



## RESEARCH ARTICLE – 4

# THE SOCIAL & ECONOMIC BENEFITS OF EMBRACING LOCAL TECHNOLOGY FOR IMPROVING LIVING STANDARDS IN NIGERIA.

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## ABSTRACT

Nigeria faces developmental challenges such as food insecurity, limited access to healthcare services, financial exclusion, and high youth unemployment. In contrast, there is a focus on digital adoption and a relatively unexplored area in the socio-economic impacts of local technologies. The aim is to investigate the potential role of native innovations in promoting sustainable development and enhancing quality of life, as part of ongoing research. This study employed a sequential mixed-methods approach; primary data were collected and analysed from 1,115 respondents, including surveys of smallholder farmers, household questionnaires, interviews with micro-entrepreneurs, questionnaires for youths, and key informant interviews. Secondary data were supplemented by national statistical and institutional reports. The analytical methods used included difference-in-differences, propensity score matching, multivariate regression, and thematic analysis.

Adoption of indigenous NSPRI storage technologies reduced post-harvest loss by 25-40%. Communities delivered contextually powered service platforms, such as mHealth, fintech performed considerably better than traditional regimes. Fintech added directly to GDP, and its contribution to total output went from 0.7% (2020) to 2.3% (2024). Digital skills training induced a 32% increase in youths' employment opportunities but not evenly for both sexes. Lack of infrastructure, fragmented regulation and low digital literacy were key obstacles to adoption. Local technologies have the capacity to uplift the quality of life in Nigeria. But they only work if conditions are right for them. We recommend a number of evidence-based policy recommendations such as the establishment of Technology Innovation Zones, a National Digital Literacy Fund and flexible regulation to create an environment conducive to domestic innovation.

## INTRODUCTION

Nigeria is at a critical juncture on its developmental path. The country is rich in both human and raw materials, yet remains trapped in poverty after ranking 164 out of the 193 on the list of Human Development Index (UNDP) but also confronts big issues including how it could tackle health care, boost agriculture productivity and bring down youth unemployment. Strategic hybridization of the technology developed locally holds out the

promise of evolutionary paths to escape the above structural constraints, while respecting local knowledge and ensuring contextual relevance (Fafchamps & Minten, 2023; Akpan et al. This article shows the potential of indigenous technologies to catalyse a better quality of life, and sustainable development based on endogenous factors, in Nigeria's divergent socio-economic settings.

The implementation of technology in the Nigeria local context The proposition of Nigeria provides a strong rationale for investigating the use of technology at a local level. There is a thriving tech scene, not least in bubbling Lagos's start-up ecosystem, amid continued development challenges. Nigeria has a median age of 17.9 years (National Bureau of Statistics [NBS], 2023) hence its young population is both the demographic dividend and jobs challenge; even with youth unemployment rate at about 38% it is still high (NBS, 2013). At the same time, structural deficits in crucial areas of need ensure that poverty and inequality continue to deepen. The doctor to patient ratio is about 1:9083 which is below WHO's recommendation, and agricultural output is still constrained by poor access to modern technology (Ojo & Baiyegunhi, 2024).

The research is supported by five core research questions relating to sectoral impacts, tract comparison, entrepreneur ecosystem development, human capital training and systemic barriers. Based on a rich empirical analysis that draws illustrative insights from impact evaluation, this paper demonstrates how local technologies that already exist can be scaled up to contribute toward achieving the Sustainable Development Goals (SDGs) and improving Nigerian lives.

## **Background and Problem Statement**

Nigeria's technological sector was shaped through inventive adaptation and contextualisation. Despite the proliferation of digital innovations, their impacts on living standards are not sufficiently documented. A persistent gap exists between technological innovations and practical application, highlighting the need for further research into the circumstances under which local technology can generate social and economic benefits (Bryld, 2024; Cole et al., 2025). In agriculture, which employs about 35% of Nigeria's workforce, post-harvest loss remains extremely high—up to 40% for some grains—largely due to low adoption of improved storage tools and technologies in the sector (NSPRI, 2024).

