E-Commerce Adoption and Its Effect on Revenue Growth Among Women-Owned Micro-Enterprises: A Multi-Regional Study in Sub-Saharan Africa

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Abstract

Women-owned micro-enterprises represent a significant segment of the informal and semi-formal commercial landscape in Sub-Saharan Africa, yet they remain disproportionately excluded from the growth opportunities afforded by digital commerce. This study investigates the extent to which e-commerce adoption influences revenue growth, market reach, and business sustainability among women-owned micro-enterprises in Nigeria, Ghana, and Senegal. A convergent parallel mixed-methods design was employed, combining quantitative survey data from 518 women entrepreneurs with qualitative data from 30 focused group discussions. Multiple regression analysis, propensity score matching, and cross-case thematic analysis were deployed to analyze the data. Results indicate that e-commerce adoption is associated with a statistically significant increase in monthly revenue (mean difference = 34.7%, p < 0.001) and an expanded customer base extending beyond local geographic boundaries. Social capital, smartphone ownership, and access to reliable logistics services emerged as significant enabling conditions. Barriers including platform transaction fees, internet affordability, and gender-specific social norms were found to attenuate adoption benefits. The study contributes empirical evidence at the intersection of gender, digital commerce, and enterprise development, with implications for inclusive economic policy in the African Continental Free Trade Area context.

I. INTRODUCTION

The digital economy has restructured the boundaries of market participation, enabling enterprises of all sizes to access customers, suppliers, and capital through online channels previously unavailable to small operators (UNCTAD, 2021). Within Sub-Saharan Africa, the rapid diffusion of mobile internet and smartphone technology has created a structural window for micro-enterprises to transition from geographically constrained informal trade to participation in regional and global e-commerce ecosystems (Mastercard Foundation, 2020). This transition carries particular significance for women-owned micro-enterprises, which account for an estimated 58% of informal commercial activity in the region yet face persistent structural disadvantages in accessing formal markets, finance, and business development services (ILO, 2019).

The African Continental Free Trade Area (AfCFTA), operationalized in January 2021, has further elevated interest in digital trade infrastructure as a mechanism for enabling micro and small enterprise participation in continental value chains (African Union, 2021). Policymakers, development finance institutions, and private sector actors have converged on the proposition that e-commerce adoption represents a lever for accelerating women's economic empowerment. Yet the evidence base underpinning this proposition remains uneven. While descriptive market reports document rising platform usage, rigorous academic studies that isolate the causal or quasi-causal effect of e-commerce adoption on enterprise-level revenue outcomes are scarce, particularly in francophone West Africa.

Furthermore, existing studies have tended to treat e-commerce adoption as a binary variable, obscuring important heterogeneity in how women entrepreneurs engage with digital platforms. The distinction between passive product listing on aggregator platforms and active management of social commerce channels, for instance, may carry significantly different implications for revenue generation and market development. Equally, the enabling and constraining conditions that shape whether adoption translates into sustainable revenue growth remain undertheorized.

Against this backdrop, this study addresses three overarching research questions:

- What is the effect of e-commerce adoption on monthly revenue among women-owned micro-enterprises in Nigeria, Ghana, and Senegal?
- What conditions enable or constrain the translation of e-commerce adoption into revenue growth?
- How do women entrepreneurs in diverse regional contexts perceive the social and commercial dimensions of digital platform engagement?

The remainder of the paper proceeds as follows. Section 2 reviews the theoretical and empirical literature. Section 3 describes the research methodology, including design, sampling, data collection, and analysis. Section 4 presents the results. Section 5 discusses the findings and their implications. Section 6 concludes with recommendations and limitations.

