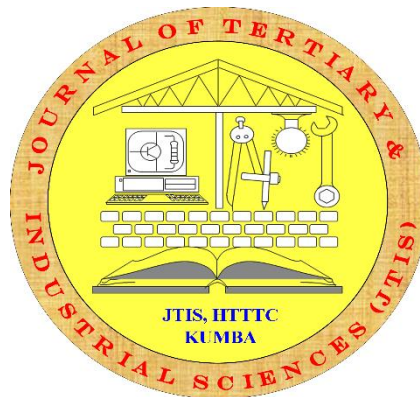


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## The Digital Harvest: An Exploratory Study on the Impact of Digital Technology Adoption on Agribusiness Growth in Cameroon

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### Abstract

This exploratory research paper investigates the relationship between digital technology adoption and agribusiness growth in Cameroon. Despite agriculture's critical role contributing approximately 15% to GDP and employing over 60% of the active population the sector faces entrenched challenges: low productivity, post-harvest losses estimated at 25–35%, and inefficient value chains that erode profitability. Digital technologies including mobile market platforms, digital financial services, and precision agriculture offer potential solutions. Using a mixed-methods design involving a survey of 200 agribusinesses across the Littoral, West, and Centre regions (conducted October–December 2024), the study finds a statistically significant positive correlation between digital adoption intensity and key growth metrics (revenue increase, market expansion). However, overall adoption remains critically low (38%). Primary barriers are high costs (85% of respondents), poor internet connectivity (78%), and limited digital literacy (65%), with language barriers (40%) emerging as a locally specific constraint. The findings call for coordinated policy interventions in infrastructure, affordability, and human capital development.

**Keywords:** Digital Harvest, Digital Technology Adoption, Agribusiness Growth and Cameroon

### 1. Introduction

Agriculture is the economic backbone of Cameroon, providing livelihoods for a majority of the population and serving as a primary source of foreign exchange (World Bank, 2023). However, the sector is trapped in a low-equilibrium trap: smallholder farmers and agribusinesses struggle with fragmented supply chains, information asymmetries, and limited access to finance and markets (Kamga & Fobasso, 2022). Post-harvest losses alone are estimated to cost the Cameroonian economy over 200 billion CFA francs annually (Nkengla-Asi & Mfouapon, 2022).

In response, a wave of digital innovations collectively termed AgriTech has emerged globally. These include mobile applications like AgriMarket and E-Farm that connect producers to buyers, mobile money platforms (MTN Mobile Money, Orange Money) enabling secure transactions, and advanced tools like drone-based crop monitoring and soil sensors (Tsan et al., 2024). The underlying promise is that digital technologies can reduce transaction costs, improve access to information, and enhance decision-making (Aker, 2011).

Despite this potential, adoption in Cameroon lags behind regional peers like Kenya and Nigeria (Bongajum et al., 2023). This gap between potential and reality motivated our

exploratory study. Specifically, we ask: Does digital technology adoption correlate with agribusiness growth in Cameroon, and what factors explain the current low adoption levels? Answering this question is essential for designing effective policies and investments to unlock the sector's digital transformation.

The Cameroonian government has launched several digital agriculture initiatives, including the National Strategy for Digital Agriculture (2020–2025). Yet, empirical evidence on their impact remains scarce. A recent survey by Bongajum et al. (2023) found that only 25% of agribusinesses in Cameroon used any digital platform for sales, a figure far lower than in East Africa. This raises a critical concern: are these policy efforts failing, or are they addressing the wrong barriers?

The conventional wisdom suggests that digital technologies drive growth by reducing transaction costs and improving market access (Aker, 2011). However, this assumption has not been rigorously tested in the Cameroonian context. Most existing studies focus on smallholder farmers rather than agribusinesses, or on single technologies (e.g., mobile money) rather than a composite adoption intensity (Kamga & Fobasso, 2022). Therefore, there is a clear need for an exploratory study that (a) quantifies the adoption-growth relationship for a broad range of technologies, and (b) identifies the specific barriers faced by Cameroonian agribusinesses.

