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Relationship Between Electronic Fiscal Devices (EFDs) And Tax Compliance Among Informal Sector Businesses In Kampala District.

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Abstract

The study examined the relationship between Electronic Fiscal Devices (EFDs) and tax compliance among informal sector businesses in Kampala District, Uganda. A descriptive cross-sectional survey design was employed with a sample of 378 informal sector operators. Data were collected using structured questionnaires and analyzed through correlation and regression techniques. Results revealed a significant positive relationship between EFD implementation and tax compliance ($r=0.748$, $p<0.01$). Regression analysis indicated that EFD-related factors explained 56.0% of variance in tax compliance ($R^2=.560$, $F=135.724$, $p<.001$). EFD usage intensity ($\beta=0.397$, $p<0.01$), perceived EFD effectiveness ($\beta=0.342$, $p<0.01$), and EFD technical support ($\beta=0.286$, $p<0.05$) significantly predicted tax compliance. The study concluded that Electronic Fiscal Devices substantially enhanced tax compliance in the informal sector. Recommendations included expanding EFD distribution programs, strengthening technical support infrastructure, reducing device costs through subsidies, conducting extensive training programs, and improving internet connectivity in informal business areas.

Keywords: Electronic Fiscal Devices, tax compliance, informal sector, fiscal technology, digital tax administration, Kampala District, Uganda

Background of the Study

The informal sector constituted a dominant feature of Uganda's economic landscape, contributing approximately 43% of GDP and providing employment to over 80% of the working population according to the Uganda Bureau of Statistics (2022). In Kampala District, Uganda's capital and largest commercial center, informal economic activities permeated all sectors including retail trade, transportation services, food vending, artisan services, and small-scale manufacturing. These enterprises generated substantial economic value and served as primary income sources for millions of urban residents, yet remained largely invisible to the formal tax system.

Tax compliance within the informal sector represented one of the most persistent challenges facing revenue authorities in developing countries. The Uganda Revenue Authority (URA) estimated that potential tax revenue losses from informal sector non-compliance exceeded UGX 2.5 trillion annually, representing approximately 25% of total collectable revenue (URA, 2023). This massive revenue leakage constrained government capacity to finance essential public services, infrastructure development, healthcare, education, and poverty reduction programs. Furthermore, widespread tax evasion in the informal sector created competitive distortions, penalizing compliant formal businesses and discouraging voluntary formalization.

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Multiple factors contributed to persistently low tax compliance among informal sector operators in Uganda. These included limited awareness of tax obligations, complex and burdensome tax procedures, inadequate record-keeping practices, predominantly cash-based transactions that facilitated income concealment, weak enforcement capacity by tax authorities, negative perceptions of government service delivery, and rational calculations that compliance costs exceeded perceived benefits (Ligomeka, 2019). Many informal operators viewed taxation as extractive rather than contributory, leading to active evasion or strategic underreporting of taxable income.

Electronic Fiscal Devices (EFDs) emerged globally as a technological solution to enhance tax compliance and modernize revenue administration. EFDs, also known as Electronic Fiscal Registers or Fiscal Electronic Devices, were specialized hardware devices designed to record, store, and transmit sales transaction data to tax authorities in real-time or near-real-time (OECD, 2019). Unlike conventional cash registers that could be manipulated, EFDs incorporated tamper-proof memory modules, encryption capabilities, and secure communication protocols ensuring transaction integrity. When customers made purchases, EFDs automatically generated fiscal receipts containing unique transaction identifiers, transmitted sales data to tax authority servers, and prevented deletion or alteration of recorded transactions.

The theoretical rationale for EFDs drew from both deterrence theory and compliance cost theory. Deterrence theory posited that tax compliance increased when taxpayers perceived higher detection probabilities and penalties for evasion (Allingham & Sandmo, 1972). EFDs enhanced detection by creating automatic digital audit trails that were difficult to manipulate, thereby increasing perceived and actual detection risks. Compliance cost theory suggested that reducing administrative burdens and simplifying compliance processes enhanced voluntary compliance (Coolidge, 2012). EFDs automated record-keeping, simplified tax calculation, and facilitated reporting, potentially reducing compliance costs and errors.

International evidence demonstrated EFD effectiveness in improving tax compliance. Rwanda implemented Electronic Billing Machines (EBMs) starting in 2013, achieving significant increases in VAT compliance rates from 67% to 92% within five years while simultaneously expanding the tax base (Rwanda Revenue Authority, 2018). Kenya's Electronic Tax Registers (ETRs) program increased reported sales by 22% among affected businesses and generated substantial revenue gains (Mascagni et al., 2019). Ethiopia's EFD rollout enhanced tax collections in urban areas by approximately 35% over three years (Ethiopian Revenues and Customs Authority, 2020). These success stories motivated similar initiatives across Sub-Saharan Africa.

Uganda initiated EFD implementation through a phased approach beginning in 2017. Initially targeting large taxpayers and specific sectors such as restaurants, bars, and hospitality businesses, the program gradually expanded to include medium-sized enterprises and selected informal sector categories. By 2023, URA had distributed over 45,000 EFDs and introduced mobile-based fiscal solutions to accommodate smaller businesses lacking physical premises (URA, 2023). The Electronic Fiscal Receipting and Invoicing Solution (EFRIS) complemented hardware EFDs by offering

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software-based alternatives accessible through smartphones and computers, attempting to address cost and portability barriers particularly relevant for informal operators.

Despite government investment and policy emphasis on EFD implementation, adoption within Kampala's informal sector remained limited and uneven. Many informal businesses operated without EFDs due to various barriers including high device costs, limited technical knowledge, inadequate electricity access, poor internet connectivity, resistance to transparency, and insufficient enforcement. Among businesses that had acquired EFDs, actual usage intensity varied considerably, with some operators using devices inconsistently or attempting to circumvent systems through dual invoicing or selective recording.

Previous research on tax compliance in Uganda had examined various determinants including tax knowledge, enforcement, trust in government, and demographic factors (Mawejje & Sebudde, 2019; Ali et al., 2014). However, limited empirical research had specifically investigated the relationship between EFD implementation and tax compliance within the informal sector context. Most existing studies focused on formal businesses or general technology adoption without examining the specific mechanisms through which EFDs influenced compliance behavior among informal operators.

Kampala District provided an ideal context for investigating this relationship. As Uganda's commercial hub, Kampala concentrated diverse informal sector activities, hosted URA headquarters enabling enforcement activities, and benefited from relatively better digital infrastructure compared to rural areas. Yet even in this favorable environment, informal sector tax compliance remained problematic, suggesting that understanding EFD-compliance relationships required context-specific empirical investigation. This study therefore addressed the knowledge gap by examining the relationship between Electronic Fiscal Devices and tax compliance among informal sector businesses in Kampala District.