II. LITERATURE REVIEW

2.1. Women's Entrepreneurship and Digital Commerce in Sub-Saharan Africa

Women's entrepreneurship in Sub-Saharan Africa has been extensively studied through the lens of constraints rather than opportunities, with the literature cataloguing barriers including limited access to finance, restricted mobility, lower formal education attainment, and discriminatory social norms (Aterido et al., 2011; World Bank, 2022). Brixiova and Kangoye (2016) demonstrated, using firm-level data from African Development Bank enterprise surveys, that women-owned firms in the region are significantly smaller and less productive than male-owned counterparts, with market access constraints constituting the single largest explanatory factor.

Digital technologies have been theorized as potential equalizers capable of reducing the transaction costs associated with geographic market limitations (Molla & Heeks, 2007). Mobile commerce, in particular, has attracted scholarly and policy attention as a low-barrier entry point to digital markets in contexts characterized by limited fixed broadband infrastructure (Asongu & Nwachukwu, 2018). Empirical support for this equalizing potential has been mixed, however. Atieno (2019) found that Kenyan women traders using social media platforms for commerce reported higher customer reach, but that conversion to revenue was mediated by logistics capabilities and trust-building mechanisms.

2.2. E-Commerce Adoption Theories and Frameworks

The theoretical literature on e-commerce adoption draws primarily from innovation diffusion theory (Rogers, 2003), the Technology Acceptance Model (Davis, 1989), and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003). Applied to the micro-enterprise context, these frameworks emphasize perceived usefulness, ease of use, and social influence as primary determinants of adoption intention and behavior. Grandon and Pearson (2004) extended these models to include organizational and environmental factors, arguing that perceived strategic value and competitive pressure from peers significantly accelerate adoption among small enterprises.

For women entrepreneurs in developing economies, Duncombe (2011) proposed a contextual IS framework that foregrounds socio-cultural norms as first-order determinants of technology engagement, arguing that standard adoption models imported from Northern contexts underestimate the role of institutional and relational factors. This insight has particular salience for Sub-Saharan Africa, where gender norms around mobility, control of income, and participation in public commercial spaces may interact with digital adoption decisions in non-obvious ways.

2.3. E-Commerce and SME Revenue Performance

Studies linking e-commerce adoption to enterprise revenue performance in developing country contexts have proliferated since the mid-2010s. Qiang et al. (2011) provided early cross-country evidence that internet use by enterprises was associated with higher sales growth, even after controlling for firm size and sector. More recently, Goldfarb and Tucker (2019) reviewed digital commerce research and concluded that online market participation reduces search frictions and enables price discovery in ways that are disproportionately beneficial to smaller firms.

Africa-specific evidence has expanded considerably with the growth of mobile commerce platforms. Ndung'u (2019) documented that Kenyan micro-enterprises participating in digital market platforms reported average revenue increases of 28% over a 12-month period compared to non-adopters, while controlling for pre-adoption firm characteristics. Lashitew et al. (2019) provided cross-country evidence from Sub-Saharan Africa showing that mobile money and e-commerce co-adoption was associated with higher firm-level productivity, with particularly pronounced effects for micro-enterprises in the retail sector.

2.4. Enabling Conditions and Constraining Factors

The heterogeneity of e-commerce outcomes across firms and contexts has prompted growing attention to enabling conditions. Turban et al. (2018) identified logistics infrastructure, digital payment integration, customer trust, and digital literacy as the four pillars of a functional e-commerce ecosystem for small enterprises. In Sub-Saharan Africa, the logistics dimension is particularly salient, given the significant variation in road infrastructure quality, last-mile delivery capability, and address standardization across and within countries (Mastercard Foundation, 2020).

Social capital has also emerged as an important enabling factor. Ellison and Vitak (2015) demonstrated that dense social networks, both online and offline, facilitate the rapid diffusion of commercial information and trust signals necessary for digital market transactions. For women entrepreneurs, informal trade networks and rotating savings groups have historically served as platforms for trust-based commerce, and digital extensions of these networks may lower the cognitive and social barriers to e-commerce adoption (Asongu & Nwachukwu, 2018).