For digital health technologies (DHTs), integration challenges include operational barriers, limited network coverage, and cultural sensitivities (Cole et al., 2025). Additionally, in the financial sector, structural exclusion persists among women, rural residents, and micro-entrepreneurs despite the expansion of Fintech (EFina, 2014). These challenges emphasise the urgent need to deploy context-specific technologies that address Nigeria's unique socio-economic conditions.

## **Research Questions**

These five key research questions shape this research:

- The Sectoral Impact Question: How much has the use of traditional agriculture-based technologies (e.g. established NSPRI storage facilities, indigenous irrigation mechanisms) influenced food security, smallholder farmer income and rural community resilience in Nigeria's Middle Belt?
- The Comparative Development Question: What is the difference in community level access to basic services (e.g. health information, financial inclusion, clean energy) between communities in Nigeria that have implemented locally innovated tech solutions (e.g. mobile health platforms, fintech apps and solar micro grids for example), from those dependent on traditional or centralized systems?
- The Entrepreneurship & Value Chain Question To what extent has the development of the fintech sector in Nigeria, led by local innovators influenced key national economic performance indicators [such as: contribution to GDP levels and Financial Inclusion rates] as well as enabling micro- entrepreneurs through increased access to credit facilities and digital payment solutions?
- The Human Capital & Gender Question: What is the connection between the increase in locally-owned digital skills training platforms and employment trajectories, earnings potential and social agency of urban youth, especially girls and young women, in Lagos and Abuja?
- The Systemic Barriers & Policy Question Given the evidence of benefits identified, what are the key policy, political, regulatory and infrastructural barriers constraining widespread diffusion of locally-developed technologies within Nigeria's Public Health and Education sectors? What sort of policy interventions would be most effective to overcome these?

## Research Objectives

The key goals of this work are:

- a) To measure returns differentials to indigenous agricultural technology in productivity, incomes, and household risk-bearing in Nigeria's Middle Belt.
- b) To compare performance and outcomes comparing locally grown tech solutions with conventional approaches for basic service delivery.
- c) To assess the economic impacts of Nigerian fintech industry and its implications on micro-entrepreneurship.
- d) To evaluate the Human Capital Development impact of digital skills-training platforms for urban youth with a focus on gender disparities.
- e) To understand structural barriers to adoption and suggest evidence-based policy solutions.

## Scope and Limitations

This study considers technology-led solutions implemented with or adapted to the Nigerian local context. The analysis covers agricultural, health, financial services and energy applications during the period from 2015 to 2025. Geographically, the study focus is also on a number of areas: Middle Belt in terms of agricultural technology; Lagos and Abuja for

digital skills and fintech analysis; and cross-cutting insights from comparative communities throughout six different states as part of our service delivery assessment.

We recognise several methodological constraints, such as potential sampling bias in conflict zones, the absence of longitudinal data due to a cross-sectional design, and challenges in establishing counterfactuals for impact modelling. These constraints will be mitigated through triangulation methods and a robust methodological approach, as detailed in the Methods section.

## **LITERATURE REVIEW**

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### **Theoretical Foundations**

There are a number of theoretical models that underpin this research. In order to tell a story in which plants do indeed have net positive local externalities, more attention should be paid to relying on Romer's (1990) and Aghion and Howitt's (1992) PCR models of technology innovations as endogenous determinants of the pace of overall growth that are good for capturing how locally-invented technologies facilitate productivity gains arising from within. Socio-technical Systems Theory (Geels, 2004) is a great perspective from which one can understand differing community adoption as they may develop at different rates of uptake and abandonment. What is more, the Capability Approach (Sen, 1999) also offers a normative stance to assess technology not in terms of their market resource value but in terms of their contribution to enhancing human capabilities and freedoms.

Such post-development perspectives (Escobar, 2018) could see orthodox models of technology transfer turned on their head and locally generated innovation systems as an end (or means: Zaman, 2023). “This is crucial in examining locally indigenous technologies which originate from a situated appreciation of Nigerian problems.

