitable growth (Nwankwo et al., 2024). In agricultural settings, improved food security is a direct outcome of enhanced productivity and supply chain efficiency; national development is further engendered when agriculture-driven growth spreads into agro-industry, labour markets, and rural infrastructure.

In the specific context of Bayelsa State, agricultural potential is constrained by factors such as flooding, soil salinity, small farm sizes, and weak institutional presence. The implementation of NADP in Bayelsa State thus demands well-coordinated extension services that can adapt interventions to local ecological conditions, mobilize farmers, and monitor outcomes. In Bayelsa, extension agents must engage in areas such as farmer training on resilient crop varieties, demonstration plots in coastal or flood-prone zones, soil amelioration advisories, facilitation of input distribution, liaison with research institutions for adaptive trials, and periodic field visits to ensure proper adoption. These extension interventions are essential to support NADP components like input subsidies, irrigation schemes, credit facilitation, and post-harvest management policies.

By identifying the critical NADP components that depend on extension engagement (e.g., input distribution, adaptive trials, capacity building) and tracing how these link to food security and development, we can build a coherent conceptual model for Bayelsa State. In light of this context, the goal of this study was to investigate the utilization of agricultural extension services for the implementation of the National Agricultural Development Programme for food security and national development in Bayelsa State.

Statement of the Problem

Agriculture remains a cornerstone of Nigeria's economic development strategy, serving as a primary source of livelihood for a considerable proportion of the population and a major contributor to food security. Despite the introduction of the National Agricultural Development

Programme (NADP) to revitalize agricultural productivity, the sector continues to experience structural inefficiencies, particularly at the grassroots level, where implementation is weakest. In Bayelsa State, the potential of agriculture to drive food security and national development remains largely underutilized due to fragmented coordination between policymakers and field actors. The disconnect between designed interventions and their actual adoption by rural farmers poses a substantial challenge, thereby undermining the intended outcomes of government agricultural programmes.

A critical factor in this gap is the ineffective utilization of agricultural extension services, which are meant to serve as the operational vehicle through which NADP initiatives reach farming communities. Extension agents, who should provide technical guidance, training, and continuous advisory support to farmers, often face systemic constraints such as inadequate funding, poor logistical support, and limited professional development. Consequently, several farmers remain unaware of improved farming practices, modern technologies, and available government incentives designed to enhance production. This situation has perpetuated low productivity levels, post-harvest losses, and weak linkages between research institutions and local producers, all of which hinder the achievement of food sufficiency targets and sustainable rural growth.

The persistence of these implementation weaknesses has far-reaching implications for food security and national development in Bayelsa State. When extension services are underutilized, the ripple effect extends to low agricultural output, rural poverty, and continued dependence on imported food commodities, which threaten the country's economic stability and self-reliance. Addressing this challenge requires a comprehensive understanding of how agricultural extension services can be effectively mobilized to strengthen the operational framework of the NADP. In light of this, the present study seeks to investigate the utilization of agricultural extension services for the implementation of the National Agricultural Development Programme for food security and national development in Bayelsa State.

Theoretical Review

The study adopted Rogers' Diffusion of Innovations Theory (2003)

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The theoretical foundation for this study is anchored on Rogers' Diffusion of Innovations Theory (2003), which provides a robust explanation for how new agricultural technologies and practices are disseminated and adopted within rural communities. The theory posits that innovation adoption follows a process of awareness, interest, evaluation, trial, and confirmation, facilitated by change agents who act as intermediaries between the source of innovation and end-users. Agricultural extension agents perform this intermediary role by transmitting research-based information to farmers and by motivating behavioural change through participatory learning and demonstration. Scholars such as Adewale et al. (2022) and Bello et al. (2023) conceptualize the theory as a social process dependent on communication effectiveness, trust, and the socio-economic characteristics of farmers. However, other authors contend that the theory underestimates structural barriers such as policy inconsistency, institutional weakness, and funding limitations that often impede the practical application of innovations in developing contexts. Within the framework of the National Agricultural Development Programme (NADP), the theory underscores the need for functional

extension systems that ensure timely, culturally appropriate, and locally adapted dissemination of agricultural technologies across diverse ecological zones such as Bayelsa State.