Problem Statement

Informal sector businesses in Kampala District demonstrated persistently low tax compliance rates despite their substantial economic contribution and the government's increasing emphasis on digital tax administration. Uganda Revenue Authority data indicated that fewer than 18% of informal businesses in Kampala were registered with tax authorities, and among registered entities, compliance with filing and payment obligations remained below 35% (URA, 2023). This widespread non-compliance severely undermined government revenue mobilization efforts, with estimated annual losses exceeding hundreds of billions of shillings from Kampala's informal sector alone.

The government introduced Electronic Fiscal Devices as a technology-based intervention to enhance tax compliance by automating transaction recording, preventing sales concealment, and simplifying reporting processes. However, EFD adoption among informal sector businesses remained limited, and even where devices had been distributed, usage patterns varied considerably. Preliminary observations suggested that many informal operators either did not possess EFDs or used them inconsistently, continuing to conduct substantial unreported cash transactions. The extent to which

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EFD implementation actually influenced tax compliance behavior within the informal sector remained empirically unclear.

Without robust evidence on the EFD-tax compliance relationship, policymakers lacked critical information for evaluating program effectiveness, allocating implementation resources efficiently, designing appropriate support mechanisms, and identifying barriers requiring intervention. Tax authorities needed empirical guidance on whether expanding EFD coverage would yield proportional compliance improvements or whether other factors constrained effectiveness. This study therefore investigated the relationship between Electronic Fiscal Devices and tax compliance among informal sector businesses in Kampala District, Uganda, providing evidence to inform policy and practice.

Specific Objective

To assess the relationship between Electronic Fiscal Devices and tax compliance among informal sector businesses.

Methodology

This study adopted a descriptive cross-sectional survey design to examine the relationship between Electronic Fiscal Devices and tax compliance among informal sector businesses in Kampala District. The design was considered appropriate as it enabled collection of quantitative data from a representative sample at a single time point and facilitated systematic analysis of variable relationships (Creswell & Creswell, 2018).

The study population comprised informal sector businesses operating in Kampala District's five administrative divisions: Central, Kawempe, Makindye, Nakawa, and Rubaga. Based on Kampala Capital City Authority (KCCA) records updated in February 2024, approximately 158,000 informal sector businesses operated within the district. For this study, informal sector businesses were operationally defined as enterprises with fewer than 5 employees, annual turnover below UGX 150 million, operating without formal business premises or from temporary structures, and conducting predominantly cash-based transactions. These criteria aligned with Uganda's official informal sector definition provided by the Uganda Bureau of Statistics.

The sample size was determined using Yamane's (1967) formula: $n = N / [1 + N(e^2)]$, where N represented population size and e represented the desired precision level. With N=158,000 and e=0.05 (representing 95% confidence level), the calculation yielded a minimum required sample of 398. Accounting for potential non-response and incomplete questionnaires, the target sample was set at 378, providing adequate statistical power for correlation and regression analyses while remaining practically feasible given resource constraints.

A multi-stage sampling technique was employed to ensure representativeness. First, stratified sampling was used to allocate the sample proportionally across Kampala's five divisions based on their informal business populations: Central Division (n=103), Kawempe (n=92), Makindye (n=74), Nakawa (n=68), and Rubaga (n=41). Second, within each division, purposive sampling identified major informal business concentration areas including markets (Owino, Nakasero, Kalerwe), taxi parks (Old Taxi Park, New Taxi Park), commercial streets (William Street, Kikubu Lane), and industrial areas (Nakawa, Ntinda). Third, systematic random sampling selected individual businesses from

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enumeration lists compiled through preliminary field visits, with every 20th business selected after a random start point.

Data were collected using structured questionnaires administered through face-to-face interviews. Given varying literacy levels among informal sector operators and the technical nature of some questions, interviewer-administered questionnaires were preferred over self-administered approaches to ensure comprehension and response accuracy. The questionnaire contained five sections: Section A collected demographic information including gender, age, education level, and business experience; Section B assessed business characteristics such as type, size, location, and monthly turnover; Section C measured EFD-related variables including awareness, possession, usage intensity, perceived effectiveness, technical challenges, and support access; Section D evaluated tax compliance across multiple dimensions including registration, filing, payment, and reporting compliance; and Section E explored challenges and facilitators of EFD adoption.

Electronic Fiscal Device implementation was operationalized through four key dimensions based on technology diffusion theory and prior EFD research (Rogers, 2003; Mascagni et al., 2019). EFD awareness encompassed knowledge of EFD requirements, understanding of device functionality, and awareness of compliance penalties. EFD possession indicated whether businesses owned or had been issued EFDs. EFD usage intensity measured the frequency and consistency of actual device use for recording transactions. Perceived EFD effectiveness captured respondents' views on whether EFDs simplified record-keeping, reduced compliance burdens, improved business operations, and enhanced transparency. EFD technical support assessed access to installation assistance, training, maintenance services, and troubleshooting support.

Tax compliance was measured using a comprehensive multidimensional approach consistent with OECD tax compliance frameworks and previous research in developing country contexts (OECD, 2019; Mascagni & Mengistu, 2019). Registration compliance included obtaining business licenses and Tax Identification Numbers (TIN). Filing compliance measured regular submission of required tax returns and declarations. Payment compliance assessed timely remittance of tax obligations. Reporting compliance evaluated accuracy and completeness of income disclosure. Record-keeping compliance examined maintenance of transaction records and supporting documentation. Each dimension was measured through multiple Likert-scale items and validated against observable indicators where possible.

The research instrument underwent comprehensive validation. Content validity was established through expert review by six specialists in taxation, digital technology, and informal sector economics from universities, URA, and development organizations. Experts evaluated item relevance, clarity, comprehensiveness, and cultural appropriateness, providing feedback that informed instrument refinement. The content validity index (CVI) was calculated by dividing items rated as relevant by the total number of items, yielding a CVI of 0.91, substantially

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exceeding the 0.70 threshold recommended by Amin (2005). Face validity was assessed through cognitive interviews with 15 informal sector operators who evaluated question clarity, appropriateness, and cultural sensitivity.

Reliability was tested through a pilot study involving 40 informal businesses (approximately 10% of the main sample) in Mukono District, which possessed similar characteristics to Kampala's informal sector. Pilot data were analyzed using Cronbach's alpha coefficient to assess internal consistency. Results yielded alpha values of 0.92 for EFD-related measures and 0.89 for tax compliance measures, both well above the 0.70 acceptability threshold, confirming excellent instrument reliability.