### **Empirical Results on Local Technology Adoption**

In agriculture, it was revealed that NSPRI storage technologies reduced post-harvest loss significantly and adoption is associated with a rise in income of the smallholders (Ojo & Baiyegunhi, 2024). Yet, there has been limited research into their impact on broader community resiliency.

In health, scoping reviews found that digital health technologies (DHTs) may promote treatment adherence and facilitate healthcare access in Nigeria, with mobile applications as a potential solution for the underserved (Cole et al., 2025; Fagbemi et al., 2024). The literature also highlights significant infrastructure and digital literacy barriers.

The fintech sector in particular has caught the fancy, and there are studies that focused on its contribution toward financial inclusion (Ovia, 2023; David-West et al., 2024). Empirical evidence indicated that mobile money has lowered the cost and increased access to transactions; however, how this ultimately translates into better quality of life for micro-enterprises are not known yet.

## Gaps in the Literature

Such interest in local technology generation, however, continues to suffer from serious information knowledge gaps. In the first place, there is little comparative investigation into the divergent effects of local versus imported technology on development across sectors. Further, the evidence based on technology adoption and its impacts in gender-disaggregated terms is still limited, especially when it comes to understanding how digital platforms enable women's economic empowerment and social agency. Third, the political economy of technology policy in Nigeria is under-researched, with insufficient focus on how power relations and institutional structures influence technological transfer.

This is the gap this research intends to address through a wide-ranging empirical examination of how local technology uptake has multifaceted relationships with different socio-economic outcomes in different groups in Nigeria.

## THEORETICAL FRAMEWORK

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The study adopts a holistic theoretical approach, where the Digital Ecosystem Framework (Osiri et al., 2023) is applied to local level technology adoption in multiple sectors. This hybrid approach enables the examination of both technical and social systems that together determine development results.

The regional technologies are mediating or intermediate variables that interact with institutional configurations, resource endowments, and social formations. The framework highlights that technology change and social change are recursively related; the linear integration model has been replaced, and a co-evolutionary perspective remains unchallenged (Geels 2004).

Key analytical concepts derived include:

- a) Technological Contextualisation – the technology that meets such needs within local socio-economic and cultural context.
- b) Institutional Embeddedness: The Extent to which technologies fit the established societal organisations and governance structure.
- c) R&D Appropriate: The ability of indigenous actors to alter and direct technologies in line with their own development agendas.

## RESEARCH METHODOLOGY

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### Research Design

This study used a mixed-methods-within-study design (Creswell and Plano Clark, 2023). Quantitative surveys helped identify patterns, while qualitative methods explored processes and lived experiences. A comparative case study framework guided the research and allowed for analysis of technology integration in agriculture, health, finance, and energy across different settings.

## Data Collection

Stratified random sampling was applied for survey distribution, while purposive sampling was used for qualitative data collection, resulting in 1,115 primary respondents. Survey instruments underwent back-translation to ensure conceptual equivalence in Hausa, Yoruba, and Igbo. The data collection strategy is summarized in the preceding table.

**Table 1: Data Collection Methods and Sources**

UQuestion	Primary Data Sources	Secondary Data Sources	Analytical Approach
Sectoral Impact (Q1)	Surveys with 100 smallholder farmers; 6 FGDs in Middle Belt.	NSSP surveys (IFPRI, 2025); NBS data.	Difference-in-differences; Multivariate regression.
Comparative Development (Q2)	Household surveys (n=100); Service facility assessments.	DHS; National Living Standards Surveys (NBS).	Propensity score matching; Comparative case analysis.
Entrepreneurship & Value Chain (Q3)	Fintech firm surveys (n=20); Interviews with 150 micro-entrepreneurs.	Central Bank of Nigeria reports; IFPRI policy briefs.	Input-output analysis; Value chain mapping.
Human Capital & Gender (Q4)	Youth surveys (n=800); Skills tests; Employer interviews.	Gendered skilling study (LBS, 2024); NBS unemployment data.	Structural equation modeling; Gender analysis framework.
Systemic Barriers & Policy (Q5)	Key informant interviews (n=45); Policy document review.	Literature on DHT challenges; Government policy documents.	Thematic analysis; Institutional analysis.

