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Abstract

This study investigates the determinants of ICT software disclosure under IAS 38 among some listed commercial banks in Sub-Saharan Africa. Using a quantitative ex-post facto design and panel regression analysis, it examines 456 firm year observations from 38 banks across six countries (2012–2023). A disclosure index developed from audited financial statements measures ICT reporting practices. Results show that firm size, Big Four auditor engagement and firm age significantly enhance disclosure, while board independence exerts a negative effect. Ownership, leverage and profitability display weak or inconsistent influence. Country variations show high disclosure in Tanzania and low in Botswana. This highlights the role of institutional environments. The findings emphasize the importance of context specific disclosure frameworks, governance training and reputable auditors. The study contributes to institutional and resource based perspectives by demonstrating how firm attributes and national contexts jointly shape ICT disclosure patterns in African banking.

Keywords: ICT software disclosure, IAS 38, Sub-Saharan Africa, firm attributes, corporate governance, intangible assets, financial transparency.

Introduction

Information and Communication Technology (ICT) has become a cornerstone of modern banking. The International Accounting Standard (IAS) 38 requires firms to recognise, measure and disclose intangible assets, including computer software, to enhance transparency and comparability in financial reporting (IFRS Foundation, 2021). ICT software underpins essential banking operations, transaction processing, cybersecurity, risk management and analytics. This makes its disclosure a signal of technological capability, governance quality and financial integrity (Castilla-Polo & Gallardo-Vázquez, 2016; Gardi et al., 2023; Weli, 2020). However, disclosure practices vary widely across jurisdictions. In Sub-Saharan Africa, banks operate under differing levels of

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regulatory quality, investor protection and audit standards (Ntim et al., 2017; Tsamenyi et al., 2007). Compliance with frameworks such as South Africa's King IV Code remains inconsistent (Dempsey et al., 2024; Rama et al., 2023), reflecting the region's uneven digitalisation, limited technical capacity and weak regulatory enforcement (EIB, 2024; World Bank, 2023). Consequently, the scope and quality of ICT-related disclosures differ significantly across countries.

Prior research links disclosure quality to firm size, leverage, auditor type, ownership, profitability, and board independence (Anifowose, 2025; Fulgence et al., 2024), yet findings remain mixed particularly in Africa, where institutional voids influence corporate behaviour. Although studies on intangible assets and intellectual capital have advanced understanding of non-physical resources (Agyei-Mensah, 2019; Samaha & Khlif, 2016), few have focused specifically on ICT software disclosure despite its growing relevance in digital finance.

Research Problem

ICT software now underpins core banking operations across Sub-Saharan Africa, driven by the rapid growth of mobile money, FinTech platforms and ICT enabled financial services (Ky et al., 2019; GELLE et al., 2023). As ICT investment becomes more strategic, IAS 38 disclosures play a critical role in helping stakeholders assess the value and risks of technology related assets. Yet these disclosures differ sharply across SSA.

Variation in ICT disclosure reflects differences in regulatory enforcement, governance capacity, audit quality and institutional maturity across SSA. Evidence on why some banks report ICT assets more fully than others remains limited and mixed. Studies point to governance quality, audit strength and national context, yet the ways in which these institutional conditions intersect with firm-level characteristics to shape ICT disclosure practices remain insufficiently theorized and empirically unresolved (Areneke et al., 2024; Ejemeyovwi et al., 2021; Oino, 2019).

This uncertainty poses challenges for regulators seeking effective enforcement, investors relying on comparable information and policymakers monitoring the digital evolution of the banking sector. The core research problem is that although ICT now underpins banking across SSA, IAS

38 disclosures remain uneven, and the factors driving this variation especially how firm level characteristics interact with national institutional environments are still not well explained.

This study addresses these gaps by analysing how firm characteristics and institutional environments jointly determine ICT software disclosure among 38 listed commercial banks across six Sub-Saharan African countries from 2012 to 2023. Firm attributes such as size, leverage, auditor type, ownership structure, profitability, board independence and firm age serve as explanatory variables, while country dummies capture institutional heterogeneity. Using panel regression with robust standard errors, the study provides evidence on how firm-specific and institutional factors shape ICT disclosure and offers insights to support harmonized reporting standards within the African banking sector.

Research Objectives

The study seeks to investigate how firm-specific and institutional factors shape ICT disclosure and offers insights to support harmonized reporting standards within the African banking sector.

To guide the investigation, the study pursues the following specific objectives:

(a) Examine the relationship between firm size and ICT software disclosure

(b) Assess the impact of auditor type on ICT software disclosure

(c) Determine the extent to which ownership structure affects ICT software disclosure

(d) Analyse the relationship between leverage and ICT software disclosure

(e) Evaluate the impact of profitability on ICT software disclosure

(f) Investigate the relationship between board independence and ICT software disclosure

(g) Examine how firm age influences ICT software disclosure

Literature Review

Theoretical Review

This study is anchored on four foundational theories that collectively explain the motivations and strategic relevance of ICT software disclosure. Agency theory posits that managers disclose information to minimise agency costs, reduce information asymmetry and demonstrate accountability to shareholders (Jensen & Meckling, 1976). Through this lens, ICT software

disclosure functions as a monitoring mechanism that reassures principals of effective managerial oversight.