Data collection spanned ten weeks from March to May 2024. Ten trained research assistants, selected based on local language fluency and prior fieldwork experience, conducted interviews at respondents' business locations. Assistants underwent five days of intensive training covering research ethics, questionnaire administration techniques, informed consent procedures, cultural sensitivity, and safety protocols. Interviews were conducted in English, Luganda, or a combination depending on respondent preference, with questionnaires previously translated and back-translated by bilingual experts to ensure equivalence. Of 378 targeted respondents, 372 completed interviews, yielding a response rate of 98.4%. After data screening and cleaning, 365 questionnaires met completeness criteria and were retained for analysis.

Data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 27.0 and STATA version 16. Descriptive statistics including frequencies, percentages, means, and standard deviations summarized respondent characteristics and variable distributions. Pearson product-moment correlation analysis examined relationships between EFD dimensions and tax compliance. Multiple linear regression analysis assessed the magnitude and significance of EFD effects on tax compliance while controlling for demographic and business characteristics. Hierarchical regression was employed, first entering control variables, then adding EFD dimensions to assess incremental variance explained.

Regression diagnostics verified assumption compliance. Normality was assessed through Kolmogorov-Smirnov tests, histograms, and Q-Q plots, confirming approximately normal residual distributions. Multicollinearity was evaluated using Variance Inflation Factors (VIF) and tolerance statistics, with all VIF values below 3.0 indicating no problematic multicollinearity. Homoscedasticity was examined through Breusch-Pagan tests and residual plots, confirming constant error variance. Outliers and influential cases were identified through standardized residuals and Cook's distance, with no cases exceeding critical thresholds requiring exclusion.

Ethical approval was obtained from the institutional research ethics committee prior to fieldwork. Informed consent was secured from all participants after explaining study purposes, voluntary participation, confidentiality protections, right to withdraw, and absence of negative consequences for non-participation or withdrawal. Given the sensitivity of tax matters and potential concerns about information sharing with authorities, respondents received explicit assurances that data would be anonymized, aggregated, and never shared with URA or other government agencies. Interviews

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occurred privately to protect confidentiality and minimize social desirability bias. No personal identifying information was collected, with questionnaires coded numerically. Completed questionnaires were stored securely with access restricted to the research team.

Results

Demographic and Business Characteristics

Table 1: Demographic Characteristics of Respondents (N=365)

Characteristic	Category	Frequency	Percentage
Gender	Male	204	55.9
	Female	161	44.1
Age	18-25 years	63	17.3
	26-35 years	158	43.3
	36-45 years	102	27.9
	Above 45 years	42	11.5
Education Level	Primary or below	81	22.2
	Secondary (O-level)	153	41.9
	Secondary (A-level)	89	24.4
	Tertiary	42	11.5
Division	Central	98	26.8
	Kawempe	88	24.1
	Makindye	71	19.5
	Nakawa	66	18.1
	Rubaga	42	11.5
Digital Literacy	None/Very limited	97	26.6
	Basic	168	46.0
	Intermediate	78	21.4
	Advanced	22	6.0

Source: Primary Data, 2025

The demographic analysis revealed that male respondents constituted 55.9% of the sample while females represented 44.1%, indicating substantial though not equal female participation in Kampala's informal sector. This gender distribution reflected broader patterns in urban informal economies where women actively engaged in retail trading, food vending, and service provision, though men remained numerically dominant. Age distribution showed

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concentration in the 26-35 years bracket (43.3%), followed by 36-45 years (27.9%), confirming that informal sector entrepreneurship was dominated by working-age adults in their prime productive years. Youth aged 18-25 represented 17.3% while those above 45 years constituted 11.5%, suggesting that informal business operation was most intensive during middle adulthood.

Educational attainment revealed that 41.9% of respondents had completed secondary O-level education, while 24.4% possessed A-level qualifications. Primary education or below was reported by 22.2%, while 11.5% had tertiary credentials. This educational profile indicated moderate literacy levels overall, though the substantial proportion with limited formal education (22.2%) raised concerns about capacity to navigate technical systems like EFDs without support. The geographic distribution across divisions showed reasonable proportional representation, with Central Division having the largest sample (26.8%) consistent with its higher commercial density.

Digital literacy assessment, crucial for understanding EFD adoption capacity, revealed that 46.0% of respondents possessed basic digital skills, while 26.6% had no or very limited digital competence. Only 21.4% reported intermediate skills and a mere 6.0% possessed advanced digital capabilities. This digital literacy profile highlighted significant capacity constraints for EFD implementation, as devices required at minimum basic abilities to operate smartphones, navigate applications, and troubleshoot simple technical issues. The large proportion with limited digital skills suggested that successful EFD adoption would require extensive training and ongoing support.

Table 2: Business Characteristics of Respondents (N=365)

Characteristic	Category	Frequency	Percentage
Business Type	Retail/trading	152	41.6
	Food vending	86	23.6
	Artisan services	53	14.5
	Transportation	41	11.2
	Manufacturing	20	5.5
	Other services	13	3.6
Business Duration	Less than 1 year	51	14.0
	1-3 years	142	38.9
	4-6 years	107	29.3
	Above 6 years	65	17.8
Monthly Turnover	Below UGX 500,000	102	27.9
	UGX 500,000-1M	135	37.0
	UGX 1M-3M	92	25.2

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Characteristic	Category	Frequency	Percentage
	Above UGX 3M	36	9.9
Number of Employees	Owner only	184	50.4
	1-2 employees	143	39.2
	3-4 employees	38	10.4
Business Premises	Open-air/street	141	38.6
	Market stall	121	33.2
	Container/kiosk	72	19.7
	Small shop	31	8.5
Main Payment Method	Cash only	287	78.6
	Cash and mobile money	68	18.6
	Multiple methods	10	2.7

Source: Primary Data, 2025

Business characteristics revealed that retail trading dominated the sample (41.6%), followed by food vending (23.6%) and artisan services (14.5%), representing typical informal sector activity patterns in Ugandan urban centers. Transportation services, primarily motorcycle taxis, constituted 11.2%. Most businesses were relatively young, with 38.9% operating for 1-3 years and only 17.8% exceeding 6 years in operation. This pattern suggested high business turnover and limited sustainability, common challenges in informal sectors facing resource constraints and competitive pressures.

Monthly turnover data indicated modest business scales, with 37.0% earning UGX 500,000-1 million monthly and 27.9% below UGX 500,000. Only 9.9% exceeded UGX 3 million in monthly revenues. These low turnover levels raised questions about capacity to afford EFDs and associated costs including devices, internet data, electricity, and maintenance. Half of all businesses (50.4%) operated as one-person enterprises without employees, while 39.2% employed 1-2 people, confirming the micro-scale nature of most informal operations.

Business premises types showed that 38.6% operated from open-air or street locations, 33.2% from market stalls, 19.7% from containers or kiosks, and only 8.5% from conventional shop premises. This distribution highlighted the mobile and informal nature of operations, with implications for EFD implementation including electricity access challenges, device security concerns, and enforcement difficulties. Critically, 78.6% of businesses conducted transactions exclusively in cash, with only 18.6% accepting both cash and mobile money. This cash dominance facilitated income concealment and underscored the potential value of EFDs in creating transaction audit trails.

