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The Role of Technological Infrastructure in Enhancing Public Service Delivery: Evidence from Huduma Centres in Nairobi Metropolitan Area, Kenya

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Abstract

Technological infrastructure has emerged as a foundational driver of public sector service delivery, yet its specific effect on service delivery outcomes in Kenya, particularly at Huduma Centres, remains understudied. These Centres aim to centralise government services, but persistent challenges in digital infrastructure continue to undermine accessibility, timeliness, and user satisfaction. This study investigated the effect of technological infrastructure in enhancing service delivery among Huduma Centres in Nairobi Metropolitan Area, Kenya. The study was anchored in a pragmatic philosophical paradigm and guided by the technology–organisation–environment framework. An explanatory mixed-methods design was adopted, targeting 13,796 individuals across nine Huduma Centres in Nairobi, Kiambu, Machakosand Kajiado counties. A stratified sampling approach using Cochran's formula yielded a sample of 549 respondents. Primary data were collected through semi-structured questionnaires, with reliability and validity ensured through Cronbach's alpha, expert validation, and construct review. Quantitative data were analysed using descriptive statistics, Pearson correlation, and simple linear regression, while qualitative data underwent thematic analysis. The study found that technological infrastructure had a significant positive effect on service delivery ($\beta = 0.650$, $p = 0.000$), explaining 44.7% of the variance in service delivery outcomes. Infrastructure reliability recorded the lowest mean score among the three infrastructure items ($M = 4.04$, $SD = 0.47$), pointing to uneven system performance across centres. Qualitative findings corroborated these results, with employees and customers identifying system downtimes, inadequate bandwidth, and equipment failures as persistent barriers to effective service provision. The study concludes that technological infrastructure is the most critical driver of service delivery performance at Huduma Centres, yet systematic gaps in reliability and system integration require immediate institutional intervention. The study recommends that Huduma Centres prioritise infrastructure upgrades, that the ICT Authority enforce uniform digital standards, and that the Ministry of ICT align the Kenya Digital Masterplan 2022–2032 with clear implementation timelines and resource allocation frameworks to ensure consistent and equitable service delivery across all centres.

Keywords: *Technological infrastructure, service delivery, Huduma Centres, Kenya*

1.0 Background to the Study

The provision of public services through digital platforms has become a defining feature of contemporary governance with technological infrastructure taking a central position in the determination of service delivery outcomes. Technological infrastructure refers to the physical and virtual ecosystem of hardware, software, communication networks and digital platforms that support data storage, connectivity, and interactions between government institutions and citizens (Chen & Li, 2024; Xiao et al., 2023). Key components are broadband connectivity, data centres, enterprise platforms, mobile technologies and cloud computing systems (Duong, 2023; Kaira et al., 2024). In this paper, technological infrastructure is defined as the adequacy and reliability of digital platforms that support the digitization of public sector processes. Sharma et al. (2023) argue that the robustness of the technological infrastructure of an organisation determines the ability to provide services to citizens effectively, respond to citizen needs in a timely manner and maintain continuity of operations in the event of disruptions and is therefore the foundation of any credible digital governance strategy.

From a strategic management perspective, technological infrastructure is not just a technical asset but a foundation enabler that determines the agility, resilience and service delivery positioning of an organisation (Alvarenga et al., 2020; Tangi et al., 2021). Robust ICT systems enable efficient inter-departmental collaboration, data sharing and real-time decision making, enabling greater transparency, accountability and responsiveness in the provision of public services. On the other hand, lack of proper infrastructure leads to data fragmentation and delays in services and low public trust (Hamidu, 2025; Kumari et al., 2023). The resource-based view places technological infrastructure in the core of the organisation as a resource that, when strategically managed, will bring sustained competitive advantage through enhanced capabilities and process optimisation. Emerging technologies like artificial intelligence, the Internet of Things and blockchain are increasingly being incorporated into government systems to improve predictive governance, automation of administrative processes and ensure data integrity across public service platforms (Kraus et al., 2021; Paul et al., 2024).