While Rogers' model provides a foundational perspective, it is limited in explaining the macro-institutional dynamics that govern agricultural development programmes. To address this limitation, the Systems Theory offers a complementary lens by viewing agricultural extension, research institutions, and policy frameworks as interdependent subsystems within a broader socio-economic environment (Nwankwo et al., 2024). Systems theorists argue that for agricultural programmes like NADP to achieve food security and contribute to national development, there must be synergy between human, institutional, and technological components. This integrated approach reconciles the micro-level behavioural orientation of the Diffusion of Innovations Theory with the macro-level systemic interrelations of national agricultural policy implementation. Consequently, combining both theoretical perspectives provides a holistic understanding of how extension services function as both catalysts for individual behavioural change and as structural instruments for policy operationalization. This theoretical synthesis Thus, guides the present study's conceptual position that effective utilization of agricultural extension services constitutes a strategic pathway for realizing the goals of the National Agricultural Development Programme in enhancing food security and national development in Bayelsa State.

Review of Related Literature

1. Concept of Agricultural Extension Services

Agricultural extension services are widely conceived as organized, intermediary systems that translate research knowledge into field-level practices through advisory visits, demonstrations, and continuous farmer education. In contemporary discourse, extension encompasses both public and pluralistic arrangements, including government departments, farmer organizations, NGOs, and private providers that facilitate technology transfer, behavioural change, and problem-solving tailored to agro-ecological conditions. By connecting research institutes with producers, extension agents function as knowledge brokers who reduce information asymmetries and transaction costs, thereby improving productivity and rural welfare (Agwu, 2023; Alhassan, 2024). In essence, extension is not merely dissemination; it is an interactive, iterative communication process anchored on trust, relevance, and adaptation.

The functional remit of extension historically rested on three pillars: education, training, and the dissemination of innovations delivered through farm visits, on-farm trials, field schools, and mass media. Recent practice adds digital advisory channels, climate-smart content, and market/pricing intelligence, reflecting the sector's shift from input-centric packages to systems thinking that integrates risk, resilience, and value chains (FAO, 2024; World Bank, 2024). This broadened portfolio aligns extension with the four dimensions of food security (availability, access, utilization, and stability), positioning agents to influence agronomic decisions, household nutrition, and post-harvest practices. Where agents are adequately resourced, these services demonstrably increase adoption rates, shorten learning curves, and lift farm incomes.

Nevertheless, conceptualizations diverge around the degree to which extension should prioritize technology transfer versus empowerment and co-production of locally adapted knowledge. While diffusion-oriented models emphasize accelerating uptake of proven practices, systems approaches

contend that extension must grapple with structural constraints finance, markets, and institutions that condition adoption incentives (Camillone, 2020; Agwu, 2023). Emerging Nigerian evidence underscores persistent underfunding and understaffing relative to farmer populations, challenging the notion that information alone drives adoption. These tensions reveal untested assumptions in linear transfer paradigms and justify hybrid models that blend facilitation, brokerage, and policy feedback roles for extension agents.

2. The National Agricultural Development Programme (NADP)

Within Nigeria's policy landscape, state-level Agricultural Development Programmes (ADPs) operationalize federal strategies by coordinating extension, input delivery, rural infrastructure, and farmer training; in public discourse, these are often framed under broader "national agricultural development" initiatives. Current federal direction is articulated in the National Agricultural Technology and Innovation Policy (NATIP) 2022–2027, which targets food security, employment, and wealth creation through technology scaling, institutional reforms, and market linkages (Federal Ministry of Agriculture and Rural Development, 2022/2024). ADPs therefore, sit at the implementation frontier, translating policy instruments into context-specific extension packages for smallholders across diverse agro-ecologies.

The programme logic typically combines supply-side measures seed systems, input subsidies, mechanization support, irrigation, and research–extension–farmer linkages, with demand-side enablers such as market access, storage, and value-addition. State exemplars describe ADPs explicitly as vehicles for extension-led productivity growth among smallholders, signaling the centrality of advisory services to programme performance (Nasarawa State Government, n.d.). Yet historical reviews caution that recurrent fiscal volatility, coordination gaps, and weak monitoring have periodically blunted the effectiveness of these instruments, creating variation in outcomes across states and years (Camillone, 2020).