Primary Objective is to explore the relationship between digital technology adoption and the growth of agribusinesses in Cameroon. Specific Objectives are: To Assess the current level and diversity of digital technologies adopted by Cameroonian agribusinesses. To Examine the statistical relationship between adoption intensity and growth indicators. To Identify and rank the primary barriers and drivers of adoption as perceived by agribusiness owners.

## **2. Literature Review**

### **2.1. Conceptual Literature Review**

**Digital Technology in Agriculture:** Following Deichmann, Goyal, and Mishra (2023), digital agricultural technologies can be grouped into four categories: Digital Marketplaces and Information Services: Platforms that provide real-time price data, weather forecasts, and connect buyers and sellers. Examples in Cameroon include AgriMarket and E-Farm.

Digital Financial Services (DFS): Mobile money, digital credit scoring, and insurance products that reduce transaction costs and increase financial inclusion (Aker & Mbiti, 2010).

Precision Agriculture Technologies: GPS mapping, drones, soil sensors, and variable-rate application tools that optimize inputs (Basso & Antle, 2020). These remain rare in Cameroon.

Supply Chain and Logistics Software: Inventory management, traceability, and logistics optimization systems (Okafor et al., 2024).

**Agribusiness Growth:** Growth is multi-dimensional. We operationalize it using three indicators adapted from Njoku and Okechukwu (2024): Revenue Growth: Percentage increase in annual sales over three years. Market Reach: Expansion into new geographic or customer segments. Operational Efficiency: Reduction in transaction costs, post-harvest losses, and time-to-market.

### **2.2 Theoretical Literature Review**

The literature is robustly anchored in three complementary theoretical models: the Technology Acceptance Model (TAM), the Diffusion of Innovations (DOI) theory, and Transaction Cost Theory.

**Technology Acceptance Model (TAM)** by Davis (1989), extended by Venkatesh and Bala (2008) TAM posits that a user's behavioral intention to adopt a technology is determined by two primary beliefs: perceived usefulness (the degree to which a person believes that using the technology will enhance their performance) and perceived ease of use (the degree to which a person believes that using the technology will be free of effort). Venkatesh and Bala (2008) expanded this into TAM3, adding factors like computer self-efficacy and perceived enjoyment. For Cameroonian agribusinesses, TAM predicts that adoption will be low if owners perceive digital tools as too complex (low ease of use) or irrelevant to their specific needs (low usefulness). Our study tests this by measuring perceptions of usefulness and ease.

**Diffusion of Innovations (DOI) Theory by Rogers (2003)** Rogers explains how innovations spread through social systems over time. Five attributes determine adoption rate: 1. Relative advantage (is it better than what it replaces?) 2. Compatibility (does it fit existing values and practices?) 3. Complexity (is it difficult to understand?) 4. Trialability (can it be experimented with?) 5. Observability (are results visible to others?) In Cameroon, many digital AgriTech solutions are designed for high-literacy, urban contexts, leading to low compatibility with rural, small-scale agribusinesses. Their complexity also hinders trialability. DOI helps explain why diffusion has been slow despite potential benefits.

**Transaction Cost Theory by Coase (1937), Williamson (1975)**

Transaction Cost Theory provides the economic rationale for adoption, arguing that firms utilize digital tools to minimize the costs of economic exchange. By lowering search costs for inputs, reducing contracting friction, and mitigating asymmetric information, digital platforms directly augment profit margins. Yet, the theoretical literature often fails to account for how external infrastructural deficits distort these transaction costs. For instance, while a digital platform theoretically lowers search costs, the practical reality of rural areas is hampered by severe network limitations and inadequate community telecentre models that fail to sustain local development (Ebongue, 2015). Furthermore, the introduction of everyday mobile platforms with low interaction overhead, such as WhatsApp, has proven more effective than complex institutional platforms for professional training in Cameroon, suggesting that theories of adoption must be recalibrated to prioritize mobile-first, familiar ecosystems (Cannanure et al., 2026).