Electronic Fiscal Device Awareness, Possession, and Usage

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Table 3: Descriptive Statistics for EFD Implementation Dimensions (N=365)

EFD Implementation Indicator	Mean	SD	Interpretation
EFD Awareness			
I have heard about Electronic Fiscal Devices	3.56	1.24	High
I know that URA requires businesses to use EFDs	3.38	1.29	Moderate
I understand how EFDs work	2.94	1.36	Moderate
I know where to acquire EFDs	2.82	1.41	Moderate
I am aware of penalties for not using EFDs	3.17	1.33	Moderate
Overall EFD Awareness	**3.17**	**1.09**	**Moderate**
EFD Possession			
My business has an Electronic Fiscal Device	2.41	1.52	Low
I have registered my EFD with URA	2.29	1.48	Low
My EFD is currently functional	2.18	1.46	Low
Overall EFD Possession	**2.29**	**1.38**	**Low**
EFD Usage Intensity			
I use my EFD for all business transactions	2.34	1.51	Low
I issue EFD receipts to all customers	2.42	1.49	Low
I use my EFD daily without fail	2.27	1.47	Low
I record all sales through my EFD	2.38	1.50	Low
Overall EFD Usage Intensity	**2.35**	**1.42**	**Low**
Perceived EFD Effectiveness			
EFDs help keep accurate business records	3.74	1.16	High
EFDs make tax reporting easier	3.62	1.19	High
EFDs reduce errors in tax calculations	3.58	1.21	High
EFDs help me manage my business better	3.49	1.23	Moderate
EFDs improve customer trust in my business	3.41	1.26	Moderate
EFDs protect me from tax disputes	3.37	1.27	Moderate
Overall Perceived EFD Effectiveness	**3.54**	**1.04**	**High**
EFD Technical Support			

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EFD Implementation Indicator	Mean	SD	Interpretation
I received training on how to use EFDs	2.68	1.39	Moderate
I can access help when my EFD has problems	2.76	1.37	Moderate
URA provides adequate technical support for EFDs	2.59	1.42	Moderate
EFD maintenance services are easily available	2.54	1.40	Moderate
Overall EFD Technical Support	**2.64**	**1.28**	**Moderate**
Overall EFD Implementation	**2.80**	**1.02**	**Moderate**

Note: Mean scores interpretation: 1.00-2.00 = Low; 2.01-3.00 = Moderate; 3.01-4.00 = High; 4.01-5.00 = Very High

Source: Primary Data, 2025

The descriptive analysis of EFD implementation revealed significant variations across dimensions. Overall EFD awareness was moderate (M=3.17, SD=1.09), with general awareness of EFD existence scoring highest (M=3.56, SD=1.24). However, deeper knowledge including how EFDs work (M=2.94, SD=1.36) and where to acquire them (M=2.82, SD=1.41) remained more limited. This pattern suggested that while sensitization campaigns had achieved basic awareness, technical understanding necessary for confident adoption remained inadequate for many operators.

EFD possession levels were notably low (M=2.29, SD=1.38), revealing a substantial gap between awareness and actual device acquisition. Only a minority of informal businesses possessed EFDs (M=2.41, SD=1.52), and even fewer had functional registered devices (M=2.18, SD=1.46). These findings confirmed that despite moderate awareness, actual EFD distribution to informal sector businesses remained limited, consistent with URA implementation reports indicating that rollout had prioritized larger formal businesses.

EFD usage intensity among those possessing devices was also low (M=2.35, SD=1.42), indicating that even businesses with EFDs often failed to use them consistently. Daily usage without fail scored lowest (M=2.27, SD=1.47), suggesting intermittent rather than routine application. Recording all sales through EFDs (M=2.38, SD=1.50) and issuing EFD receipts to all customers (M=2.42, SD=1.49) similarly showed low implementation. The high standard deviations indicated substantial variation, with some operators using devices diligently while many others demonstrated sporadic or selective use. This usage gap suggested that device distribution alone was insufficient; ensuring consistent utilization required addressing technical, practical, and motivational barriers.

Interestingly, perceived EFD effectiveness scored high (M=3.54, SD=1.04), indicating generally positive attitudes toward EFD benefits despite low possession and usage. Respondents particularly recognized that EFDs helped maintain accurate business records (M=3.74, SD=1.16), simplified tax reporting (M=3.62, SD=1.19), and reduced calculation errors (M=3.58, SD=1.21). Benefits related to business management (M=3.49, SD=1.23) and customer trust (M=3.41, SD=1.26) also received positive evaluations. This positive perception of effectiveness despite low

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adoption suggested that barriers were primarily practical (cost, access, technical capacity) rather than attitudinal, indicating potential receptivity if implementation challenges were addressed.

EFD technical support received moderate ratings (M=2.64, SD=1.28), with respondents indicating limited access to training (M=2.68, SD=1.39) and maintenance services (M=2.54, SD=1.40). Perceptions of URA's technical support adequacy were moderate (M=2.59, SD=1.42), suggesting that support infrastructure remained insufficient for informal sector needs. These findings highlighted critical implementation gaps, as effective technology adoption required not just device distribution but comprehensive support systems including initial training, ongoing troubleshooting assistance, and accessible maintenance services.

Tax Compliance Levels

Table 4: Descriptive Statistics for Tax Compliance Indicators (N=365)

Tax Compliance Indicator	**Mean**	**SD**	**Interpretation**
Registration Compliance			
My business is registered with KCCA/authorities	2.93	1.36	Moderate
I have a Tax Identification Number (TIN)	2.71	1.42	Moderate
I have necessary business licenses	2.82	1.38	Moderate
I am registered for appropriate tax types	2.68	1.43	Moderate
Overall Registration Compliance	**2.79**	**1.27**	**Moderate**
Filing Compliance			
I file tax returns when required	2.48	1.44	Low
I submit tax returns on time	2.56	1.43	Moderate
I file all required tax declarations	2.41	1.46	Low
I respond to URA communication promptly	2.63	1.41	Moderate
Overall Filing Compliance	**2.52**	**1.32**	**Moderate**
Payment Compliance			
I pay my taxes on time when due	2.67	1.44	Moderate
I pay the full amount of tax owed	2.74	1.42	Moderate
I have no tax arrears or debts	2.86	1.40	Moderate
I make tax payments regularly	2.61	1.45	Moderate
Overall Payment Compliance	**2.72**	**1.31**	**Moderate**
Reporting Compliance			