Bayelsa-focused evidence indicates that the State ADP's project and extension portfolios have been evaluated with mixed results, reflecting both the promise of structured outreach and the drag of implementation bottlenecks common to deltaic environments, access constraints, flooding, and dispersed settlements. Survey-based assessments document how farmer exposure to ADP extension correlates with adoption and productivity, while also noting constraints in logistics, staffing, and follow-up (Wauton & Odinwa, 2022; AJAEES, 2022). These findings reinforce a key proposition for this study: the "national" programme's success is mediated by sub-national extension capacity, which determines how policy intentions materialize on farms in Bayelsa.

3. Extension Service Delivery and Food Security in Nigeria

A growing body of Nigerian scholarship links robust extension delivery to improvements across all four pillars of food security. Through targeted education, training, and timely information, extension increases yields (availability), improves incomes and market participation (access), supports nutrition-sensitive practices (utilization), and promotes climate-smart adaptation that buffers shocks (stability). Global and national agencies similarly assert that sustainable food and agriculture agendas hinge on effective advisory systems that mainstream resilience and inclusion, especially for smallholders (FAO, 2024; World Bank, 2024). This systems-level framing moves beyond yields alone to the stability of food systems under climate and market volatility.

Empirical and programmatic reviews within Nigeria report that where extension is adequately staffed and financed, adoption of improved varieties, better husbandry, and post-harvest handling rises, reducing losses and smoothing seasonal scarcities. Conversely, chronic resource deficits and high agent-to-farmer ratios depress contact frequency and erode advisory quality, diluting programme effects (Camillone, 2020). Recent analyses also emphasize digital extension and e-agriculture as accelerators of reach and timeliness, though they caution that connectivity gaps and digital literacy remain binding constraints in rural zones (Akpabio, 2025). These patterns suggest that the extension's food-security impact is conditional on organizational capability and enabling infrastructure.

Cross-state comparisons further reveal heterogeneous productivity responses to ostensibly similar interventions, pointing to contextual moderators such as ecology, market access, and local governance. Studies in northern and central states document gains where agent networks and farmer organizations are dense, while coastal and riverine contexts face mobility and coordination challenges that dampen returns to advisory investment (Lai-Solarin et al., 2024; Alhassan, 2024). For Bayelsa, this evidence motivates a tailored extension strategy that integrates mobility solutions, climate adaptation content, and community-embedded lead-farmer models to unlock food-security dividends within the National Agricultural Development Programme.

4. Challenges of Extension Services in Bayelsa State

The operational terrain of Bayelsa State presents distinctive ecological and infrastructural constraints that complicate routine extension delivery, including seasonal inundation, low-lying tidal landscapes, dispersed riverine settlements, and transport bottlenecks that raise the cost and reduce the frequency of farm visits. Evidence from recent Nigerian flood assessments shows that the 2022 nationwide floods disrupted agricultural activities across 33 states, with the Niger Delta among the hardest hit, undermining access to fields, damaging community infrastructure, and interrupting training calendars, all of which directly erode advisory contact and on-farm demonstrations essential to adoption (Audu et al., 2024; Eteh & Edem, 2025). Bayelsa-focused analyses further document how recurrent flooding compromises practical agricultural training and destroys demonstration plots, thereby weakening the pedagogic core of extension and limiting farmers' exposure to adaptive practices (Nwaubani & Okoli, 2025). In this setting, the travel time, logistics, and safety considerations associated with riverine mobility constrain agent coverage and diminish the timeliness of advice, especially during peak agronomic windows when guidance is most consequential.

Institutional and fiscal constraints compound these ecological pressures. Evaluations of the Bayelsa State Agricultural Development Programme (ADP) report mixed performance—extension exposure correlates with adoption where contact occurs, yet underfunding, vehicle shortages, and staffing gaps depress the regularity and quality of service (Wauton & Odinwa, 2022). Broader national reviews similarly highlight chronic resource deficits, high agent-to-farmer ratios, and weak monitoring systems that attenuate programme effects and reduce accountability for results (Camillone, 2020; World Bank, 2025). The consequence is a structural implementation gap: even well-designed input support or training schemes fail to materialize at the farm level without predictable operational budgets, field logistics, and performance management frameworks that reward intensive farmer engagement.

Policy evolution has introduced promising digital pathways, but uneven readiness risks new divides. The Federal Government's National Electronic Extension Platform (NEEP) and allied e-advisory initiatives aim to scale low-cost, timely messages to dispersed smallholders; multilateral and international agencies likewise advocate modernized, climate-responsive extension that integrates ICTs and resilience content (Federal Ministry of Agriculture and Food Security, 2025; FAO, 2023; CABI, 2025). Yet in riverine Bayelsa, connectivity gaps, device affordability, and digital literacy can limit uptake unless complemented by last-mile facilitation and human brokerage. This reveals an implementation paradox: digital tools can extend reach, but only if embedded in well-resourced local systems that solve the physical access problem while safeguarding inclusivity for the hardest-to-reach communities.