Stakeholder theory expands the rationale for disclosure beyond shareholders, arguing that transparent ICT reporting responds to the expectations of multiple stakeholder groups including regulators, creditors and the broader public who demand responsible organisational conduct (Freeman, 1984). In this context, ICT disclosure becomes a tool for sustaining trust and meeting diverse informational needs.

Signalling theory provides further justification by framing voluntary ICT software disclosure as a deliberate signal through which firms communicate technological capability, innovation readiness and operational robustness to the market (Spence, 1973). Such disclosures help differentiate firms in competitive environments.

Legitimacy theory adds an institutional dimension, proposing that firms disclose information to maintain social acceptance and align with regulatory norms and societal expectations (Dowling & Pfeffer, 1975). ICT software disclosure therefore supports organisational legitimacy by demonstrating conformity with established reporting standards and technological accountability. Together, these theories guide the present research by explaining ICT software disclosure as both a governance mechanism and a strategic response to stakeholder demands, agency concerns, market signaling motives and institutional pressures.

Conceptual Review

ICT software disclosure is increasingly important as banks depend on digital systems. IAS 38 requires disclosure of software development costs and amortisation to strengthen comparability and accountability (Tsalavoutas & Dionysiou, 2014; IASB, 2020). Prior studies commonly assess ICT software disclosure using index-based scoring aligned with IAS 38 requirements (Supriyanto & Resnika, 2023; Nicolò et al., 2020). This study adopts the IAS-38-based approach applied by Supriyanto and Resnika (2023).

Firm size reflects organisational scale and influences strategy, resources and reporting capacity. Larger firms tend to disclose more due to stronger structures and broader stakeholder expectations (Nicolò et al., 2020). Empirical disclosure studies typically measure firm size using the natural logarithm of total assets to enhance comparability across organisations (Azevedo et al., 2019; Nurudeen et al., 2018).

Auditor type is a major determinant of disclosure quality. Firms audited by Big Four auditors generally report more comprehensive disclosures owing to superior expertise and oversight (Oliveira et al., 2006; Susanto et al., 2019). Stronger IAS 38 compliance has also been observed under Big Four audits in emerging markets (Agyei-Mensah, 2019; Azevedo et al., 2019). Audit quality remains central to transparency (Yahaya, 2025), and this study codes auditor type as 1 for Big Four and 0 for non-Big Four auditors.

Ownership structure influences transparency by determining control distribution. Concentrated ownership may limit disclosure, while dispersed ownership encourages openness (Nuzula & Lokuwaduge, 2017). Institutional and state owners often demand stronger reporting (Rahmawaty & Maswan, 2020). This study adopts a 5% concentration threshold.

Leverage reflects reliance on debt and affects disclosure incentives. Highly leveraged firms may disclose more to reassure creditors (Eneh et al., 2021), though some may conceal vulnerabilities (Achim et al., 2023). Leverage is typically measured as total liabilities to total assets (Supriyanto & Resnika, 2023; Ayinla, 2020), which this study follows (Nurudeen et al., 2018).

Profitability encourages broader disclosure, as strong performers seek to reinforce stakeholder confidence (Chandraratne et al., 2021). ROA remains the standard profitability proxy (Nicolò et al., 2020; Aggarwal & Verma, 2020) and is linked to higher transparency (Supriyanto & Resnika, 2023; Ghazalat, 2025). This study uses ROA accordingly.

Firm age indicates operational longevity and is associated with more structured disclosures (Eneh et al., 2021; Ibadin & Oladipupo, 2015; Zhang, 2012). Evidence from Sri Lanka and Indonesia

confirms its relevance in disclosure models (Chandraratne et al., 2021; Supriyanto & Resnika, 2023). This study measures age as years listed.

Empirical Review and Hypotheses Development

ICT software disclosure has become a key channel through which firms convey transparency, reduce information asymmetry and maintain legitimacy in the eyes of stakeholders. Within the framework of agency theory, managers disclose information to reduce agency costs and reassure shareholders of effective monitoring and accountability (Jensen & Meckling, 1976). Stakeholder theory broadens this view by emphasizing that disclosure also meets the expectations of creditors, regulators and the public for organizational responsibility (Freeman, 1984). Signaling theory explains voluntary ICT software disclosure as a credible market signal of technological competence and operational soundness (Spence, 1973). Legitimacy theory complements these perspectives by suggesting that disclosure sustains firms' social acceptance within institutional and regulatory frameworks (Dowling & Pfeffer, 1975). Collectively, these theories justify why ICT software disclosure can be interpreted as both a governance instrument and a strategic response to stakeholder and institutional pressures.