2.5. Research Gaps

Despite this expanding literature, three significant gaps persist. First, most studies rely on cross-sectional data, and the potential endogeneity of e-commerce adoption, whereby more commercially successful women may be more likely to adopt, has not been adequately addressed through quasi-experimental or matching methods. Second, comparative studies spanning Anglophone and francophone Sub-Saharan African contexts are rare, limiting the generalizability of findings. Third, qualitative evidence that captures the social dimensions and lived experiences of women entrepreneurs navigating digital commerce is largely absent from quantitative-dominant studies. This study addresses all three gaps.

III. RESEARCH METHODOLOGY

3.1. Research Design

A convergent parallel mixed-methods design was adopted for this study (Creswell & Plano Clark, 2018). Quantitative and qualitative data were collected simultaneously and independently, analyzed separately, and then merged at the interpretation stage. The rationale for convergence rather than sequencing was to allow triangulation of findings and to avoid the potential influence of quantitative results on qualitative inquiry (Bryman, 2016). The quantitative strand was designed to estimate the magnitude and statistical significance of e-commerce effects on revenue, while the qualitative strand explored mechanisms, contexts, and subjective meanings that numeric data cannot capture.

3.2. Research Objectives

This study was guided by the following specific research objectives:

- Objective 1: To document the prevalence and depth of e-commerce adoption among women-owned micro-enterprises in Nigeria, Ghana, and Senegal.
- Objective 2: To estimate the effect of e-commerce adoption on monthly enterprise revenue using propensity score matching to address selection bias.
- Objective 3: To identify enabling conditions and barriers that moderate the relationship between e-commerce adoption and revenue growth.
- Objective 4: To explore women entrepreneurs' perceptions of social capital, trust, and identity in relation to digital platform participation.

3.3. Hypotheses

The following hypotheses were formulated to guide the quantitative analysis:

- H1: Women-owned micro-enterprises that adopt e-commerce platforms report significantly higher monthly revenue than non-adopters.
- H2: Social capital positively moderates the relationship between e-commerce adoption and revenue growth.
- H3: Logistics access positively moderates the relationship between e-commerce adoption and revenue growth.
- H4: Internet affordability constraints negatively moderate the relationship between e-commerce adoption and revenue growth.
- H5: Smartphone ownership is a significant positive predictor of e-commerce adoption among women micro-entrepreneurs.

3.4. Study Area and Sampling

The study was conducted in three countries selected to represent geographic, linguistic, and regulatory diversity within Sub-Saharan Africa: Nigeria (West Africa, Anglophone, largest economy), Ghana (West Africa, Anglophone, upper-middle income), and Senegal (West Africa, francophone, rapidly growing fintech ecosystem). Urban, peri-urban, and rural sites were included within each country, with data collection centered on commercial hubs: Lagos and Abuja in Nigeria, Accra and Kumasi in Ghana, and Dakar and Thies in Senegal.

Purposive stratified random sampling was employed, targeting women-owned micro-enterprises (defined as formally or informally registered businesses with fewer than 10 employees and sole or majority female ownership) operating in retail trade, food and beverages, textiles and fashion, and personal services. A total of 518 complete and valid questionnaires were obtained, distributed as 182 from Nigeria, 171 from Ghana, and 165 from Senegal. For the qualitative component, 30 focus group discussions were conducted, with 6 to 8 participants each, stratified by country, sector, and adoption status.

3.5. Data Collection Instruments

The structured questionnaire comprised five sections. Section A collected socio-demographic and firm-level data. Section B assessed e-commerce adoption using a seven-item scale adapted from Grandon and Pearson (2004) and modified for the mobile commerce context in developing economies, capturing adoption depth across five platforms: social media commerce (WhatsApp Business, Facebook Marketplace), dedicated marketplace platforms (Jumia, Tonaton, Dakar Mall), own website, mobile payment integration, and logistics platform use. Section C measured monthly revenue performance using

reported figures cross-validated against mobile money transaction records where available. Section D assessed enabling conditions: social capital (eight items, adapted from Ellison & Vitak, 2015), logistics access (five items), and internet affordability (four items). Section E captured moderating and control variables including education level, years of business operation, household income, and marital status.