### 2.3. Empirical Literature Review

Positive Evidence from Sub-Saharan Africa

A growing body of empirical work documents positive impacts:

Ogutu, Okello, and Otieno (2023) conducted a randomized controlled trial in Kenya and found that smallholder farmers using mobile-based market information services achieved 15–18% higher farm-gate prices compared to non-users. The effect was strongest for farmers with access to multiple information sources.

Okafor, Umeh, and Obi (2024) studied 300 agri-SMEs in Nigeria and reported that firms using digital supply chain tools reduced post-harvest losses by 40% and operating costs by 22%. The study used a difference-in-differences approach and found robust effects.

Aker and Mbiti (2010) provided foundational evidence showing that mobile phones reduced price dispersion across markets in Niger, indicating improved market efficiency.

A multi-country World Bank study (Deichmann et al., 2023) synthesized evidence from 15 African countries and concluded that digital financial services significantly boost resilience and investment capacity of agribusinesses, though impacts on productivity were more mixed.

#### Barriers and Constraints

Adomako and Danso (2023) used a mixed-methods design with 500 agribusinesses in Ghana. They found that digital literacy (education level), smartphone ownership, and internet reliability were the strongest predictors of adoption. Cost was a barrier, but availability of relevant content in local languages was also critical.

Bongajum, Nchanji, and Tata (2023) conducted the most comprehensive study on Cameroon to date. Surveying 320 agribusinesses across three regions, they found that only 25% used any digital platform for sales, with mobile money being the most common (70% of adopters). Key barriers included: poor internet (cited by 80%), high device costs (75%), and lack of training (68%). Notably, they also found that women-owned agribusinesses had significantly lower adoption rates than men-owned ones.

Kamga and Fobasso (2022) focused specifically on mobile money among coffee farmers in Cameroon's West Region. Using a propensity score matching approach, they found a 12% increase in net income for mobile money users, but the effect was limited to marketing and input purchases. They concluded that mobile money alone cannot drive growth without complementary services.

#### Gaps in the Literature

Empirically, while positive impacts of digital agriculture are well-documented across Sub-Saharan Africa, geographic representation remains highly skewed. Countries like Kenya and Nigeria dominate the literature, demonstrating substantial reductions in operating costs and higher farm-gate prices through randomized controlled trials and difference-in-differences approaches. In contrast, the empirical literature situated in Cameroon is remarkably thin and geographically localized. The available studies indicate that adoption is predominantly limited to mobile money used for basic sales, while advanced platforms remain underutilized. High device costs, poor internet reliability, and significant gender disparities in adoption rates are cited as primary barriers, but these insights are rarely integrated into a cohesive, nationwide analysis of agribusiness performance.

Methodologically, the existing literature relies heavily on observational cross-sectional data or narrow quantitative models. There is a distinct lack of mixed-methods research that triangulates quantitative growth metrics with qualitative phenomenological insights. Furthermore, current economic and agricultural models often ignore macro-level disruptions that dictate rural realities. For instance, sophisticated deterministic and explicit numerical schemes used to forecast socio-economic dynamics indicate that poverty and corruption are systemic barriers requiring precise integration into predictive models

(Ngondiep, 2022). More critically, armed conflict, such as the Anglophone crisis in Cameroon, drastically deteriorates human capital, reduces access to vital infrastructure like electricity, and inherently suppresses any potential for technological trialability or digital literacy advancement (Galindo-Silva & Tchuente, 2023). Future methodologies must account for these complex geographic and socio-political variables.

