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Development And Implementation Of An Integrated Cashless Rent Management System: Case Study Of Kampala Capital City Authority

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Abstract

This study presents the development and implementation of an Integrated Cashless Rent Management System (ICRMS) for Kampala Capital City Authority (KCCA), the administrative body responsible for managing Uganda's capital city. KCCA manages a substantial portfolio of commercial and residential properties, markets, and public spaces from which it collects rental income as a significant component of its internally generated revenue. Persistent challenges with manual and fragmented rent collection processes including revenue leakage, late payment, inadequate record-keeping, corruption, and limited management visibility provided the impetus for developing a comprehensive digital rent management solution. The system was developed using the Agile Scrum methodology and integrates a tenant registration module, rent billing and invoicing module, mobile money and bank payment gateway, automated reminder and notification module, and a management analytics dashboard. Evaluation was conducted through a structured survey of 138 respondents including KCCA property management staff, tenants, and IT administrators, supplemented by analysis of revenue data from 24 months before and after implementation. The findings demonstrate that the ICRMS resulted in a 43.7% increase in rent revenue collection efficiency, a 71.2% reduction in payment disputes, and a 58.4% reduction in rent collection administration costs. Regression analysis identified system integration quality, user experience design, and mobile money compatibility as the strongest predictors of system adoption success. The study concludes that the ICRMS represents a transformative improvement in KCCA's property revenue management and provides a replicable model for other Ugandan public authorities.

Keywords: Cashless Rent Management System, KCCA, Kampala Capital City Authority, Digital Payment, Mobile Money, E-Government, Revenue Management, Smart City.

1.0 Background of the Study

Kampala Capital City Authority (KCCA) was established by the Kampala Capital City Authority Act of 2010 as the statutory body responsible for the governance, administration, and development of Kampala, Uganda's capital and largest city(Kazaara & Kazaara, 2025). With a population of approximately 3.5 million people and serving as the country's primary commercial hub, Kampala generates substantial volumes of economic activity that translate into significant revenue potential for KCCA through property rates, market dues, rental income, parking fees, and other locally generated revenues(Amos et al., 2024). Among these revenue streams, rental income from KCCA-managed properties including market stalls, commercial offices, storage facilities, and residential units represents a substantial and strategically important component of the Authority's internally generated revenue(Paul et al., 2023).

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Prior to the development of the ICRMS, KCCA's rent collection processes were fragmented across multiple systems and heavily reliant on manual, cash-based transactions. Tenants were required to make rent payments in cash at designated KCCA revenue offices or through selected bank branches, processes that were time-consuming, geographically inconvenient, and susceptible to both honest error and deliberate fraud(Innocent et al., 2023). Revenue officers maintained paper-based ledgers and manual receipt books, creating significant risks of record falsification, data loss, and reconciliation errors. The lack of a centralized digital database meant that management had no real-time visibility into rent collection status, outstanding arrears, or tenant compliance rates across the Authority's property portfolio(Winny et al., 2023).

The government of Uganda's broader digital transformation agenda, articulated in the National Information and Communications Technology Policy (2018) and the National e-Government Framework, provides a supportive policy environment for the development of digital public service delivery systems(Christopher, 2024). Mobile money technology, in particular, has achieved remarkable penetration in Uganda, with the Uganda Communications Commission reporting over 32 million registered mobile money accounts and annual transaction volumes exceeding UGX 100 trillion(Agrawal, 2025). This mobile money infrastructure provides a ready-made payment channel that can be leveraged to facilitate convenient, cashless rent payments from any location and at any time, radically reducing the friction associated with rent payment compliance.

2.0 Problem Statement

KCCA's manual rent collection system generated a cascade of interrelated problems that undermined the Authority's revenue generation capacity, operational efficiency, and governance integrity(Nancy & Prudence, 2024). Revenue leakage through cash handling encompassing both theft and deliberate underreporting by collection officers was estimated by internal audit reports to represent between 15% and 25% of collectible rent revenue annually(Julius et al., 2024). Late payment rates were chronically high, with approximately 40% of tenants in arrears at any given time, in part because the inconvenience of in-person cash payment created a natural barrier to timely compliance(Florence & Julius, 2023). Dispute resolution was hampered by inadequate paper records, with tenants frequently unable to produce receipts for payments made months or years earlier. The absence of an automated reminder and notification system meant that KCCA relied entirely on manual follow-up processes for arrears recovery, consuming significant staff time while achieving inconsistent results.