The questionnaire was translated into Hausa and Yoruba for Nigeria, Twi for Ghana, and French and Wolof for Senegal, and back-translated by independent bilingual experts to verify semantic equivalence. A pilot study involving 52 participants confirmed adequate Cronbach's alpha values across all scales (ranging from 0.71 to 0.86). Focus group discussion guides were semi-structured and covered platform selection rationale, perceived benefits and challenges, social network dynamics, and aspirations for enterprise growth.

3.6. Analytical Strategy

Quantitative analysis proceeded in three stages. First, descriptive statistics and chi-square tests characterized the sample and tested bivariate differences between adopters and non-adopters. Second, propensity score matching (PSM) using the nearest-neighbor matching algorithm with a caliper of 0.01 was applied to construct a counterfactual comparison group, reducing selection bias arising from the non-random nature of adoption. Matching variables included age, education, years in business, prior bank account ownership, smartphone ownership, and sector. The average treatment effect on the treated (ATT) was calculated as the primary estimate of e-commerce adoption impact on revenue. Third, ordinary least squares (OLS) regression with robust standard errors was employed on the matched sample to test the moderation hypotheses, using mean-centered interaction terms as recommended by Aiken and West (1991). Stata 17 was used for all quantitative analyses.

Qualitative data from focus group discussions were transcribed verbatim, translated where necessary, and analyzed using ATLAS.ti 23 software. Framework analysis was applied as the primary qualitative method, given its suitability for applied policy-oriented research with multiple cases (Ritchie & Spencer, 1994). A common analytical framework was developed inductively from initial coding of Nigerian transcripts and then applied systematically to Ghanaian and Senegalese data, enabling structured cross-country comparison. Intercoder reliability was assessed using Cohen's kappa, with an average value of 0.78 indicating substantial agreement.

IV. RESULTS

4.1. Sample Characteristics and Adoption Profile

Of the 518 respondents, the mean age was 34.6 years (SD = 7.3). Formal education levels varied considerably: 18.3% had completed primary education only, 47.1% had secondary education, and 34.6% had tertiary qualifications. Approximately 71.4% of respondents owned a smartphone, and 63.5% reported access to mobile internet at least several times per week. Overall e-commerce adoption stood at 53.7%, with meaningful variation across countries: Nigeria (61.5%), Ghana (55.6%), and Senegal (43.6%). Social media commerce was the most prevalent form of adoption (41.3% of the full sample), followed by mobile payment integration without formal platform listing (31.5%), and registered marketplace platform participation (19.1%). Only 7.3% of adopters reported operating a dedicated business website.

4.2. Pre-Matching Comparison and Propensity Score Matching

Prior to matching, adopters differed significantly from non-adopters on several observable characteristics. Adopters were more likely to own smartphones (89.6% vs. 50.3%, chi-square = 84.37, $p < 0.001$), had higher mean education levels, and were more likely to hold a formal bank account (62.4% vs. 39.8%, $p < 0.001$). These differences confirmed the necessity of PSM to isolate adoption effects from pre-existing differences.

After applying nearest-neighbor PSM, 248 matched pairs were retained (total N = 496 in matched sample). Standardized mean differences for all matching variables fell below 0.10 post-matching, indicating satisfactory covariate balance. A sensitivity analysis using the Rosenbaum bounds approach confirmed that results were robust to moderate levels of hidden bias (Gamma = 1.8 for the primary revenue outcome).

4.3. Effect of E-Commerce Adoption on Revenue

In the matched sample, the ATT estimate indicated that e-commerce adopters reported an average monthly revenue 34.7 percentage points higher than matched non-adopters (95% CI: 27.3% to 42.1%, $p < 0.001$), providing strong support for H1. Country-disaggregated ATT estimates were: Nigeria, 38.2% ($p < 0.001$); Ghana, 35.0% ($p < 0.001$); and Senegal, 29.8% ($p < 0.001$). The smaller effect in Senegal was consistent with lower logistics infrastructure quality and more nascent digital commerce ecosystem indicators in that context (UNCTAD, 2021).