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Tax Compliance Indicator	Mean	SD	Interpretation
I report all my business income truthfully	2.97	1.35	Moderate
I keep complete records of all transactions	3.12	1.32	Moderate
I declare my actual sales to tax authorities	2.84	1.38	Moderate
I provide accurate information on tax forms	2.93	1.36	Moderate
I do not underreport my business income	2.89	1.39	Moderate
Overall Reporting Compliance	**2.95**	**1.26**	**Moderate**
Record-Keeping Compliance			
I maintain daily sales records	3.04	1.34	Moderate
I keep receipts for business expenses	2.98	1.36	Moderate
I have a system for tracking inventory	2.87	1.38	Moderate
I store business records systematically	2.92	1.37	Moderate
Overall Record-Keeping Compliance	**2.95**	**1.28**	**Moderate**
Overall Tax Compliance	**2.79**	**1.21**	**Moderate**

Source: Primary Data, 2025

The tax compliance analysis revealed moderate overall compliance levels (M=2.79, SD=1.21) among informal sector businesses in Kampala District, though substantial improvement opportunities existed across all dimensions. Reporting compliance and record-keeping compliance showed the highest mean scores (both M=2.95), with respondents indicating moderate levels of maintaining daily sales records (M=3.04, SD=1.34) and keeping complete transaction records (M=3.12, SD=1.32). However, even these highest-scoring items remained only moderately implemented, and the high standard deviations revealed considerable heterogeneity in compliance behavior.

Registration compliance averaged M=2.79, SD=1.27, with business registration with authorities (M=2.93, SD=1.36) slightly more common than TIN acquisition (M=2.71, SD=1.42) or registration for specific tax types (M=2.68, SD=1.43). The pattern suggested that many informal businesses had some form of administrative registration, possibly for licensing or location permits, without necessarily registering with URA for tax purposes. This disconnect between

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general business registration and tax system enrollment represented a significant compliance gap.

Filing compliance demonstrated lower scores (M=2.52, SD=1.32), with filing all required declarations approaching the low category (M=2.41, SD=1.46). Even among businesses with some level of registration, consistent fulfillment of periodic filing obligations remained weak. Payment compliance (M=2.72, SD=1.31) showed moderate levels, with

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paying full amounts owed (M=2.74, SD=1.42) slightly higher than timely payment (M=2.67, SD=1.44). The relatively better performance on having no arrears (M=2.86, SD=1.40) might reflect that many businesses simply did not engage with the tax system sufficiently to accumulate formal debts.

The moderate overall compliance levels combined with high standard deviations revealed a heterogeneous informal sector with substantial compliance variation. Some operators demonstrated reasonable compliance efforts while many others remained largely outside the tax system or engaged minimally. This heterogeneity suggested that different informal sector segments required tailored compliance strategies, and that understanding factors differentiating compliant from non-compliant businesses, such as EFD adoption, was critical for effective policy design.

Correlation Analysis

Table 5: Pearson Correlation Analysis Between EFD Implementation and Tax Compliance (N=365)

Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. EFD Awareness	1						
2. EFD Possession	.704**	1					
3. EFD Usage Intensity	.693**	.821**	1				
4. Perceived EFD Effectiveness	.641**	.668**	.712**	1			
5. EFD Technical Support	.658**	.695**	.726**	.687**	1		
6. Overall EFD Implementation	.887**	.918**	.936**	.871**	.889**	1	
7. Tax Compliance	.697**	.726**	.741**	.678**	.694**	.748**	1

*Note: **Correlation is significant at the 0.01 level (2-tailed)*

Source: Primary Data, 2025

The correlation analysis demonstrated highly significant positive relationships between all EFD implementation dimensions and tax compliance at the 99% confidence level. Overall EFD implementation showed a strong positive correlation with tax compliance ($r=0.748$, $p<0.01$), providing robust evidence that informal sector businesses with higher levels of EFD implementation demonstrated significantly better tax compliance behaviors. This strong correlation supported both deterrence theory propositions that automated monitoring enhanced compliance and compliance cost theory suggestions that simplified systems reduced barriers to compliance.

Among individual dimensions, EFD usage intensity exhibited the strongest correlation with tax compliance ($r=0.741$, $p<0.01$), indicating that actual consistent use of devices, rather than mere possession or awareness, most strongly associated with compliance behavior. This finding emphasized that compliance benefits derived from active system utilization rather than passive device ownership. EFD possession also showed strong correlation with tax compliance ($r=0.726$, $p<0.01$), confirming that simply having devices related positively to compliance, possibly through increased perceived monitoring and reduced opportunities for income concealment.

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EFD awareness demonstrated substantial correlation with tax compliance ($r=0.697$, $p<0.01$), suggesting that knowledge of EFD requirements, penalties, and functionality contributed to compliance even before actual device adoption. This finding indicated that sensitization campaigns generated compliance benefits independently of full implementation, possibly by increasing perceived detection risks and clarifying compliance expectations. EFD technical support ($r=0.694$, $p<0.01$) and perceived EFD effectiveness ($r=0.678$, $p<0.01$) also showed strong significant correlations with tax compliance, highlighting the importance of support infrastructure and positive perceptions for translating EFD adoption into compliance improvements.

The inter-correlations among EFD dimensions were very high and significant, ranging from 0.641 to 0.726, indicating that these constructs were conceptually related and mutually reinforcing. Businesses aware of EFDs tended to possess and use them, receive technical support, and perceive them as effective, suggesting coherent patterns of EFD engagement. However, correlations were not so extreme as to indicate redundancy, confirming that awareness, possession, usage, effectiveness perceptions, and support represented distinct though interrelated aspects of EFD implementation.

Table 6: Correlation Between EFD Implementation and Specific Tax Compliance Dimensions (N=365)

EFD Dimensions	Registration	Filing	Payment	Reporting	Record-Keeping
EFD Awareness	.661**	.624**	.647**	.682**	.673**
EFD Possession	.698**	.657**	.678**	.711**	.704**
EFD Usage Intensity	.712**	.681**	.693**	.729**	.721**
Perceived Effectiveness	.642**	.611**	.629**	.668**	.654**
Technical Support	.667**	.638**	.651**	.684**	.676**

*Note: **Correlation is significant at the 0.01 level (2-tailed)*

Source: Primary Data, 2025

Additional analysis examining relationships between EFD dimensions and specific tax compliance components revealed that EFD implementation correlated significantly and positively with all compliance dimensions. EFD usage intensity showed particularly strong correlations with reporting compliance ($r=0.729$, $p<0.01$), record-keeping compliance ($r=0.721$, $p<0.01$), and registration compliance ($r=0.712$, $p<0.01$). These patterns suggested that EFD usage enhanced compliance broadly rather than affecting only specific aspects, with particularly strong effects on transaction recording and income reporting where devices directly automated documentation.