3.0 Main Objectives

The main objective of the study was to develop and implement an Integrated Cashless Rent Management System for KCCA that would streamline rent collection, enhance revenue transparency, and reduce administrative overhead. The specific objectives were: (i) to analyze KCCA's existing rent management processes and identify key technological and operational improvement opportunities; (ii) to design a comprehensive system architecture for the ICRMS

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incorporating tenant registration, billing, digital payment, notification, and analytics functionalities; (iii) to develop and deploy the ICRMS using appropriate technologies and development methodologies; and (iv) to evaluate the system's impact on rent collection efficiency, revenue performance, administrative costs, and user satisfaction.

4.0 Literature Review

4.1 E-Government and Digital Revenue Management

E-government, broadly defined as the use of information and communication technologies to deliver government services, enhance governmental operations, and promote democratic participation, has been extensively studied as a mechanism for improving public sector efficiency and reducing corruption. Heeks (2002) established a foundational framework for understanding e-government success and failure, identifying the mismatch between system design assumptions and operational realities as the primary driver of implementation failure in developing country contexts. Subsequent research has refined this understanding, with particular attention to the critical importance of local context adaptation, stakeholder engagement, and post-deployment support in determining e-government outcomes(Nancy & Prudence, 2024).

Digital revenue management systems encompassing e-payment platforms, cashless collection systems, and integrated revenue management information systems have demonstrated significant impacts on public sector revenue performance across multiple African contexts(Lydia et al., 2023). A study by Fjeldstad and Moore (2009) documented how the introduction of electronic revenue collection systems in several East African countries significantly reduced opportunities for corrupt revenue officer behavior and improved overall collection efficiency. In Kenya, the implementation of the Integrated Financial Management Information System (IFMIS) and associated digital payment platforms contributed to measurable improvements in government revenue transparency and accountability(Atuhairwe et al., 2020).

4.2 Mobile Money as a Public Payment Platform

Mobile money platforms including Uganda's MTN Mobile Money and Airtel Money have transformed the financial services landscape across sub-Saharan Africa, providing accessible, convenient, and cost-effective payment and transfer services to populations previously excluded from the formal banking system(Polycarp et al., 2023). The integration of mobile money into public service payment systems represents a particularly promising avenue for improving revenue collection in contexts characterized by limited bank account penetration but high mobile phone ownership. Research by Jack and Suri (2011) in Kenya demonstrated the transformative social and economic impacts of mobile money adoption, while subsequent studies by Mbiti and Weil (2011) provided evidence of significant improvements in transaction convenience and cost efficiency.

5. System Design and Development

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The ICRMS was developed using the Agile Scrum methodology, organized into five two-week sprints covering requirements gathering and system design, core module development, payment gateway integration, testing and quality assurance, and deployment and user training respectively. The system was built on a microservices architecture using Node.js for the backend API layer, React.js for the web frontend, and Flutter for the native mobile applications (iOS and Android). PostgreSQL was selected as the primary relational database, with Redis used for session management and caching. Payment gateway integrations were established with MTN Mobile Money, Airtel Money, and Stanbic Bank's internet banking platform, enabling tenants to pay rent through any of these three channels.

The ICRMS comprises six integrated modules. The Tenant Registry Module maintains a comprehensive digital database of all KCCA tenants, including property details, lease terms, and contact information. The Billing and Invoicing Module automatically generates rent invoices on the first day of each month and delivers them to tenants via SMS, email, and the mobile application. The Payment Gateway Module processes cashless payments through MTN Mobile Money, Airtel Money, and bank transfer, with real-time payment confirmation and automatic ledger updating. The Arrears Management Module automatically tracks outstanding rent, generates escalating reminder communications, and produces arrears reports for property management staff. The Dispute Resolution Module provides a digital channel for tenants to raise payment disputes and tracks dispute resolution progress. Finally, the Management Analytics Dashboard provides KCCA property management and executive teams with real-time visibility into collection rates, arrears profiles, revenue trends, and property performance metrics.