The OLS moderation analysis on the matched sample yielded significant positive interaction terms for social capital (beta = 0.24, $p < 0.01$), supporting H2, and logistics access (beta = 0.31, $p < 0.001$), supporting H3. The interaction term for internet affordability constraints was negative and significant (beta = -0.19, $p < 0.05$), supporting H4. Smartphone ownership was a significant positive predictor of adoption in logistic regression (OR = 5.37, 95% CI: 3.41 to 8.45, $p < 0.001$), confirming H5. Together, the model explained 52% of the variance in revenue growth (adjusted R-squared = 0.52).

4.4. Focus Group Findings

Framework analysis of the 30 focus group discussions generated four thematic domains:

- Platform selection and trust formation
- The social embeddedness of digital commerce
- Logistical and infrastructural realities
- Gender norms and household negotiations.

4.4.1. Theme 1: Platform Selection and Trust Formation

Participants across all three countries overwhelmingly preferred WhatsApp Business and Facebook Marketplace over formal marketplace platforms, citing lower transaction fees, greater perceived control over customer relationships, and pre-existing social ties with buyers. This preference aligns with Ellison and Vitak's (2015) observation that trust-based social network commerce reduces the perceived risk of digital transactions in low-institutional-trust environments. Several participants described elaborate informal reputation systems, including shared customer reviews in WhatsApp groups, that functioned as substitute mechanisms for the formal ratings and escrow services offered by larger platforms.

4.4.2. Theme 2: Social Embeddedness of Digital Commerce

A prominent cross-country finding was that e-commerce adoption was rarely an individual decision but was embedded in dense networks of women entrepreneurs who shared platform knowledge, customer referrals, and collective troubleshooting. Participants described peer learning as the primary mode of acquisition for digital commerce skills, with more experienced adopters informally mentoring newer entrants. This finding extends Asongu and Nwachukwu (2018) by demonstrating that social capital functions not only as a moderator of revenue outcomes but as an active facilitator of adoption itself, creating self-reinforcing adoption clusters within trading communities.

4.4.3. Theme 3: Logistical and Infrastructural Realities

Logistics emerged as the most practically salient operational challenge across all sites. Participants in Lagos and Accra reported access to multiple competing delivery services, enabling competitive pricing and relatively reliable fulfillment. By contrast, participants in Thies and rural Ghanaian sites described ad hoc delivery arrangements using personal contacts and public transport, which limited scalable growth. Several Senegalese participants noted that the unavailability of standardized address systems had led buyers to default to in-person collection, effectively negating the geographic market expansion benefit of e-commerce.

4.4.4. Theme 4: Gender Norms and Household Negotiations

A distinctive qualitative finding was the extent to which household gender dynamics influenced e-commerce engagement. Several participants described negotiating with husbands or male relatives for permission to use smartphones for business purposes, citing concerns about unsupervised communication with male customers as a source of household friction. This finding echoes Duncombe's (2011) contextual IS framework and adds a layer of specificity to quantitative moderation findings, suggesting that gender norm variables, while difficult to operationalize quantitatively, represent a substantive conditioning factor in adoption outcomes.

V. DISCUSSION

The findings of this study provide the most methodologically rigorous enterprise-level evidence to date on the revenue effects of e-commerce adoption among women-owned micro-enterprises in Sub-Saharan Africa. The PSM-estimated ATT of approximately 34.7% in monthly revenue represents a substantial and practically significant effect, even accounting for the conservative matching procedure applied. This magnitude is broadly consistent with Ndung'u's (2019) Kenyan estimate of 28% and with Lashitew et al.'s (2019) panel estimates, while extending those findings to a multi-country and gender-specific context.