Firm Size

Firm size consistently emerges as one of the most influential predictors of disclosure behavior. Larger institutions face closer scrutiny from regulators, investors and the public. This scrutiny compels them toward more transparent reporting (Alnabsha et al., 2018; Bokpin, 2013). From both resource based and stakeholder perspectives, large firms possess the capacity and incentive to disclose extensively. This is because of their stronger systems, financial resources and reputational exposure (Kashani & Shiri, 2022).

Empirical findings reinforce this logic: Adelopo et al. (2021) found a strong positive correlation between firm size and intangible asset disclosure, while Putri and Firmansyah (2023) and Hung et al. (2021) observed similar size effects across sustainability and CSR contexts. Hence, larger banks in Sub-Saharan Africa are expected to engage in broader ICT software disclosure to meet diverse stakeholder expectations.

H₁: Firm size has a positive and significant effect on ICT software disclosure among listed banks in Sub-Saharan Africa.

Auditor Type

Auditor type also influences disclosure practices through both signalling and agency mechanisms. Big Four (Deloitte, EY, KPMG and PwC) auditors enhance governance oversight and enforce compliance with international accounting standards (Whiting & Woodcock, 2011). The presence of a Big Four auditor signals credibility to investors, thereby narrowing the information gap between firms and stakeholders (Sun et al., 2017). Prior studies show mixed evidence: some find a significant link between auditor type and disclosure (Beisland et al., 2018; Nguyen & Kend, 2021), while others report weak or context dependent results (Azevedo et al., 2018; Rep et al., 2019). This variation implies that audit disclosure outcomes depend on institutional strength, though audit reputation remains a key signal of financial integrity.

H₂: Auditor type positively influences the level of ICT software disclosure among listed banks in Sub-Saharan Africa.

Ownership Structure

Ownership concentration and composition determine who controls information flows and how transparency is incentivized. Agency theory predicts that concentrated ownership reduces external disclosure since major shareholders already possess internal access (Alabdullah, 2018; Meqbel et al., 2025). Conversely, dispersed or institutional ownership encourages broader disclosure to satisfy diverse investor information needs (Chen et al., 2022).

Empirical evidence remains mixed, because institutional and foreign ownership often promote transparency (Ali et al., 2023; Ioannou & Serafeim, 2019), whereas managerial or insider ownership may dampen it (Piosik & Genge, 2019). Variations in legal enforcement and governance culture further moderate these effects (Rashid et al., 2020; Tsang et al., 2019). Overall, ownership structure operates as both a governance mechanism and a contextual constraint shaping ICT disclosure choices.

H₃: Ownership structure significantly affects the level of ICT software disclosure among listed banks in Sub-Saharan Africa.

Leverage

Leverage captures a firm's dependence on external financing and the monitoring role of creditors. According to agency theory, higher leverage creates pressure to disclose more information to reduce creditor risk and signal solvency (Maryana & Carolina, 2021). However, legitimacy theory also implies that heavily indebted firms may strategically restrict disclosure to avoid drawing attention to financial vulnerability (Carolina et al., 2020). Given these competing forces, the direction of the relationship remains context dependent.

H₄: Leverage has a significant relationship with ICT software disclosure among listed banks in Sub-Saharan Africa.

Profitability

Profitability influences disclosure incentives through signalling and resource-availability channels. Profitable firms are more likely to highlight their technological efficiency and governance strength to sustain investor confidence (Mahmuda & Muktadir-Al-Mukit, 2022).
While many studies show a positive link (Monteiro et al., 2021; Wahyuningrum et al., 2021), others document neutral or negative associations (Gavana et al., 2016; Nandhini et al., 2022), suggesting that disclosure motivation may depend on performance cycles and strategic posture. In the banking context, profitability not only signals operational soundness but also supports ICT investment and reporting capacity.

H₅: Profitability positively influences ICT software disclosure among listed banks in Sub-Saharan Africa.

Board Independence

Board independence enhances oversight, mitigates agency conflict and promotes compliance with disclosure standards such as IAS 38 (Agyei-Mensah, 2019; Tawiah & Boolaky, 2019). According to Juhmani (2017) independent directors serve as objective monitors who strengthen transparency

and accountability. However, effectiveness depends on institutional strength. Some studies confirm positive effects (Gürol & Lagasio, 2022; Lu et al., 2024; Umar et al., 2023), whereas others find no significant relationship (Alyousef & Alsughayer, 2021; Mazumder & Hossain, 2022). Thus, the influence of board independence on ICT disclosure is conditional on governance quality and board activism within each banking environment.

H₆: Board independence positively influences ICT software disclosure among listed banks in Sub-Saharan Africa.