## Analytical Techniques

Multivariate regression models were used to estimate adoption and impacts, accounting for confounders. We employed propensity score matching to generate counterfactuals against which the exposure could be compared. A thematic analysis, using both deductive (theory-driven) and inductive coding of qualitative data, was then conducted. Fabric and joint displays were utilised to combine the mixed methods.

## Ethical Considerations

The study complied with high ethical standards and was approved by the institutional review boards. On the ground, informed consent, confidentiality and safety of participants.

## FINDINGS AND DISCUSSION

### The impact of indigenous agricultural technologies across sectors

High positive correlations have been observed in Nigeria's Middle Belt between the adoption of indigenous agricultural technologies and development indicators. The reduction ranged from 25% to 40% in post-harvest losses in NSPRI adopting communities compared to non-adopting communities ( $p < 0.01$ ) and, in fact, directly provided food during times of hunger. Farmers with small farm holdings, using localised irrigation techniques, were found to experience higher income stability in the face of climatic variation. For drought periods, 68% of adopters had constant in-household food consumption compared with 42% among non-adopters ( $p < 0.05$ ). These technologies increase the resilience of community raising units by increasing production options offered by Ojo & Baiyegunhi (2024). However, the uptake levels were limited due to a lack of access to credit facilities, highlighting the need for financial support mechanisms (Nwagboso 2023). There were also differences between communities, with stronger effects in the communities where traditional authority and collective action were higher. This means that technology effectiveness is mediated by social capital and the acknowledgement of the importance of socio-cultural context (Uphoff, 2023).

### Comparison of Community Basic Services Accessions

Initial findings indicate there are very major access gaps if more tech-d services and propagating the old ways of the past offerings (connected using home-grown technological solution) are compared with those connected using old traditional means.

**Table 2: Comparative Service Access Between Technology-Integrated and Traditional Communities**

Service Type	Technology-Integrated Communities	Traditional Systems Communities	Disparity Ratio
Healthcare Information	68% access via mobile platforms	32% through health facilities	2.1:1
Financial Inclusion	63% using fintech apps	28% using formal banks	2.3:1
Clean Energy Access	45% with solar micro-grids	22% with national grid	2.0:1
Educational Resources	51% digital access	31% physical access only	1.6:1

Technology-connected communities were much more satisfied with services, particularly dependability and cost. By the interventions, these communities were found to raise rates of preventive service use by 23% ( $p < 0.05$ ). However, there were age, gender and education-based patterns of digital exclusion which upheld the literature on the digital divide (Omona & Ikoja-Odongo, 2023). Hybrid service models, including digital and traditional medical distribution systems, had the largest coverage area, suggesting that technological solutions should be more complementary instead of substitutive to existing infrastructure.

## **Fintech Growth and Economic Empowerment**

Nigeria's fintech industry continues to be a major economic driver, contributing directly to 0.7% of the country's Gross Domestic Product (GDP) in 2020 and is expected to rise to around 2.3% by 2024. This is indicative of a strong innovation ecosystem and fast growth in the uptake of digital financial services (CBN, 2024).

At the micro level, 52% of entrepreneurs surveyed said they found credit easier to secure in digital platforms, compared with conventional banks. The increased accessibility was associated with company growth: more products in stock (37%), extra employee recruitment (18%) and diversified selection of goods (42%). These results are consistent with Ovia (2023) on the revolutionary prospects of fintech. But, the benefits of these opportunities were not evenly felt as women entrepreneurs and rural businesses benefited less thereby suggesting a participation gap that demands specific attention (Olufote et al., 2023).

## **Digital Skills in Youth Empowerment and Capacity Development**

A study supported by WIEGO from Lagos and Abuja demonstrates the cyclical nature of digital skills training and youth employment. Program participants were 32% more likely to be employed than matched non-participants ( $p < 0.01$ ). This figure also reveals notable gender disparities: Young women experienced a 28 percent increase in employment compared to a 35 percent increase for young men, despite having the same completion rates.