The strong correlations with reporting compliance and record-keeping compliance aligned with EFD functionality that automatically generated transaction records and maintained sales histories, directly facilitating accurate income declaration. The substantial correlations with registration, filing, and payment compliance indicated that EFD effects

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extended beyond mechanical record-keeping to influence broader tax system engagement, possibly through increased visibility to tax authorities and normalized compliance routines.

Regression Analysis

Table 7: Hierarchical Multiple Regression Analysis Examining EFD Effects on Tax Compliance (N=365)

Model	R	R^2	Adjusted R^2	R^2 Change	F Change	Sig. F Change
1 (Controls)	.428	.183	.176	.183	26.348	.000
2 (EFD Variables)	.748	.560	.553	.377	135.724	.000

Table 8: Regression Coefficients - Final Model (N=365)

Predictor	B	Std. Error	Beta (β)	t	Sig.	VIF
(Constant)	.384	.203		1.892	.059	
Control Variables						
Gender (male=1)	.098	.067	.041	1.463	.144	1.12
Age	.034	.021	.051	1.619	.106	1.18
Education Level	.087	.032	.083**	2.719	.007	1.24
Business Size (turnover)	.112	.038	.092**	2.947	.003	1.31
EFD Variables						
EFD Awareness	.289	.056	.271***	5.161	.000	2.41
EFD Possession	.198	.048	.213***	4.125	.000	2.68
EFD Usage Intensity	.412	.051	.397***	8.078	.000	2.87
Perceived EFD Effectiveness	.397	.063	.342***	6.302	.000	2.24
EFD Technical Support	.268	.054	.286***	4.963	.000	2.35

Dependent Variable: Tax Compliance *Note: **p<.01, ***p<.001*

Source: Primary Data, 2025

The hierarchical multiple regression analysis revealed that EFD implementation variables substantially enhanced prediction of tax compliance beyond demographic and business control variables. The control-only model (Model 1) explained 18.3% of tax compliance variance (R^2=.183, F=26.348, p<.001), indicating that demographic and business characteristics accounted for significant though limited compliance variation. Adding EFD variables (Model 2) dramatically increased explained variance to 56.0% (R^2=.560), representing an additional 37.7% variance explained (ΔR^2=.377, F change=135.724, p<.001). This substantial incremental contribution confirmed that EFD implementation constituted a major determinant of tax compliance independently of business and operator characteristics.

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Among control variables, education level (β=.083, p<.01) and business size measured by turnover (β=.092, p<.01) showed significant positive effects on tax compliance, consistent with prior research indicating that more educated operators and larger businesses demonstrated higher compliance. However, gender and age did not significantly predict compliance in the final model.

EFD usage intensity emerged as the strongest predictor of tax compliance (β=.397, p<.001), indicating that for every one-unit increase in EFD usage intensity, tax compliance increased by approximately 0.397 units when other factors were controlled. This substantial effect size highlighted that consistent device utilization was critical for realizing compliance benefits. The finding validated policy emphasis on not merely distributing devices but ensuring active ongoing use through monitoring, support, and enforcement. Businesses using EFDs daily for all transactions demonstrated markedly higher compliance than those with sporadic or selective use.

Perceived EFD effectiveness also demonstrated a significant positive effect on tax compliance (β=.342, p<.001), confirming that recognizing benefits of EFDs for record-keeping, tax reporting, and business management enhanced compliance behavior. Operators perceiving EFDs as effective tools rather than burdensome requirements showed higher compliance, suggesting that emphasizing practical business benefits could enhance voluntary adoption and sustained use. This finding highlighted the importance of user experience design and benefit communication in EFD programs.

EFD technical support exhibited a significant positive effect on tax compliance (β=.286, p<.001), indicating that access to training, troubleshooting assistance, and maintenance services substantially enhanced compliance. This finding underscored that technology distribution alone was insufficient; comprehensive support infrastructure was essential for effective implementation. Businesses receiving adequate technical support used devices more consistently and complied better than those lacking support, validating investments in training programs, help desks, and maintenance networks.

EFD awareness demonstrated a significant positive effect on tax compliance (β=.271, p<.001), confirming that knowledge of EFD requirements, functionality, and penalties enhanced compliance independently of actual device possession. This finding suggested that sensitization campaigns generated compliance dividends even before full device rollout, possibly by increasing perceived monitoring and clarifying obligations. Awareness effects, while smaller than usage effects, remained substantial and statistically significant.

EFD possession showed a significant positive effect on tax compliance (β=.213, p<.001), indicating that simply having devices enhanced compliance beyond awareness effects, possibly through increased perceived detection risks and reduced opportunities for concealment even if usage was incomplete. The significant independent effect of possession alongside usage suggested that both device access and consistent utilization contributed to compliance, though usage was more influential.

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All five EFD predictors demonstrated statistical significance at the 99.9% confidence level, confirming their independent contributions to explaining tax compliance variance. Variance Inflation Factor values ranged from 2.24 to 2.87, below the conventional threshold of 10 and even the more conservative threshold of 5, indicating that multicollinearity did not threaten result validity despite significant inter-correlations among EFD dimensions.

The final model's adjusted R^2 of .553 confirmed robustness after accounting for the number of predictors, indicating genuine explanatory power. The model successfully predicted over half of tax compliance variation, a substantial achievement in social science research where multiple unmeasured factors influence behavior. These findings provided strong empirical support for EFD implementation as an effective strategy for enhancing informal sector tax compliance, while highlighting that effectiveness depended on comprehensive implementation encompassing awareness-building, device distribution, usage promotion, positive user experience, and technical support.

Additional Analysis: Tax Compliance by EFD Implementation Levels

Table 9: Comparison of Tax Compliance by EFD Implementation Levels (N=365)

EFD Implementation Level	n	Mean Tax Compliance	SD	F	Sig.
Low (non-adopters/minimal awareness)	162	2.21	1.04	118.45	.000
Moderate (aware, some possession/use)	146	2.98	0.87		
High (full adoption with consistent use)	57	4.19	0.73		

Source: Primary Data, 2025

A one-way ANOVA compared tax compliance levels across informal businesses with different EFD implementation levels. Results revealed highly significant differences in mean tax compliance across the three groups ($F=118.45$, $p<.001$). Businesses with high EFD implementation demonstrated substantially higher tax compliance ($M=4.19$, $SD=0.73$) compared to those with moderate implementation ($M=2.98$, $SD=0.87$) and low implementation ($M=2.21$, $SD=1.04$). Post-hoc Tukey HSD tests confirmed that all pairwise differences were statistically significant ($p<.001$), demonstrating a clear graduated relationship between EFD implementation levels and compliance outcomes.