5. Linking Agricultural Extension to National Development

Conceptually, effective extension is a leverage point through which agricultural policy translates into broad-based development—increasing productivity (availability), stabilizing household incomes (access), improving nutrition-sensitive practices (utilization), and building resilience to climatic and market shocks (stability). International syntheses argue that when advisory systems are adequately staffed, funded, and performance-managed, they accelerate adoption, shorten learning cycles, and crowd-in complementary investments across seed systems, input markets, storage, and processing—multipliers that link farm-level gains to agro-industrial growth and rural employment (FAO, 2024; World Bank, 2024). In Nigeria, transport and market access interventions have been paired with extension to unlock value-chain efficiencies, underscoring that advisory services are most development-enhancing when coupled with rural infrastructure and enterprise development policies. This systems perspective reframes extension from a narrow information conduit to a catalyst of structural transformation in food systems.

Within Nigeria's current policy architecture, the National Agricultural Technology and Innovation Policy (NATIP) 2022–2027 positions extension as the operational backbone for technology scaling, inclusion, and climate adaptation, while state ADPs sit at the implementation frontier where programme instruments meet farmer realities. NATIP's emphasis on innovation ecosystems, market linkages, and data systems implies that advisory services must broker relationships among research, input suppliers, financial services, and processors to convert innovation pipelines into measurable productivity and welfare outcomes (FMARD, 2024; IFPRI, 2022). In coastal states such as Bayelsa, aligning extension content with flood- and salinity-tolerant varieties, adaptive planting calendars, and risk-management tools (e.g., insurance and early-warning) is central to translating national policy ambition into localized development dividends.

At the same time, scholarly debate cautions against linear “technology-push” models that presume information sufficiency; pluralistic, climate-responsive, and equity-centered approaches are required to address structural barriers that mediate adoption, including finance, market power, gendered access, and institutional capacity (African Climate Foundation, 2025; CABI, 2025). Emerging Bayelsa and Niger Delta evidence suggests that advisory impact is highest where human brokerage, community leadership, and digital tools are combined, ensuring both reach and relevance under mobility constraints (Nwaubani & Okoli, 2025; Wauton & Odinwa, 2022). Therefore, the linkage from extension to national development is contingent on an enabling system that integrates resilient infrastructure, inclusive digitalization, and accountable service delivery—

conditions under which extension becomes a reliable conduit through which national programmes such as the ADP/NADP drive food security and inclusive growth.

Implications for Policy and Practice

The conceptual analysis of agricultural extension services within the framework of the National Agricultural Development Programme (NADP) provides several strategic implications for government policy in Nigeria, particularly for Bayelsa State. At the policy level, the findings underscore the necessity of strengthening institutional capacity and resource allocation for extension operations. A consistent budgetary provision should be established to ensure regular field mobility, logistics, and remuneration for extension agents. Beyond funding, the government must also prioritize continuous professional development through systematic training and retraining programmes that reflect the evolving demands of climate-smart agriculture, digital extension, and gender-inclusive participation. Incorporating advanced data analytics and real-time monitoring into the extension management system will also enhance transparency, accountability, and performance evaluation. Thus, effective policy realignment must transition from short-term project funding to long-term institutionalization of extension as an indispensable component of Nigeria's agricultural governance architecture.

For agricultural institutions, the implications point towards the urgent integration of information and communication technologies (ICTs) in extension communication and coordination. The deployment of mobile-based advisory platforms, online resource hubs, and remote sensing tools can bridge the spatial and logistical barriers that constrain agent-farmer interaction, especially in flood-prone and riverine environments like Bayelsa. Training institutions and agricultural research centers should collaborate to produce digital content that simplifies scientific information for farmer consumption while encouraging feedback mechanisms through participatory media. Moreover, polytechnics, universities, and vocational centers in Bayelsa can serve as innovation incubators by embedding extension technology into their agricultural curricula, thereby equipping the next generation of practitioners with the competencies to operationalize digital agriculture effectively. These interventions will not only modernize extension systems but also align them with Nigeria's broader digital transformation agenda in the agricultural sector.