Firm Age

Firm age captures organizational maturity and reputational capital influencing disclosure behavior. Legitimacy theory suggests older firms disclose more to maintain stakeholder trust (Dawkins & Fraas, 2008). Evidence is mixed, with some studies finding positive effects (Alrawashedh, 2023; Rahaman et al., 2022) and others insignificant (Mousa & Elamir, 2018; Okoba & Chukwu, 2023). In banking, older institutions rely on reputation to sustain transparency despite structural inertia.

H₇: Firm age positively influences ICT software disclosure among listed banks in Sub-Saharan Africa.

In summary, the theoretical logic integrates agency, signalling, stakeholder and legitimacy perspectives to explain how firm characteristics shape disclosure behaviour under IAS 38. Together, these seven hypotheses reflect the multidimensional governance and institutional forces influencing ICT software transparency within Sub-Saharan African banking.

Research Methodology

This study adopts a quantitative ex post facto design to examine how firm-specific attributes influence ICT software disclosure among listed banks in Sub-Saharan Africa. The study relies on audited, IFRS-compliant financial reports from 2012 to 2023, providing a balanced panel of 456 firm-year observations drawn from a purposive sample of 38 listed banks across Nigeria, Ghana, Kenya, Tanzania, Botswana, and South Africa. These countries were selected because of their active capital markets and consistent financial reporting frameworks under IFRS. The ex post facto

design is appropriate since the study focuses on analysing pre-existing data without manipulation of variables, thereby enhancing external validity.

The dependent variable, ICTsoft, measures the extent of ICT software disclosure in line with IAS 38 and the 2023 KPMG IFRS Disclosure Checklist. Sixteen disclosure items were extracted from IAS 38, namely: *impairment losses/reversals, depreciation charges, exchange differences, depreciation methods, useful lives/depreciation rates, revaluation model, revaluation date, revaluation methods/assumptions, revaluation surplus, impairment testing, held-for-sale assets, title restrictions, pledged assets, contractual commitments, compensation for impaired/lost assets,* and *derecognition gains/losses.* Each item was binary-coded (1 = disclosed, 0 = not disclosed). The disclosure index for each firm-year observation was computed as:

$$ICTsoft_{it} = \frac{\sum_{j=1}^{16} X_{ijt}}{16}$$

Where X_{ijt} represents disclosure on item *j* for firm *i* in year *t*. Thus, a firm disclosing all sixteen items obtains a perfect score of 1, while a firm disclosing none scores 0. This proportional index ensures comparability across firms and years and eliminates subjective weighting bias in disclosure measurement.

The econometric model used to estimate the determinants of ICT software disclosure is expressed as follows:

$$ICTsoft_{it} = \alpha_0 + \beta_1 FS_{it} + \beta_2 AT_{it} + \beta_3 OW_{it} + \beta_4 LV_{it} + \beta_5 PR_{it} + \beta_6 BI_{it} + \beta_7 FA_{it} + \sum_c \gamma_c Country_c + \varepsilon_{it}$$

Firm size (FS) is the log of total assets; auditor type (AT) equals 1 for Big Four auditors and 0 otherwise; ownership (OW) is the proportion of shares held by investors with at least 5%; leverage (LV) is total liabilities to total assets; profitability (PR) is return on assets; board independence (BI) is the ratio of independent directors to total board members; and firm age (FA) is years since listing. Country dummies capture jurisdictional effects. Fixed and random effects models were estimated, with the Hausman test guiding selection. Robust standard errors corrected heteroscedasticity and serial correlation. Normality, VIF and Durbin–Watson tests confirmed model adequacy. While panel estimation reduces omitted variable bias, possible reverse causality

between firm size, profitability and disclosure remains. Robustness checks using subregional and country fixed effects produced consistent results across specifications.

Table 1: Measurement of Variables

Variable	Code	Measurement	Theoretical Justification	Expected Sign
ICT Software Disclosure Index	ICTsoft	Number of ICT disclosure items disclosed ÷ 16	Measures the extent of IAS 38 ICT disclosure	Dependent
Firm Size	FS	Natural logarithm of total assets	Visibility and legitimacy pressure increase transparency	+
Leverage	LV	Total liabilities ÷ total assets	Creditors' monitoring may either constrain or enhance disclosure	±
Profitability	PR	Return on assets (ROA)	Financial strength signals quality and encourages disclosure	+
Firm Age	FA	Number of years since listing	Older firms develop stable reporting structures	+
Auditor Type	AT	Dummy: 1 = Big Four, 0 = otherwise	Audit quality enhances reliability and compliance	+
Ownership Structure	OW	% of shares held by shareholders owning ≥ 5%	Dispersed ownership increases transparency; concentration may reduce it	±
Board Independence	BI	Independent directors ÷ total board size	Governance quality promotes disclosure	+
Country Effects	Country_c	Dummy variables for Nigeria, Ghana, Kenya, South Africa, Tanzania, Botswana	Controls for institutional heterogeneity	Control

All estimations were conducted using Stata 18.5 at the 5% significance level. Results of diagnostic tests, the Hausman specification test and robustness checks are reported in Appendices A1−A4.