Globally, the evidence of the relationship between technological infrastructure and better public service delivery is well-established, albeit contextually varied in the scope and application of the evidence. In Ghana, Agyepong et al. (2019) found a strong positive relationship between ICT infrastructure and service responsiveness among 150 public employees, generating an R2 of 0.68. In Jordan, Abu-Shanab (2020) confirmed through structural equation modelling that ICT infrastructure had a significant effect on perceived service reliability and user satisfaction (b = 0.64). In Rwanda, Sharamanzi (2024) showed that the expansion of broadband, private sector partnerships and real-time analytics were important in improving e-government service delivery in resource constrained settings. These results confirm that strategic infrastructure investment is converted into tangible service quality improvements. Nevertheless, most studies looked at infrastructure in isolation from complementary transformation variables (digital competencies, process automation, and legislative policy frames) and as a result, their explanatory depth was limited and generalizability to devolved governance contexts like Kenya was limited (Meru and Kinoti, 2022).

Within Africa, countries that have made progress in the public infrastructure highlight the promise and the gaps that continue to exist in the delivery of technology services. In Uganda, Nalubega and Uwizeyimana (2024) found that applications of AI improved the productivity of public sector and minimized human error although unresolved problems in infrastructure

security limited sustainable gains. In South Africa, Manda (2022) showed that a lack of strategic direction and legislative frameworks resulted in inconsistent digital transformation outcomes and confirmed that infrastructure without policy coherence has limited improvement. In Kenya, Meru and Kinoti (2022) have noted that persistent inequalities in infrastructure and systems downtimes continued to jeopardize service reliability in spite of some significant national digital advances. Poudel (2024) further established in Nepal that the cloud infrastructure vulnerabilities and data governance gaps constrained the sustainability of the public services that are driven by AI, highlighting the robustness of infrastructure as a prerequisite of the effectiveness of the service delivery. These findings from the continent point consistently to the need for integrated infrastructure strategies within the framework of policy environments of governance.

Kenya set up Huduma Centres as integrated one-stop service centres aimed at centralising government services under a technology-enabled roof, supported by biometric verification, integrated management information systems and queue management platforms (Ng'ang'a, 2021). Despite this strategic intent, evidence of persistent infrastructural shortfalls is well-documented. The GPO Nairobi Huduma Centre recorded thirty percent downtime in biometric systems in 2022, which has disrupted identity processing and impacted people's confidence (ICT Authority, 2022). In peri-urban centres like Kajiado, the poor internet connectivity and poor backup systems are still causing service continuity interruptions (Nyamai & Njagi, 2023). Musyoka et al. (2023) found in a longitudinal study of 250 employees that the use of secure servers, integrated platforms and networks that don't crash increased accessibility and user satisfaction significantly. Yet gains were still limited by lack of staff digital capacity and a lack of policy-aligned maintenance protocols that exposed systemic gaps that go well beyond the provision of hardware alone.

Empirical studies in Kenya shed more light on the relationship between technological infrastructure and public service delivery. Wanyoike et al. (2021) in a mixed-method study of 120 county public servants showed that digital infrastructure has significantly reduced service delays and increased operational efficiency. Kepha, Peterson, and Kate (2023) found in a quantitative study of 178 state corporations that IT strategy accounted for 58.7 percent of the variance in service delivery outcomes. Mugo and Gikunda (2022) supported these results using data from 180 users of the Huduma Centre, establishing that system uptime, internet connectivity and hardware reliability significantly increased transparency and timeliness ($R2 = 0.71$). Kiprono and Cheruiyot (2024) further confirmed through the use of quasi-experimental analysis that the use of AI-powered infrastructure improved the speed and accuracy of public services. Collectively, these studies confirm the centrality of infrastructure to service delivery performance but consistently reveal persistent gaps in policy integration, qualitative triangulation and comprehensive digital transformation frameworks.

The Kenya Digital Masterplan 2022-2032, published under the Ministry of ICT, offers the most comprehensive national commitment to the advancement of the technological infrastructure in public institutions, outlining targets for digital infrastructure improvements, network expansion and systems integration (ICT Authority, 2022). Njuguna and Karimi (2025) showed using hierarchical regression that conformity with this Masterplan significantly magnified the effects of ICT infrastructure on service delivery performance ($R2$ change = 0.11). Kamau and Omwenga (2025) similarly found that digital infrastructure had a significant positive impact on the provision of service ($b = 0.312$). These findings confirm that infrastructure investment has its highest returns if embedded within supportive legislative frameworks. However, the

implementation of this policy vision to a consistent operational improvement in all Huduma Centres is uneven, especially in the peri-urban locations (Njoroge & Mwangi, 2023). This paper fills that gap by presenting targeted empirical evidence on the effects of technological infrastructure on accessibility, timeliness and user satisfaction in the Huduma Centres in the Nairobi Metropolitan Area.