At the community level, the study's conceptual synthesis reinforces the importance of participatory extension models that empower local farmers as co-creators of knowledge rather than passive recipients. Strengthening farmer field schools, cooperative societies, and community-based organizations will enhance trust, ownership, and sustainability of extension initiatives. By embedding community feedback loops into programme design, extension agents can ensure that agricultural innovations are culturally appropriate, economically feasible, and ecologically sustainable. Furthermore, community empowerment through inclusion of women and youth in local advisory networks will promote equity and intergenerational learning, expanding the reach of NADP interventions beyond traditional boundaries. Such empowerment is critical for achieving sustained food security and rural resilience across Bayelsa's complex socio-ecological landscape.

Finally, the conceptual framework advanced in this paper opens a pathway for future research aimed at empirical validation. Scholars can apply quantitative and mixed-method approaches to test the proposed relationships between extension service utilization, NADP implementation, and food security outcomes across different ecological zones in Nigeria. Comparative studies among

coastal, savannah, and hinterland states could reveal how contextual factors mediate extension effectiveness, while longitudinal analyses may determine how policy reforms shape long-term productivity and welfare indicators. In light of these prospects, the present study calls for a multidisciplinary research agenda that integrates economics, environmental science, sociology, and information technology to deepen understanding of extension's transformative potential. Therefore, institutionalizing a research policy practice feedback mechanism remains a vital step toward achieving resilient food systems and sustainable national development in Bayelsa State and beyond.

Conclusion

The conceptual exposition presented in this study reaffirms that agricultural extension services constitute an indispensable vehicle for translating the objectives of the National Agricultural Development Programme (NADP) into measurable outcomes of food security and national development. As discussed, extension agents serve as the crucial link between agricultural research, policy implementation, and farmers' adoption of improved technologies. By providing continuous education, training, and advisory services, extension systems bridge the gap between innovation and application, ensuring that government interventions reach the intended beneficiaries at the grassroots level. The integration of well-structured extension networks within the NADP framework Thus, transforms policy intentions into tangible productivity gains, enhances farmer competence, and strengthens the institutional fabric that sustains agricultural progress. This conceptual alignment establishes agricultural extension as both a technical and social mechanism for actualizing Nigeria's broader agricultural transformation agenda.

Furthermore, the effective utilization of agricultural extension services has far-reaching implications for strengthening local food systems and combating rural poverty. When extension activities are properly funded, professionally managed, and strategically deployed, they enable farmers to make informed decisions on crop selection, pest management, post-harvest handling, and market participation. This, in turn, leads to higher yields, reduced food losses, and improved household incomes. In Bayelsa State, where ecological vulnerabilities and infrastructural limitations pose unique challenges, extension services play an even more critical role in disseminating adaptive farming techniques that mitigate the effects of flooding, soil degradation, and climate variability. Consequently, enhanced extension delivery not only promotes food sufficiency but also underpins inclusive economic growth and social stability, cornerstones of national development. In this context, extension becomes a strategic tool for achieving the Sustainable Development Goals (SDGs), particularly those related to zero hunger, poverty eradication, and sustainable livelihoods.

Suggestions

In light of these conclusions, this study suggests that governments at all levels should prioritize the revitalization of extension systems through increased funding, improved logistics, and continuous capacity development for extension personnel. Digital innovation must be integrated into extension operations to overcome the challenges of accessibility in rural and riverine communities, particularly through mobile-based advisory platforms and e-learning portals. Agricultural institutions should also strengthen partnerships between research bodies, universities, and local communities to ensure that innovations are contextually relevant and demand-driven. Moreover,

community-based extension models that emphasize participatory learning and inclusivity should be institutionalized to enhance ownership and sustainability of agricultural programmes.

Finally, it is recommended that future research efforts focus on empirically validating the conceptual relationships proposed in this study, particularly by exploring how extension utilization mediates the implementation outcomes of the NADP across Nigeria's diverse ecological zones. Such evidence-based investigations will inform targeted policy reforms and optimize the design of agricultural interventions that combine traditional advisory approaches with digital innovations. Ultimately, if agricultural extension services are systematically strengthened and strategically aligned with national policy frameworks, they will not only accelerate the achievement of food security in Bayelsa State but also serve as a sustainable engine for Nigeria's long-term national development.

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