6.0 Results and Evaluation

6.1 Revenue Performance Comparison

Revenue Metric	Pre-Implementation (Avg/month)	Post-Implementation (Avg/month)	% Change
Gross Rent Collected (UGX millions)	847.3	1,217.6	+43.7%
Collection Rate (% of billed rent)	61.4%	84.2%	+37.1%
Average Days to Payment	22.4	8.7	-61.2%
Payment Disputes per Month	143	41	-71.3%
Administration Cost (UGX millions/month)	67.8	28.2	-58.4%
Tenants in Arrears (> 30 days)	38.7%	14.2%	-63.3%

Source: Primary Data, 2025

The revenue performance data presented in Table 1 provides compelling evidence of the ICRMS's transformative impact on KCCA's rent collection operations. Gross monthly rent collections increased by 43.7% from an average of UGX 847.3 million pre-implementation to UGX 1,217.6 million post-implementation, representing a substantial and

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sustained improvement in revenue generation that directly contributes to KCCA's capacity to fund public services and infrastructure(Nelson et al., 2022). The rent collection rate the proportion of billed rent actually collected within the billing period improved from 61.4% to 84.2%, a gain of 37.1 percentage points that reflects the combined effects of payment convenience improvements, automated reminders, and enhanced arrears enforcement capabilities. Average days-to-payment fell dramatically from 22.4 days to 8.7 days, reflecting the frictionless convenience of mobile money and internet banking payment options compared to the previous requirement for in-person cash payment.

Payment disputes decreased by 71.3% from an average of 143 per month to just 41, attributable to the automated payment confirmation and digital receipt system that provides tenants with instant, permanent, and verifiable proof of payment(Florence & Julius, 2023). Administration costs fell by 58.4% due to the elimination of manual receipt writing, cash counting, ledger posting, and physical bank deposits that previously consumed substantial staff time. The proportion of tenants with arrears exceeding 30 days fell from 38.7% to 14.2%, a reduction of 63.3%, reflecting the combined effect of automated reminders, payment convenience, and more systematic enforcement of arrears recovery.

6.2 User Satisfaction Analysis

Satisfaction Dimension	Tenant Mean	Staff Mean	Overall Mean	Sig. (t-test)
Ease of Payment	4.51	4.23	4.41	0.000
System Reliability	4.18	4.34	4.24	0.000
Payment Confirmation Speed	4.62	4.41	4.54	0.000
Dispute Resolution Efficiency	3.87	4.12	3.97	0.001
Overall System Satisfaction	4.31	4.28	4.30	0.000

Source: Primary Data, 2025

The user satisfaction analysis presented in Table 15 reveals high levels of satisfaction with the ICRMS among both tenant users and KCCA staff users. Payment confirmation speed recorded the highest overall satisfaction mean (M = 4.54), reflecting tenants' appreciation for the instantaneous confirmation provided by mobile money transaction receipts compared to the delayed or absent confirmation that characterized cash payment under the old system. Ease of payment also scored very highly (M = 4.41), confirming that mobile money integration has successfully addressed the accessibility and convenience barriers that previously impeded timely rent payment. The relatively lower satisfaction score for dispute resolution efficiency (M = 3.97) suggests that while the digital dispute resolution module is an improvement over the previous manual process, further enhancements to response time and resolution transparency are warranted. Overall system satisfaction of 4.30 on a five-point scale is an excellent indicator of the ICRMS's successful adoption.

6.3 Regression Analysis: Predictors of System Adoption

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Predictor	B	Std. Error	Beta	t	Sig.
(Constant)	0.784	0.347		2.260	0.025
System Integration Quality	0.348	0.069	0.367	5.043	0.000
User Experience Design	0.287	0.072	0.291	3.986	0.000
Mobile Money Compatibility	0.261	0.068	0.268	3.838	0.000
Training & Support Adequacy	0.198	0.064	0.201	3.094	0.002
Management Commitment	0.163	0.061	0.168	2.672	0.008

$R = 0.817$, $R^2 = 0.667$, Adjusted $R^2 = 0.634$, $F = 52.418$, $p < 0.000$

Source: Primary Data, 2025

The regression analysis examining predictors of overall ICRMS adoption success presents a nuanced picture of the factors that drive successful implementation of digital payment systems in public sector contexts. The overall model is highly significant ($F = 52.418$, $p < 0.000$) and explains 66.7% of the variance in adoption success ($R^2 = 0.667$), with an adjusted R^2 of 0.634 demonstrating robust predictive power(Nelson et al., 2023). System integration quality emerges as the strongest predictor (Beta = 0.367, t = 5.043, $p < 0.000$), reflecting the critical importance of seamless connectivity between the ICRMS and existing KCCA property management databases, payment gateway APIs, and financial reporting systems. Fragmented or unreliable integrations create data inconsistencies that undermine both operational efficiency and user trust.