1.1 Statement of the Problem

Kenya's Huduma Centres were set up as one-stop government service centres to improve citizen access to key public services such as identity card issuance, tax compliance and licensing (Latupeirissa et al., 2024). Despite their transformative intent, these centres still struggle with persistent failures in service delivery which have their roots specifically in inadequate technological infrastructure. Frequent system downtimes, unreliable internet connectivity and poorly maintained digital hardware have caused significant bottlenecks in service provision across multiple centres, particularly within the high-demand Nairobi Metropolitan Area (Odhiambo & Okello, 2019). These infrastructural deficiencies directly affect accessibility, timeliness and user satisfaction - the three pillars of good public service delivery. The inefficiencies have serious socio-economic consequences such as higher operational costs, low citizen satisfaction and low public confidence in government institutions, ultimately affecting the long-term sustainability of Huduma Centres as Kenya's flagship service delivery model (Filgueiras et al., 2019; Nurfadilah & Haliah, 2024).

Although the role of technological infrastructure in the delivery of digital services is widely recognised as the backbone of digital service delivery, empirical studies that focus on the specific role of technological infrastructure in the delivery of digital services within Kenya's Huduma Centres are limited in scope and contextual relevance. Since their establishment in 2013, Huduma Centres have been facing worsening operational inefficiencies that are driven by the increasing service demand which has outpaced infrastructural investment (Koech et al., 2023; Sihombing et al., 2024). Existing studies focus mainly on developed country contexts and leave large empirical and contextual gaps on infrastructure-related challenges in the devolved governance framework in Kenya (Kasmiah et al., 2024). Furthermore, the conceptual framing of technological infrastructure tends to consider it in isolation from complementary transformation enablers, and rarely explores it in the context of the moderating influence of policy frameworks such as the Kenya Digital Masterplan 2022-2032 (Latupeirissa et al., 2024). This fragmented approach constrains the generation of actionable evidence for infrastructure investment decisions in the public sector of Kenya (Khisro, 2020; Odhiambo et al., 2019).

To overcome persistent service delivery inefficiencies in Huduma Centres, the Government of Kenya operationalized the Kenya Digital Masterplan 2022-2032 as a strategic instrument for digital infrastructure investment and transformation (Koech & Bett, 2023). However, how far this framework has contributed to the improvement of technological infrastructure and the effectiveness of service delivery is yet to be explored, which is a significant knowledge and practice gap (Larasati et al., 2022; Setyawan, 2024). Addressing this gap is crucial for policy formulation, infrastructure deployment optimization, and equitable service access promotion in line with Kenya Vision 2030 and the Sustainable Development Goals (Li et al., 2024; Nurfadilah et al., 2024). This paper thus examines in detail the specific impact of technological infrastructure on accessibility, timeliness and user satisfaction among Huduma Centres in the Nairobi Metropolitan Area, producing concentrated empirical evidence to inform institutional and policy action (Idrus et al., 2024; Kirana & Majid, 2022).

1.2 Research Objective

To examine the role of technological infrastructure in enhancing public service delivery among Huduma Centres in Nairobi Metropolitan Area, Kenya.

1.3 Hypothesis

H_0: There is no statistically significant effect of technological infrastructure on service delivery among Huduma Centres in Nairobi Metropolitan Area, Kenya.

2.0 Literature Review

This chapter presents an extensive review of scholarly works by various authors, which serve as the foundation for examining the study's objectives. It begins with a discussion of the theories that underpin the research, providing a theoretical framework to contextualize the relationships between the key variables. The chapter also includes a detailed review of empirical literature review and conceptual framework.