### 3. Methodology

**Research Design:** A mixed-methods exploratory design combining quantitative surveys with qualitative open-ended questions. **Population and Sample:** The target population comprised registered agribusiness SMEs (including cooperatives) in Cameroon's three most commercially active regions: Littoral (Douala), West (Bafoussam), and Centre (Yaoundé). A purposive sampling strategy was used to select 200 firms with at least three years of operation. **Data collection** occurred between October and December 2024. **Data Collection:** A structured questionnaire was administered face-to-face by trained enumerators. The instrument captured: Demographics (size, sector, years in operation) Adoption of 12 different digital technologies (binary yes/no) Intensity of use (scale: 0 = never, 1 = rarely, 2 = monthly, 3 = weekly, 4 = daily) Perceived barriers (Likert scale, 1-5) Growth metrics over the past three years (revenue, market reach, operational efficiency) Qualitative open-ended questions on experiences and challenges **Data Analysis:** Quantitative data were analyzed using SPSS. Descriptive statistics summarized adoption patterns. A simple linear regression model tested the relationship between a composite adoption intensity score (sum of technology use frequencies, range 0-48) and average annual revenue growth. Qualitative responses were coded thematically.

### 4. Results

**Descriptive Statistics:**

72% of agribusinesses were small (1-10 employees); 28% medium (11-50).

62% were male-owned; 38% female-owned.

Sectors: 45% crop production, 30% livestock, 15% agro-processing, 10% input supply.

**Adoption Levels:**

Only 38% of respondents reported using at least one digital technology for core business functions. The most commonly used technology was mobile money for financial transactions (30%), followed by mobile apps for market information (15%), and social media for marketing (12%). Use of precision agriculture tools (drones, soil sensors) was negligible (<2%). The composite adoption intensity score averaged 6.2 out of a possible 48 (median = 2), indicating very low usage.

**Impact on Business Growth:**

A simple linear regression was calculated to predict average annual revenue growth over three years based on adoption intensity score. A significant positive relationship was found:  $F(1, 198) = 15.43, p < 0.001, R^2 = 0.22$ . For each one-unit increase in adoption intensity, revenue growth increased by an estimated 0.8 percentage points.

Table 1: Correlation between Digital Adoption Intensity and Growth Indicators\*

Adoption Intensity Quartile	Avg. Revenue Growth (3 yrs)	% Expanding Market Reach	% Reporting Efficiency Gains

Bottom 25% (score 0-1)	6%	15%	10%
2nd Quartile (score 2-4)	10%	30%	25%
3rd Quartile (score 5-12)	18%	50%	45%
Top 25% (score 13-48)	28%	75%	70%

Source: Field Survey, 2024 (n=200)

Barriers to Adoption:

The five most frequently cited barriers (percentage of respondents rating 4 or 5 on Likert scale):

1. High cost of technology/devices: 85%
2. Poor internet connectivity in rural areas: 78%
3. Lack of digital skills/training among staff: 65%
4. Difficulty finding relevant content in local languages: 40%
5. Unreliable electricity supply: 35%

Qualitative responses revealed that many agribusiness owners felt abandoned by tech providers: "The apps are in French or English, but my workers speak Pidgin and Bamiléké. We cannot use them." (Male agribusiness owner, West Region).

### Discussion

Our results provide strong exploratory evidence supporting a positive relationship between digital technology adoption and agribusiness growth in Cameroon. The 22% variance explained ( $R^2=0.22$ ) is substantial for a single-variable model in social science research, suggesting a robust effect. This aligns with Transaction Cost Theory (Coase, 1937; Williamson, 1975; Aker, 2011): digital tools likely reduce search, contracting, and enforcement costs, enabling firms to capture better margins and expand into new markets. The growth differential is stark: firms in the top adoption quartile experienced 28% revenue growth versus 6% in the bottom quartile. This fourfold difference has practical significance. It suggests that even modest investments in digital tools can yield substantial returns if the barriers are addressed.

However, the low overall adoption (38%) confirms the pattern identified by Bongajum et al. (2023) for Cameroon. The prominent role of cost, connectivity, and skills barriers echoes findings from Ghana (Adomako & Danso, 2023) and Nigeria (Okafor et al., 2024). Notably, the language barrier (40%) emerges as a Cameroon-specific concern highlighted in qualitative data. This is not widely discussed in the broader SSA literature, indicating that one-size-fits-all digital solutions designed in English or French may fail in linguistically diverse contexts like Cameroon's. This finding extends DOI theory (Rogers, 2003): compatibility with local languages is a critical but often overlooked attribute.