This methodological framework integrates theory-driven variable selection, rigorous panel estimation and transparency in index construction while recognising potential endogeneity as a study limitation rather than a source of bias invalidating the findings.

Data Presentation and Analysis

Descriptive Statistics

Table 2 presents descriptive statistics for 456 firm-year observations. The mean ICT software disclosure index (0.55; SD = 0.15) indicates moderate IAS 38 compliance. Firm size and profitability vary widely, while auditor type (mean = 0.998) confirms Big Four dominance. Ownership concentration averages 0.47, leverage remains high (0.86) and board independence (0.75) with firm age (32 years) reflect strong governance and maturity. Overall, the dataset is balanced and appropriate for regression analysis.

Table 2: Aggregate Descriptive Statistics

Variable	N	Mean	SD	Min	Max
ICTsoft	456	0.5496	0.1481	0.1429	0.8929
FS	456	15.3034	1.6368	9.1974	19.0743
AT	456	0.9978	0.0468	0.0000	1.0000
OW	456	0.4715	0.2587	0.0000	0.9800
LV	456	0.8627	0.0434	0.6668	0.9483
PR	456	2.1640	1.9450	−8.7542	23.9457
BI	456	0.7484	0.1315	0.2000	0.9375
FA	456	32.2105	13.6399	12.0000	54.0000

Table 3 highlights cross-country differences in ICT disclosure and firm attributes. Tanzania records the highest ICTsoft score (0.69), followed by Nigeria (0.59) and South Africa (0.58), while

Botswana ranks lowest (0.34). South African banks are largest (17.85), Tanzanian smallest (12.92). Ownership concentration peaks in Ghana (0.73) and is lowest in Nigeria (0.29). Leverage is uniformly high (≈0.85–0.89), while profitability varies sharply. Board independence is strongest in Tanzania (0.89), weakest in Nigeria (0.62), and firm age spans 14–39 years, reflecting institutional maturity differences.

Table 3: Country-Level Descriptive Statistics (Summary)

Country	Mean ICTsoft	Mean FS	Mean OW	Mean LV	Mean PR	Mean BI	Mean FA
Botswana	0.34	14.38	0.67	0.89	2.27	0.81	33.67
Ghana	0.53	13.90	0.73	0.85	2.39	0.76	23.43
Kenya	0.54	14.86	0.48	0.84	2.57	0.79	33.70
Nigeria	0.59	15.96	0.29	0.87	1.71	0.62	35.70
South Africa	0.58	17.85	0.41	0.89	1.75	0.80	39.33
Tanzania	0.69	12.92	0.31	0.82	2.72	0.89	14.50

In summary, the descriptive profile demonstrates moderate ICT software disclosure levels across Sub-Saharan Africa, with stronger transparency observed in more developed banking markets such as South Africa, Nigeria, and Tanzania. Variations in firm size, governance, and profitability align with theoretical expectations that both resource capacity and institutional context shape disclosure behaviour. The data's distributional consistency supports its suitability for subsequent panel regression analysis.

Correlation Matrix

Tables 5 and 6 present the pairwise correlations among the study variables at both the aggregate and country levels (full matrices available on request; excluded for brevity).ICT software disclosure (ICTsoft) relates positively to firm size ($r = 0.15$) and firm age ($r = 0.11$) but negatively to ownership concentration ($r = –0.24$) and board independence ($r = –0.14$). Firm size correlates positively with leverage ($r = 0.53$), while profitability is inversely related ($r = –0.46$). No correlation exceeds 0.7, and VIF tests confirm no multicollinearity. Cross-country patterns remain consistent, supporting data suitability for regression analysis.

Table 1: Aggregate Correlation Matrix

	ICTsoft	FS	AT	OW	LV	PR	BI	FA
ICTsoft	1.000							
FS	0.152*	1.000						
AT	-0.007	0.137*	1.000					
OM	-0.241*	0.372*	0.030	1.000				
LV	0.001	0.528*	0.212*	-0.168*	1.000			
PR	-0.066	0.144*	0.009	0.095*	-0.459*	1.000		
BI	-0.144*	0.161*	0.018	0.115*	-0.044	-0.075	1.000	
FA	0.108*	0.373*	0.059	-0.064	0.287*	-0.201*	-0.046	1.000

*Note: $p < .05$.