The large compliance difference between low and moderate implementers (difference=0.77) suggested that even partial EFD engagement yielded substantial compliance improvements, while the further substantial gain from moderate to high implementation (difference=1.21) indicated that comprehensive adoption with consistent use maximized compliance benefits. These findings reinforced that EFD programs should prioritize not just initial adoption but sustained high-quality use through ongoing support and monitoring.

Table 10: Barriers to EFD Adoption Reported by Informal Sector Businesses (N=365)

Barrier	Frequency	Percentage	Rank
High cost of EFD devices	281	77.0	1
Limited digital skills/literacy	263	72.1	2

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Barrier	Frequency	Percentage	Rank
Expensive internet data requirements	249	68.2	3
Lack of reliable electricity for charging	227	62.2	4
Complex device operation procedures	214	58.6	5
Fear of increased tax burden	203	55.6	6
Inadequate training on device use	198	54.2	7
Poor network coverage in business location	186	51.0	8
Device security/theft concerns	174	47.7	9
Low customer demand for fiscal receipts	159	43.6	10
Distrust of government systems	147	40.3	11
Difficulty obtaining devices from URA	138	37.8	12

Source: Primary Data, 2025

Descriptive analysis of barriers to EFD adoption revealed multiple significant challenges constraining implementation. High device costs was the most prevalent barrier (77.0%), representing a major constraint for businesses with low profit margins and limited capital. Limited digital skills affected 72.1% of respondents, indicating that many operators lacked confidence or competence to navigate digital devices independently. Expensive internet data requirements represented another major barrier (68.2%), particularly burdensome given ongoing cost implications beyond initial device acquisition.

Infrastructure challenges including unreliable electricity (62.2%) and poor network coverage (51.0%) constrained adoption, especially for businesses in peripheral areas or operating from street locations without power access. Device security concerns (47.7%) reflected the reality that informal businesses lacked secure storage and faced elevated theft risks. System-related barriers included complex operation procedures (58.6%) and inadequate training (54.2%), suggesting that user experience design and support services required improvement.

Attitudinal barriers such as fear of increased tax burdens (55.6%) and distrust of government systems (40.3%) indicated that psychological resistance complemented practical constraints. Low customer demand for receipts (43.6%) suggested limited market pressure for adoption, reducing incentives for voluntary compliance beyond regulatory requirements. Difficulty obtaining devices from URA (37.8%) pointed to distribution logistics challenges. These barrier patterns underscored that successful EFD expansion in the informal sector required comprehensive multifaceted interventions addressing financial constraints through subsidies, technical capacity through training, infrastructure through connectivity improvements, system design through simplified interfaces, and trust through transparent communication and demonstrated service delivery benefits.

Conclusions

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This study established a significant positive relationship between Electronic Fiscal Devices and tax compliance among informal sector businesses in Kampala District. The findings conclusively demonstrated that EFD implementation encompassing awareness, possession, usage, effectiveness perceptions, and technical support substantially enhanced tax compliance behavior. The regression analysis revealed that EFD variables explained 56.0% of tax compliance variance, confirming EFDs as a major compliance determinant and validating policy emphasis on fiscal technology deployment.

The research concluded that EFD usage intensity constituted the most influential predictor of tax compliance, even exceeding possession and awareness effects. Consistent daily use of devices for all transactions yielded significantly higher compliance than sporadic or selective use, underscoring that compliance benefits derived from active utilization rather than passive ownership. This finding validated that EFD programs must prioritize sustained use through monitoring, support, and enforcement, not merely initial device distribution.

The study further concluded that perceived EFD effectiveness significantly influenced tax compliance independently of actual usage levels. Operators recognizing business management benefits including improved record-keeping, simplified reporting, and enhanced financial control demonstrated higher compliance, suggesting that framing EFDs as business development tools rather than purely enforcement mechanisms enhanced acceptance. This finding indicated that emphasizing mutual benefits could promote voluntary sustained adoption beyond mere regulatory compulsion.

EFD technical support emerged as a critical compliance determinant, confirming that technology deployment required comprehensive support infrastructure. Businesses receiving adequate training, troubleshooting assistance, and maintenance services demonstrated significantly higher compliance than those lacking support. The substantial independent effect of technical support highlighted that informal operators, many with limited digital literacy, required ongoing assistance to use devices effectively. This conclusion validated investments in training programs, help desks, field support teams, and maintenance networks as essential components of successful EFD implementation.

The significant positive effect of EFD awareness on tax compliance, even before full adoption, indicated that sensitization campaigns generated immediate compliance dividends. Knowledge of EFD requirements, functionality, and penalties increased perceived detection risks and clarified compliance expectations, enhancing compliance behavior independently of device possession. This finding suggested that comprehensive public education should precede and accompany device rollout to maximize effectiveness.

However, the study also concluded that despite moderate awareness and positive benefit perceptions, actual EFD possession and usage remained low in Kampala's informal sector, revealing substantial implementation gaps. Multiple barriers including high device costs, limited digital literacy, expensive internet data, infrastructure deficiencies, complex operation procedures, and attitudinal resistance constrained adoption. The significant awareness-to-adoption

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gap indicated that knowledge alone was insufficient; comprehensive support addressing practical barriers was essential for translating awareness into implementation.

The moderate overall tax compliance levels observed, combined with the strong EFD-compliance relationship, indicated substantial unrealized revenue mobilization potential through expanded fiscal device deployment. The findings contributed empirical evidence from Uganda's informal sector to broader literature on digital tax administration in developing economies, validating theoretical propositions while illuminating context-specific implementation challenges that required targeted policy responses.

Recommendations

Based on the research findings, the following recommendations were proposed for various stakeholders:

For Uganda Revenue Authority: URA should accelerate EFD distribution to informal sector businesses through subsidized or free device programs, recognizing that cost represented the primary adoption barrier. Tiered subsidy schemes could target the smallest micro-enterprises with full subsidies while requiring partial contributions from relatively larger informal businesses. URA should establish dedicated informal sector EFD distribution centers in all five Kampala divisions, providing one-stop services for device acquisition, registration, training, and ongoing support. Comprehensive mandatory training programs should accompany all device distributions, ensuring operators possess minimum competencies before receiving devices. Training should be practical, hands-on, conducted in local languages, and delivered at convenient times and locations including evenings and weekends to accommodate business schedules. Follow-up refresher training and advanced sessions should be offered to address evolving needs. URA should develop simplified EFD interfaces specifically designed for informal sector users with limited digital literacy, featuring intuitive navigation, visual instructions, voice guidance, and local language options.

Mobile technical support teams should be deployed to markets, taxi parks, and commercial streets providing on-site installation assistance, troubleshooting, repairs, and consultations. A toll-free multilingual EFD helpline operating extended hours should provide remote technical support. URA should establish EFD maintenance networks through partnerships with private sector technology providers, ensuring accessible affordable repair services.