User experience design is the second strongest predictor (Beta = 0.291, t = 3.986, $p < 0.000$), emphasizing that the intuitiveness, visual clarity, and functional efficiency of the ICRMS interface are crucial determinants of adoption, particularly among users with varying levels of digital literacy. Mobile money compatibility ranks third (Beta = 0.268, t = 3.838, $p < 0.000$), confirming the strategic importance of integrating Uganda's dominant payment infrastructure into the system. Training and support adequacy (Beta = 0.201, t = 3.094, $p = 0.002$) and management commitment (Beta = 0.168, t = 2.672, $p = 0.008$) also make significant contributions, underscoring that technical excellence alone is insufficient without organizational readiness and sustained leadership support(Ntirandekura et al., 2022).

7.0 Discussion of Results

The results of this evaluation provide compelling evidence that the ICRMS has delivered transformative improvements across all dimensions of KCCA's rent management operations. The 43.7% increase in gross rent collections, combined with the 71.3% reduction in payment disputes and 58.4% reduction in administration costs, represents a trifecta of benefits that simultaneously enhance revenue generation, reduce operational expenditure, and improve stakeholder satisfaction. These outcomes are directly attributable to the system's core design principles: cashless payment convenience through mobile money integration, automated billing and reminder workflows, real-time payment reconciliation, and management analytics that enable proactive intervention.

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The strong predictive effect of system integration quality on adoption success highlights a critical lesson for public sector digital transformation initiatives. In complex institutional environments like KCCA, which operates multiple legacy systems for property management, human resource management, and financial reporting, the quality of system integrations is often more important to operational outcomes than the sophistication of any individual system component. Poorly integrated systems create data silos, require manual reconciliation processes, and generate distrust among users who encounter inconsistencies between systems. The ICRMS investment in robust API-based integrations with KCCA's existing systems and multiple payment gateways was therefore a strategically sound architectural decision that paid measurable dividends in adoption quality.

The finding that mobile money compatibility is a significant predictor of adoption success validates the strategic decision to center the ICRMS payment architecture around Uganda's mobile money ecosystem rather than internet banking or card-based payment alternatives. With mobile money penetration in Uganda exceeding 70% of the adult population compared to formal bank account penetration of approximately 35%, mobile money integration is not merely a convenience feature but an equity imperative: a system that can only be used by those with internet banking access would systematically exclude the majority of KCCA tenants, many of whom are small-scale market vendors and informal sector operators.

8.0 Conclusions and Recommendations

This study has successfully documented the development, implementation, and evaluation of an Integrated Cashless Rent Management System for Kampala Capital City Authority. The ICRMS has delivered substantial and measurable improvements in rent collection efficiency, revenue performance, dispute resolution, and administrative cost reduction, confirming the transformative potential of digital payment systems in public sector revenue management. The system's success provides a compelling proof of concept for digital revenue transformation in Ugandan public authorities and offers a replicable model for other municipal and national government entities.

Based on the findings, the study recommends that: (i) KCCA continue to invest in ICRMS feature development, including the integration of property rates and market dues collection to create a unified municipal revenue management platform; (ii) KCCA scale the ICRMS model to additional revenue streams including parking fees, business licensing, and building permits; (iii) the Ministry of Local Government consider mandating the adoption of similar cashless revenue management systems by all district local governments as part of Uganda's Public Finance Management reform agenda; (iv) future system development prioritizes offline payment functionality to accommodate users in areas with intermittent internet connectivity; and (v) KCCA establish a dedicated digital transformation unit

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with sufficient technical capacity to maintain, upgrade, and continuously improve the ICRMS and any future digital systems developed by the Authority.

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