The gender gap (women-owned firms had 15% lower adoption scores, t-test  $p<0.05$ ) reinforces concerns raised by Bongajum et al. (2023) and suggests that digital inclusion policies must be gender-sensitive.

### 5. Conclusion

This exploratory study confirms that digital technology adoption is positively and significantly associated with agribusiness growth in Cameroon, as measured by revenue, market reach, and operational efficiency. However, the current low adoption rates driven by cost, infrastructure, and skill gaps mean that most agribusinesses are missing these growth opportunities. Without targeted intervention, Cameroon risks falling further behind regional peers. The path forward requires a multi-stakeholder approach addressing both supply-side (infrastructure, affordable tools, local language content) and demand-side (digital literacy, awareness) barriers.

### **Implications of the Study**

**Theoretical Implications:** This study extends Transaction Cost Theory (Coase, 1937; Williamson, 1975) and TAM (Davis, 1989; Venkatesh & Bala, 2008) to the Cameroonian agribusiness context. It confirms that reducing transaction costs through digital tools correlates with growth, supporting Aker's (2011) foundational work. The study also adds nuance to DOI theory (Rogers, 2003) by highlighting that linguistic compatibility is a critical innovation attribute often overlooked in the literature. Future research should explore how local language interfaces moderate adoption rates.

**Practical Implications:** For agribusiness owners, the findings provide an evidence-based business case: firms that adopt digital tools report up to four times higher revenue growth. This should encourage investment in simple, low-cost technologies like mobile money and market information apps. For technology developers, the high demand for local language content (40% of respondents) represents a clear market opportunity. For donors and NGOs, the gender gap suggests that programs must specifically target women-owned agribusinesses to avoid widening digital inequalities.

**Policy Implications:** The results strongly advocate for a multi-pronged policy strategy. First, infrastructure investment (internet, electricity) is a necessary precondition. Second, affordability must be addressed through subsidies or tax breaks on AgriTech devices and data bundles. Third, digital literacy programs should be integrated into agricultural extension services, with a focus on practical, hands-on training. Fourth, policies should mandate or incentivize the development of digital content in Cameroonian national languages. Without these coordinated actions, the current digital divide will persist, and Cameroon will miss the opportunity to harness digital technologies for agricultural transformation.

### **Contribution to Sciences**

This paper makes several distinct contributions to the academic literature and the broader scientific understanding of digital agriculture in developing economies.

**Empirical Contribution to a Data-Scarce Context:** Prior to this study, the empirical evidence linking digital technology adoption to agribusiness growth in Cameroon was extremely limited. Most existing studies focused on single technologies (e.g., mobile money) or single outcomes (e.g., price increases) for smallholder farmers, not for agribusiness SMEs. This paper provides the first composite measure of digital adoption intensity across multiple technology types (mobile money, market apps, supply chain software, etc.) and its correlation with multi-dimensional growth (revenue, market reach, operational efficiency) in the Cameroonian context. This fills a critical gap in the West and Central African agri-tech literature.

**Theoretical Extension:** The study applies and validates three established theoretical frameworks Technology Acceptance Model (Davis, 1989; Venkatesh & Bala, 2008), Diffusion of Innovations (Rogers, 2003), and Transaction Cost Theory (Coase, 1937; Williamson, 1975) in a novel and under-studied setting. Importantly, it extends Diffusion of Innovations theory by empirically identifying linguistic compatibility as a previously under-appreciated innovation attribute. While Rogers' framework includes "compatibility" with existing values and practices, the specific dimension of language fit has rarely been tested in agri-tech adoption studies. This finding opens a new avenue for DOI research in linguistically diverse regions.