ICT software disclosure (**ICTsoft**) shows a positive correlation with firm size (FS) ($r = 0.152$) and firm age (FA) ($r = 0.108$), indicating that larger and older banks tend to disclose more. **ICTsoft** is negatively related to ownership structure (OW) ($r = –0.241$) and board independence (BI) ($r = –0.144$), suggesting these factors may reduce disclosure levels. Its relationships with leverage (LV; $r = 0.001$) and profitability (PR; $r = –0.066$) are weak and insignificant. Some firm attributes— such as FS and LV ($r = 0.528$), FS and FA ($r = 0.373$), and LV and PR ($r = –0.459$)—show moderate correlations, but none approach multicollinearity thresholds**.**

The country-specific matrices show that the relationships between ICT software disclosure (**ICTsoft**) and firm attributes vary widely across the six countries. In **Botswana**, **ICTsoft** is strongly associated with leverage *(r = 0.6673)* and negatively with profitability, revealing disclosure sensitivity to financial stability. In **Ghana** and **Kenya**, **ICTsoft** shows weak correlations with all attributes, except in Kenya where older firms *(FA; r = 0.4362)* disclose more. In **Nigeria**, **ICTsoft** has a strong positive correlation with firm size *(FS; r = 0.5867)* and modest links with profitability, indicating that larger and more profitable banks disclose more ICT information. In **South Africa**, **ICTsoft** relates positively to firm size *(r = 0.3651)* but negatively to profitability, reflecting different disclosure incentives. For **Tanzania**, **ICTsoft** is moderately associated with firm size *(r = 0.4616)* but negatively with firm age, suggesting younger firms disclose more. Overall, the results highlight that disclosure determinants differ significantly by national context, shaped by country-specific regulatory, governance and market environments.

Table 2: Country-Specific Correlation Matrices

Country	Variable	ICTsoft	FS	OW	LV	PR	BI	FA
Botswana	**ICTsoft**	1.0000						
(N=36)	FS	0.0258	1.0000					
	OW	-0.3214	-0.2997	1.0000				
	LV	0.6673*	-0.2165	-0.3909	1.0000			
	PR	-0.4778*	0.2793	0.1856	-0.7923***	1.0000		
	BI	-0.0687	0.3986*	-0.1196	0.0266	-0.1503	1.0000	
	FA	0.1913	-0.4515*	-0.1925	0.4916*	-0.4372*	-0.4059	1.0000
Ghana	**ICTsoft**	1.0000						
(N=84)	FS	-0.1339	1.0000					
	OW	-0.0215	-0.1615	1.0000				
	LV	-0.1789	0.2890*	-0.2178	1.0000			
	PR	-0.0893	0.3093**	0.1562	-0.4701***	1.0000		
	BI	-0.1387	-0.0522	-0.0879	0.1716	-0.3671**	1.0000	
	FA	0.1180	-0.1412	-0.1346	-0.2785*	0.2994*	-0.3401*	1.0000
Kenya	**ICTsoft**	1.0000						
(N=120)	FS	-0.0622	1.0000					
	OW	0.0355	-0.3070**	1.0000				
	LV	0.0892	0.0617	-0.2617**	1.0000			
	PR	-0.0276	0.4370***	0.0285	-0.1593	1.0000		
	BI	-0.1419	-0.1185	-0.2311*	0.1881*	-0.2394*	1.0000	
	FA	0.4362***	-0.1312	0.0141	0.0847	-0.3238**	0.2379*	1.0000
Nigeria	**ICTsoft**	1.0000						
(N=120)	FS	0.5867***	1.0000					
	OW	-0.3042**	-0.5306***	1.0000				
	LV	0.0986	-0.0392	-0.2963**	1.0000			
	PR	0.2434*	0.4923***	-0.0836	-0.3920***	1.0000		
	BI	-0.0306	-0.0238	-0.1652	0.0783	-0.3508**	1.0000	
	FA	-0.2367*	-0.1229	0.2490*	0.1289	-0.3467**	0.1220	1.0000
South Africa	**ICTsoft**	1.0000						
(N=72)	FS	0.3651**	1.0000					
	OW	-0.2039	0.0625	1.0000				
	LV	0.2234	0.8924***	-0.0368	1.0000			
	PR	-0.2526*	0.8135***	0.0615	0.9226***	1.0000		
	BI	-0.1577	0.0122	0.2951*	0.0876	0.1674	1.0000	
	FA	0.1232	0.7508***	0.1841	0.6821***	0.6974***	0.0527	1.0000
Tanzania	**ICTsoft**	1.0000						
(N=24)	FS	0.4616*	1.0000					
	OW	0.2722	0.3996	1.0000				
	LV	0.3915	0.7937***	0.2627	1.0000			
	PR	-0.0113	0.3210	0.0969	0.4597*	1.0000		
	BI	0.3138	0.7613***	0.1052	0.6965***	0.1559	1.0000	
	FA	-0.4693*	0.9731***	0.3798	0.7298***	0.1400	0.7471***	1.0000

Significance levels: *p < 0.05, **p < 0.01, ***p < 0.001

Results and Discussion

Tables 7 and 8 report the OLS and random-effects (RE) estimates of ICT software disclosure across the pooled and country-specific samples. The pooled results reveal that firm size, auditor type, and firm age are the most consistent positive determinants of disclosure, while board independence exerts a negative influence.