Mediating factors included internet access, mentorship, and curriculum-market alignment. Technical schools that integrated entrepreneurship into their training programmes were 25 per cent more likely to start a business. For young women, acquiring digital skills was linked to increased social agency, such as greater participation in household financial decision-making. However, gender-based discrimination, security issues, and unequal domestic responsibilities continued to act as structural barriers that limited achievements, as similarly reported by David-West (2024).

## **Systemic Barriers and Policy Implications**

The study uncovers shared barriers which still impede the spread of the designs. In health care and education, important barriers include a lack of infrastructure, low levels of digital literacy and flawed incentives (Cole et al., 2025; Fagbemi et al., 2024).

Political and regulatory obstacles (institutional). These include policy instability, multiple jurisdiction overlays and lack of intergovernmental coordination. The 2023 Electricity Act was passed, resulting in a fully integrated territorial regulation." (Serrari Group, 2025) The 2023 Act is an off-the-shelf model for other kinds of coordination problems within the energy sector. The same kind of sectoral reforms are also needed in health and education.

## CONCLUSION AND POLICY IMPLICATIONS

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### Summary of Key Findings

This study helps to reveal some of the compounding effects that technologies developed locally have on the standard of living in Nigeria. In all sectors, contextual technologies solutions can have a substantial potential to contribute to development challenges when combined with an enabling environment and related investments. Key findings include:

- a) Indigenous Agricultural Technologies contribute significantly to food security and community resilience in Nigeria's middle belt, but social institutions and access to complementary resources shape the impacts.
- b) Community-generated models of service delivery perform better than stand-alone systems across a range of access and satisfaction measures, with hybrid approaches holding particular potential.
- c) Fintech has become a significant contributor to economic growth and access to finance, but the gains have been unevenly distributed.
- d) Digitalised skills training schemes are associated with positive employment outcomes for urban youth, yet gender-specific barriers limit young women's success.
- e) Structural impediments to technology adoption are pervasive and call for a comprehensive policy response at the infrastructure, regulatory, and skills levels.

### Theoretical and Practical Contributions

There are several theoretical implications of this study for understanding technology innovation in developing countries. It adopts a co-evolutionary theory of technological change that emphasises the mutual shaping of socio-technical nexuses and social orders. The study also introduces the concept of 'developmental appropriation' to explain how local actors reshape technologies to align with their specific development priorities context.

In a practical sense, the study also provides policymakers, technology developers, and practitioners with evidence-informed recommendations. The results highlight the importance of user-centred approaches to design, as well as additional investments in digital infrastructure and literacy, and flexible regulatory policies that strike a balance between fostering innovation and safeguarding consumers.

### Policy Recommendations

Policy recommendations These policy options are being suggested in line with the results of the present research:

- a) Create Technology Innovation Zones, with simplified regulations and fiscal incentives to help drive local technology development that addresses sector-specific challenges.
- b) Set up a National Digital Literacy Fund to support skills training, especially for women and disadvantaged groups, through curriculum relevant to market-based requirements.
- c) Establish Sector Specific Technology Integration Roadmaps that prioritize applications, infrastructure investments and regulatory changes necessary to facilitate adoption.
- d) Encourage Research- Industry Interactions by providing matching grants and collaborative R&D programmes to make technological innovations system friendly.
- e) Develop flexible and risk-based Regulatory Approaches that allow experimentation with novel technologies while managing risks possibly through the use of regulatory sandboxes.

### Directions for Future Research

This study suggests several directions of future research which seem promising:

- a) Longitudinal studies of the long-run effects of technology adoption on intergenerational mobility, structural transformation.
- b) or comparative research on local technology ecosystems across diverse African settings to distil lessons that can be transferred.
- c) Problematizing the political economy aspects of technology policy, including how power relations influence regulation and resource distribution.
- d) Research on the ‘ecological sustainability’ of locally engineered technologies and their climate-resistant (climate-resilient) potential.

In conclusion, this research suggests that indigenous technologies could be a promising pathway to improve living standards in Nigeria if supported by appropriate policies and investments. The knowledge-driven innovative use of these technologies, harnessing local expertise and contextual relevance, can address persistent development challenges and create avenues for sustainable progress in social and human development.

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