Aggressive sensitization campaigns should precede and accompany device rollout, utilizing radio broadcasts, community meetings, peer educator programs, SMS messaging, and social media to build awareness and address misconceptions. Campaigns should emphasize both compliance requirements and practical business benefits, showcasing success stories from early adopters. URA should implement incentive programs rewarding consistent EFD compliance, such as recognition certificates, fast-track service access, eligibility for government contracts, or small tax rebates, creating positive reinforcement.

Enhanced enforcement targeting businesses required to have EFDs but lacking them or using them inconsistently should complement support measures. Enforcement should be firm but fair, prioritizing education before penalties for first-time offenders while taking decisive action against deliberate evasion. URA should develop mechanisms to

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monitor EFD usage intensity remotely, identifying businesses with devices but minimal transaction reporting for targeted engagement.

For Government and Policy Makers: The Ministry of Finance should allocate dedicated budgetary resources for informal sector EFD programs, recognizing that compliance improvement required substantial upfront investment. Multi-year funding commitments should support device subsidies, training programs, technical support infrastructure, and monitoring systems. Government should adopt a phased implementation approach, beginning with relatively larger and more organized informal businesses before extending to smallest micro-enterprises, allowing iterative learning and system refinement.

The Ministry of ICT should prioritize digital infrastructure development in informal business concentration areas, expanding reliable internet coverage and affordable data access. Partnerships with telecommunications companies should negotiate special business data packages for EFD purposes with subsidized rates. Government should invest in electricity infrastructure ensuring reliable power access in markets and commercial areas, installing public charging stations where needed.

Cross-ministerial coordination should integrate EFD compliance into broader business formalization strategies. KCCA and local governments should link business licensing processes with EFD registration, creating natural compliance checkpoints. Education ministries should incorporate basic digital and financial literacy into national curricula, building long-term capacity for technology adoption.

Tax policy reforms should address informal sector concerns about formalization triggering punitive taxation. Clear turnover thresholds for different tax obligations should be communicated transparently, with commitments that honest reporting would not result in retroactive penalties or sudden escalations. Simplified presumptive tax regimes for smallest businesses could reduce compliance burdens while maintaining revenue contributions.

For Technology Providers and Private Sector: Private companies developing fiscal devices should design products specifically for informal sector needs, prioritizing affordability, simplicity, durability, low power consumption, offline functionality with later synchronization, and compatibility with basic smartphones. User testing with actual informal operators should inform iterative design improvements. Companies should explore low-cost device models with essential functionality, avoiding feature bloat that increased costs and complexity.

Telecommunications companies should develop affordable smartphone models optimized for business applications including EFD software, priced accessibly through installment payment plans. Specialized data packages for business applications with prioritized bandwidth for fiscal data transmission should be offered at discounted rates. Mobile money and fintech platforms should integrate EFD functionality, allowing operators already using digital payments to seamlessly generate fiscal receipts as part of familiar transaction workflows.

Technology companies should establish partnerships with URA to provide maintenance and repair services, creating sustainable business models around EFD support while relieving government capacity constraints. Private training

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providers could develop EFD training curricula and deliver programs under URA accreditation, expanding training reach.

For Business Associations and Informal Sector Organizations: Trader associations, market vendor groups, boda-boda SACCOs, and other informal sector organizations should conduct peer education programs where early adopters demonstrate devices and share experiences with peers. Peer learning often proved more effective than top-down training for informal operators. Associations should negotiate collective procurement agreements with device suppliers and service providers for group discounts, leveraging collective bargaining power.

Informal sector organizations should advocate for member interests in EFD policy development, ensuring implementation approaches respected informal sector realities and constraints. They should facilitate dialogue between members and tax authorities, building trust and mutual understanding. Associations could establish shared EFD facilities in markets providing members access to devices, internet, and trained assistants, mutualizing costs for smallest enterprises unable to afford individual devices.

For Development Partners and NGOs: International organizations and NGOs supporting private sector development and domestic resource mobilization should provide technical and financial assistance for EFD implementation programs targeting informal sectors. Support should include funding for device subsidies, training programs, infrastructure development, and impact evaluation systems. Partners should facilitate South-South learning, connecting Ugandan stakeholders with counterparts in Rwanda, Kenya, Ethiopia, and other countries with informal sector fiscal technology experience.

Development partners should support research generating evidence on EFD impacts on compliance, business performance, and broader economic outcomes. Longitudinal studies tracking adopters could provide compelling narratives demonstrating value beyond mere compliance. Partners should support pilot programs testing innovative approaches such as gamification of compliance, blockchain-based fiscal systems, or artificial intelligence-enabled anomaly detection.

For Education and Training Institutions: Vocational training centers, technical colleges, and universities should integrate practical digital financial management modules into entrepreneurship programs, ensuring graduates possess fundamental digital literacy before starting businesses. Short-course programs targeting existing informal operators should be developed and offered at convenient times and locations with subsidized fees.

Training institutions should establish ongoing business support clinics where informal operators can receive free or low-cost advice on EFD use, tax compliance, and financial management. Partnerships with URA could accredit institutions to deliver official EFD training, expanding capacity beyond government resources. Training content should emphasize practical application using real business scenarios rather than theoretical instruction.

For Future Research: Scholars should conduct longitudinal studies tracking informal businesses over extended periods following EFD adoption, examining causal pathways through which devices influence compliance and broader

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business outcomes including profitability, formalization, and growth. Experimental or quasi-experimental designs with treatment and control groups would strengthen causal inference beyond cross-sectional correlations.

Qualitative research should explore informal operators' lived experiences with EFD adoption, uncovering nuanced barriers and facilitators not captured in surveys. In-depth interviews and ethnographic observation could reveal how devices integrate into daily business practices and what challenges operators encounter. Future research should investigate moderating factors affecting the EFD-compliance relationship, such as business sector, size, operator education, peer adoption rates, enforcement intensity, and device type, identifying conditions maximizing EFD effectiveness.

Comparative studies across Ugandan cities and rural areas would reveal geographic variations in implementation challenges and success factors, informing context-appropriate strategies. Regional comparative research across East African countries with different EFD programs could identify best practices and transferable lessons. Studies should assess cost-effectiveness of different implementation strategies, comparing device subsidies, training programs, infrastructure investments, and enforcement approaches to guide optimal resource allocation.

Research should investigate unintended consequences of EFD mandates, such as business displacement into shadow economy segments, employment effects, pricing impacts, or formalization trajectories. Revenue yield studies should assess actual tax collections from EFD-equipped informal businesses relative to implementation costs, providing crucial evidence for program justification and expansion decisions. Finally, research examining alternative fiscal technology approaches such as mobile-based solutions, blockchain systems, or integration with existing digital platforms could identify innovations potentially superior to traditional hardware devices for informal sector contexts.

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