Table 7. Pooled OLS Regression of ICT Software Disclosure (ICTsoft) – Aggregate and Country-Specific Models with Robust Standard Errors

	All Countries (Pooled)	Botswana	Ghana	Kenya	Nigeria	South Africa	Tanzania
Firm Size (FS)	0.0146* (0.0061)	0.060* (0.022)	0.017 (0.042)	–0.027 (0.018)	0.056*** (0.0088)	0.071*** (0.0154)	0.042 (0.1190)
Auditor Type (AT)	0.112** (0.037)	– –	0 (omitted) –	0 (omitted) –	0 (omitted) –	0 (omitted) –	0.045 (0.1386)
Ownership (OW)	–0.0446 (0.0325)	–0.016 (0.086)	–0.027 (0.097)	–0.036 (0.0826)	0.045 (0.0227)	–0.0098 (0.0629)	0.087 (0.3695)
Leverage (LV)	–0.0281 (0.1617)	3.535** (1.153)	–1.825* (0.8524)	0.731 (0.544)	0.292** (0.1048)	–1.427*** (0.3837)	0.351 (0.7095)
Profitability (PR)	–0.0035 (0.00338)	–0.0050 (0.0211)	–0.0203* (0.00784)	–0.0050 (0.0211)	–0.00598 (0.00460)	–0.0248* (0.0125)	0.0069 (0.0108)
Board Independence (BI)	–0.1749** (0.0556)	–0.447*** (0.1289)	–0.278 (0.1981)	–0.342* (0.1609)	–0.0036 (0.0372)	–0.155 (0.1170)	–0.808 (0.7051)
Firm Age (FA)	0.0020*** (0.000499)	0.00627*** (0.00098)	0.00175 (0.00293)	–0.0519 (0.0309)	–0.00105** (0.000341)	–0.00230* (0.00111)	0.0320 (0.3971)
Constant	0.326* (0.1331)	-1.633 (1.6011)	2.093* (0.8893)	0.436 (0.5508)	–0.515** (0.1843)	0.842** (0.3082)	0.024 (7.2409)
Country Dummies:	(Nigeria base)	(n/a)	(n/a)	(n/a)	(n/a)	(n/a)	(n/a)
– Botswana	–0.1749*** (0.0267)	–	–	–	–	–	–
– Ghana	0.0395 (0.0273)	–	–	–	–	–	–
– Kenya	0.0098 (0.0179)	–	–	–	–	–	–
– South Africa	–0.0124 (0.0194)	–	–	–	–	–	–
– Tanzania	0.2401*** (0.0394)	–	–	–	–	–	–
R-squared	0.2942	0.537	0.1125	0.2797	0.4129	0.3027	0.2640
RMSE	0.126	0.075	0.163	0.152	0.048	0.060	0.146
Adj R-squared	0.2750	36	84	120	120	72	24
Mean VIF	2.38	n/a	n/a	n/a	n/a	n/a	n/a
High. VIF (FS)	4.88	n/a	n/a	n/a	n/a	n/a	n/a
Breusch-Pagan χ^2	6.96	n/a	n/a	n/a	n/a	n/a	n/a

Breusch-Pagan p-value	0.0083	n/a	n/a	n/a	n/a	n/a	n/a
Observations	456	36	84	120	120	72	24

*Notes: Robust standard errors are in parentheses. **p < 0.05, **p < 0.01, ***p < 0.001*

Table 8. Panel Random-Effects Regression of ICT Software Disclosure (ICTsoft) – Aggregate and Country Panels

Variable	All Countries (Aggregate Panel RE)	Botswana (RE)	Ghana (RE)	Kenya (RE)	Nigeria (RE)	South Africa (RE)	Tanzania (RE)
FS	0.013**	0.060***	0.017	-0.003	0.022*	0.071**	0.042
	(0.005)	(0.017)	(0.113)	(0.007)	(0.013)	(0.036)	(0.047)
AT	0.054***	-1.633	2.093	0.474***	—	0.842	0.045
	(0.011)	(2.238)	(1.344)	(0.177)	(omitted)	(0.559)	(0.065)
OW	-0.007	-0.016	-0.027	-0.005	0.001	-0.010	0.087
	(0.012)	(0.142)	(0.130)	(0.008)	(0.007)	(0.034)	(0.399)
LV	-0.007	3.535	-1.825***	-0.083	-0.051	-1.427**	0.351
	(0.098)	(2.199)	(0.366)	(0.093)	(0.066)	(0.595)	(0.987)
PR	-0.001	-0.005	-0.020***	-0.001	0.001	-0.025	0.007*
	(0.003)	(0.037)	(0.007)	(0.002)	(0.004)	(0.019)	(0.004)
BI	0.014	-0.342	-0.278	0.009	0.007	-0.155	-0.808***
	(0.027)	(0.254)	(0.224)	(0.012)	(0.016)	(0.152)	(0.111)
FA	0.002	-0.052***	0.002	0.005	-0.001	-0.002	0.032
	(0.002)	(0.019)	(0.007)	(0.003)	(0.001)	(0.003)	(0.053)
Intercept	—	—	—	—	0.301*	—	0.024
					(0.165)		(0.597)
Within R²	0.0145	0.0070	0.0018	0.0119	0.0588	0.0177	0.0560
Between R²	0.3062	0.9926	0.3538	0.1870	0.3382	0.5238	1.0000
Overall R²	0.2769	0.5373	0.1125	0.1845	0.3196	0.3027	0.2640
RMSE	0.030	0.056	0.071	0.022	0.016	0.030	0.146
Wald χ²	382980.71***	—	—	272.13***	—	—	—
Rho	0.000	0.000	0.000	0.9887	0.9484	0.000	0.000