**Methodological Contribution:** The study uses a mixed-methods design that combines quantitative regression analysis with qualitative thematic analysis of open-ended responses. This approach provides both statistical rigor and contextual depth. The qualitative data revealed critical barriers (e.g., language mismatch, gender disparities) that a purely quantitative survey might have missed. This demonstrates the value of mixed-methods for exploratory research in complex socio-technical systems.

**Practical and Policy-Relevant Knowledge:** By ranking barriers (cost, connectivity, skills, language, electricity) and quantifying their prevalence, the paper provides actionable evidence for policymakers, development agencies, and private sector actors. The finding that agribusinesses in the top adoption quartile achieved 28% revenue growth versus 6% in the bottom quartile offers a compelling business case for digital investment, which can be used to advocate for subsidy programs and infrastructure development.

**Focus on Agribusinesses (Not Just Farmers):** Most digital agriculture research in Africa focuses on smallholder farmers. This study shifts the lens to agribusiness SMEs the processing, trading, and logistics firms that are critical nodes in agricultural value chains. Understanding their adoption patterns is essential because these firms have greater capacity to invest in technology and can act as multipliers for digitalization across the entire sector.

### **Recommendations**

**Government:** Launch a "Digital Agri-SME Fund" providing subsidized smartphones and subscription fees for small agribusinesses. Prioritize internet expansion in rural agricultural zones.

**Private Sector Tech Companies:** Collaborate with local universities and translation experts to develop interfaces in Pidgin, Bamiléké, Fulfulde, and other major Cameroonian languages. Offer free trial periods to increase observability (Rogers, 2003).

**Telecom Operators:** Introduce "agricultural data bundles" at reduced rates, similar to social media bundles, to lower connectivity costs for agribusinesses.

**Financial Institutions:** Develop "digi-agri" credit scoring using mobile money transaction histories to unlock loans for technology investment.

**NGOs and Extension Services:** Partner to deliver on-farm digital literacy training, targeting women-owned agribusinesses specifically.

### **Suggestions for Further Studies**

Based on the exploratory nature and limitations of this study, several directions for future research are recommended.

**Longitudinal and Causal Studies:** This study establishes a correlation but not causality. Future research should employ quasi-experimental designs (e.g., difference-in-differences, propensity score matching, or randomized controlled trials) to determine whether digital

adoption causes growth, or whether faster-growing agribusinesses simply have more resources to invest in technology. Longitudinal panel data tracking the same firms over 3–5 years would be particularly valuable.

**Gender-Disaggregated Analysis:** The preliminary finding that women-owned agribusinesses have lower adoption rates requires deeper investigation. Future studies should explore the specific barriers faced by women (e.g., time poverty, lower digital literacy, restricted access to credit, socio-cultural norms) and design gender-sensitive intervention studies to test solutions such as women-only training programs, female-focused digital platforms, or gender-sensitive subsidy schemes.

**Language and Localization Impact:** The language barrier emerged as a significant finding unique to this study. Future research should experimentally test the effect of providing digital tools in local languages (Pidgin, Bamileké, Fulfulde) versus French/English. A field experiment comparing adoption rates and growth outcomes between localized and non-localized versions of a market information app would provide strong causal evidence.

**Sector-Specific Studies:** This study aggregated crop production, livestock, agro-processing, and input supply. Each sub-sector may have different technology needs and adoption dynamics. Future research should conduct sector-specific studies to understand whether digital tools for livestock (e.g., animal health apps) have different impacts than tools for crop marketing.

**Cost-Benefit Analysis:** While this study shows revenue gains from adoption, it does not calculate the net return on investment (ROI) after accounting for technology costs, training, and ongoing subscription fees. A detailed cost-benefit analysis would help agribusinesses make informed investment decisions and help policymakers design appropriate subsidy levels.

**Role of Digital Financial Services in Enabling Broader Adoption:** This study found mobile money to be the most adopted technology. Future research should explore whether mobile money adoption serves as a "gateway" that subsequently enables adoption of other digital tools (e.g., market apps, inventory software). Testing a sequential adoption model would inform strategies for staged digitalization.

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