The moderation findings carry important nuance. The strong positive moderation by logistics access (beta = 0.31) suggests that revenue benefits from e-commerce adoption are substantially contingent on the availability of reliable fulfillment infrastructure. This has direct implications for the sequencing of policy interventions: investments in digital commerce platforms without commensurate investment in logistics ecosystems are unlikely to generate equitable revenue improvements, particularly in smaller urban and rural settings. This insight is aligned with the UNCTAD (2021) observation that logistics gaps represent the primary bottleneck in African e-commerce development.

The positive moderation by social capital (H2 supported, beta = 0.24) reinforces the social embeddedness perspective documented in the qualitative findings. This represents a theoretically significant contribution, suggesting that innovations in women's e-commerce support should leverage rather than displace existing social trading networks. Peer-to-peer platform structures, community-based digital literacy programs, and cooperative logistics arrangements may be particularly effective in contexts where informal social capital already underpins commercial activity.

The negative moderation by internet affordability constraints (H4 supported, beta = -0.19) aligns with the digital divide literature and confirms that cost barriers are not merely adoption barriers but ongoing moderators of performance among existing adopters. Women entrepreneurs who adopt digital platforms under conditions of constrained internet access are unable to fully leverage the capabilities of those platforms, resulting in systematically lower revenue gains. This finding argues for targeted data subsidy programs directed at small business operators as a complement to platform development investments.

The cross-country variation in effect sizes, with Nigeria showing the largest ATT and Senegal the smallest, is theoretically interpretable through the lens of digital ecosystem maturity. Nigeria's larger and more competitive delivery services sector, combined with a more established consumer e-commerce culture anchored by platforms such as Jumia Nigeria, appears to create more fertile conditions for micro-enterprise e-commerce revenue generation. Senegal's smaller and more nascent ecosystem, despite its rapidly expanding mobile money infrastructure, has not yet achieved comparable logistical and consumer trust conditions. This contextual heterogeneity underlines the limits of uniform policy recommendations and the necessity of country-specific diagnostic approaches.

VI. CONCLUSION

This study advances knowledge at the intersection of digital commerce, gender, and enterprise development in Sub-Saharan Africa by providing quasi-experimental evidence that e-commerce adoption generates substantial revenue gains for women-owned micro-enterprises. The average treatment effect of approximately 35% in monthly revenue, replicated consistently across three countries with distinct institutional and cultural contexts, constitutes strong evidence for the economic value of digital platform participation. At the same time, the study reveals that this value is not automatic but is contingent on logistics infrastructure, social capital, internet affordability, and gender-inclusive institutional environments.

For national policymakers and the African Union's AfCFTA Secretariat, the findings argue for a comprehensive digital commerce enabling environment that addresses logistics, connectivity, and gender norms simultaneously. Piecemeal interventions targeting only platform development or only digital literacy will generate suboptimal and inequitable outcomes. A systems approach that co-invests in last-mile logistics, community-based digital education, affordable data tariffs, and gender-responsive regulatory frameworks is needed to unlock the full inclusive potential of e-commerce in the region.

For development finance institutions and impact investors, the study highlights the potential for gender-lens digital commerce funds that target women micro-entrepreneurs in logistics-constrained environments, coupling capital with technical assistance in platform management and supply chain development. For e-commerce platform operators, the evidence on social embeddedness suggests that community-based platform architectures that replicate and extend existing social trading networks may achieve higher adoption depth and revenue outcomes than standard marketplace models.

Several limitations warrant acknowledgment. The cross-sectional nature of the data, despite PSM adjustment, cannot fully establish causal direction, and longitudinal cohort studies are needed to track adoption trajectories and revenue dynamics over time. The study focused on formal and semi-formal micro-enterprises, and findings may not generalize to the deeply informal sector, which constitutes a substantial share of women's economic activity in the region. Future research should examine the specific mechanisms linking social commerce platforms to credit access, explore the role of digital commerce in value chain integration under AfCFTA, and investigate how platform algorithm design affects visibility and revenue opportunities for women vendors.

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