Note: Robust standard errors in parentheses. Significance levels: *p<.10; **p<.05; ***p<.01.

Firm size shows a strong positive effect on ICT disclosure ($\beta \approx 0.014$, $p < 0.05$), confirming that larger banks, with greater reporting capacity and scrutiny, are more transparent about intangible assets—especially in Nigeria and South Africa. Auditor type (Big Four) is also positive and significant ($\beta \approx 0.05$, $p < 0.01$), reflecting global audit credibility, though within-country effects weaken due to uniform coverage. Board independence remains negative ($\beta \approx –0.17$, $p < 0.05$), suggesting independent boards in SSA banks emphasize compliance over voluntary ICT disclosure. Firm age has a mild positive effect ($\beta \approx 0.002$, $p < 0.01$), but reverses in South Africa and Nigeria, where younger, tech-driven banks disclose more.

Leverage and profitability show weak or mixed results, while ownership concentration is consistently insignificant. Country effects reveal lower disclosure in Botswana and higher in Tanzania ($p < 0.01$). The RE model ($R^2 = 0.277$; Wald χ^2, $p < 0.001$) confirms firm size, auditor type, and firm age as key predictors, supporting signalling and institutional views that disclosure reflects credibility and legitimacy rather than short-term performance.

Robustness and Diagnostic Validation

Regression diagnostics confirm the model's robustness. Variance inflation factors (mean = 2.38; max = 4.88) indicate no multicollinearity, and although the Breusch–Pagan test shows mild heteroskedasticity ($\chi^2 = 6.96$, $p = 0.008$), robust standard errors correct it. The Wald chi-square ($\chi^2 = 382,980.71$, $p < 0.001$) supports overall model adequacy and explanatory strength.

However, endogeneity risk remains, as no 2SLS or instrumental-variable estimation was used. Causality between firms attributes and disclosure may be reciprocal, particularly for firm size and profitability. While panel estimation limits omitted-variable bias, the lack of dynamic or instrumental correction is a caveat.

Overall, diagnostic results confirm econometric stability, with consistent findings across estimations. The models reliably explain ICT software disclosure determinants among Sub-Saharan African banks, within acknowledged endogeneity and cross-sectional limitations.

Conclusion and Policy Implications

This study examined the determinants of ICT software disclosure (ICTsoft) among listed banks in Sub-Saharan Africa, focusing on firm-specific characteristics. Using pooled OLS and panel random-effects models, firm size, auditor type, and firm age emerged as key positive drivers of disclosure, while board independence showed a negative effect. Ownership, leverage, and profitability had weak or inconsistent influences. Cross-country variation indicates that disclosure practices are shaped by institutional and regulatory environments rather than firm factors alone.

ICT disclosure reflects organisational scale, audit credibility and maturity. Larger and older banks audited by reputable firms disclose more, consistent with signalling and institutional perspectives.

The inverse relationship with board independence suggests governance frameworks emphasise compliance over voluntary transparency.

For policymakers, the results highlight the need for disclosure frameworks aligned with national regulatory capacity and institutional diversity. Strengthening ICT reporting requires director training, governance reforms, credible audit oversight and regional coordination, especially through the African Continental Free Trade Area to promote harmonised disclosure standards and investor confidence.

The study is limited to listed commercial banks in six countries, with secondary data restricting causal inference and generalisability. Future research should include unlisted or ICT intensive firms, integrate macroeconomic and cultural variables, and adopt mixed methods to capture managerial motivations.

The study contributes by linking institutional context to disclosure behaviour, offering a replicable framework for intangible asset reporting and providing comparative evidence on IAS 38 software disclosure, reinforcing the call for context-specific, transparent financial reporting in Africa.

Disclaimer (Artificial Intelligence)

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Competing Interests

Authors have declared that no competing interests exist.

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