2.1 Theoretical Review

This study was supported by Technology-Organisation-Environment (TOE) Framework, which was first proposed by Tornatzky and Fleischer (1990) and offers the best theoretical lens for analysing the impact of technological infrastructure on public service delivery in Huduma Centres. The framework describes three dimensions, which are interdependent: technology, which refers to adequacy and reliability of digital systems; organisation, which refers to internal capabilities and staff readiness; and environment, which refers to external pressures such as regulatory frameworks (Latupeirissa et al., 2024). In this study, the technological dimension is directly related to the independent variable, technological infrastructure, which is adopted and effective at the same time by organisational readiness and government policy directives. The TOE Framework is especially relevant because it does not consider technology as a driver of outcomes in isolation but as a dimension conditioned by the broader organisational and environmental context, and is therefore well-suited for investigating infrastructure-service delivery relationships in Kenya's devolved and policy-governed public service system.

The relevance of the TOE Framework to this study is further confirmed by the fact that it has been established as applicable in public sector digital transformation research in developing country contexts. Aboelmaged (2020) validated the predictive power of the framework in modelling the adoption of e-services, where the technological and environmental dimensions were found to be significant predictors of e-service adoption in resource-constrained environments. Within Kenya, the Kenya Digital Masterplan 2022-2032 directly operationalizes the environmental dimension of TOE by requiring infrastructure investment standards, informing resource allocation, and establishing compliance benchmarks for public institutions including Huduma Centres (ICT Authority, 2022). The organisational dimension is manifested through staff training and system integration capacities that determine whether infrastructure investments produce intended improvements in service delivery. Collectively, the three dimensions of TOE describe the interaction of technological infrastructure with staffing capacity and policy environment to influence the service delivery outcomes of accessibility, timeliness, and user satisfaction, and thus offer this study a strong and contextually grounded theoretical foundation (Sharma et al., 2023).

2.2 Empirical Literature Review

Technological infrastructure is the backbone on which public service delivery is effective and includes hardware, software, data systems and communication networks that promote seamless operations, coordination and citizen engagement. Researchers have become increasingly aware of the importance of infrastructure investments in digital transformation, but many studies examine the impact of digital transformation in isolation without taking into account broader contextual and legislative factors that influence performance outcomes. Agyepong et al. (2019) examined digital transformation on public sector performance in Ghana using descriptive cross-sectional survey of 150 public employees and found a strong positive relationship between ICT infrastructure and service responsiveness ($R2 = 0.68$, $p < 0.01$) and confirmed that efficient infrastructure enables real-time communication and faster transaction processing. In Rwanda, Sharamanzi (2024) showed that expansion of broadband connectivity, private sector partnerships and real-time analytics were vital to improving e-government services, concluding that strategic collaboration and data-driven governance were important to overcome infrastructural challenges in resource-limited settings.

Abu-Shanab (2020) used a cross-sectional survey of 200 Jordanian citizens to examine the impact of ICT infrastructure on e-government adoption, using structural equation modelling to confirm that there exists a significant positive relationship between ICT infrastructure and perceived reliability and user satisfaction ($b = 0.64$, $p < 0.05$), indicating that well-developed infrastructure improves the dependability of services and public trust. In Nepal, Poudel (2024) similarly found that use of AI and big data integration as part of cloud-oriented government infrastructures made systems more transparent, also improved response times and service personalization in the health, urban management, and social welfare sectors. In Uganda, Nalubega and Uwizeyimana (2024) further showed in a mixed-methods study the benefits of AI applications integrated into the public service infrastructure by improving productivity, minimizing human error and personalising citizen interactions, further reinforcing the argument that technology-driven public sector infrastructure is a foundational driver of public sector efficiency and responsiveness across varied governance contexts.

Ng'ang'a (2021) investigated the effectiveness of ICT at GPO Huduma Centre Nairobi and found that ICT adoption enhanced accessibility, reduced turnaround time and enhanced transparency in government transactions, although frequent technical failures sometimes affected the continuity of service. Meru and Kinoti (2022) further developed this view in a qualitative analysis of digital transformation in Kenya, which showed that although the country had made significant gains in digital transformation, the infrastructure inequalities and system downtimes still impacted the reliability of service. Wanyoike et al. (2021) further showed in a mixed-method study of 120 county public servants that digital infrastructure had a significant effect on reducing service delays and improving operational efficiency ($p = 0.031$), although the study did not measure integration with central government platforms. Together, these studies validate the infrastructural investment in public sector in Kenya to a measurable level of service delivery improvement whilst at the same time exposing systemic gaps in infrastructural sustainability and cross-platform integration.

Mugo and Gikunda (2022) using data from 180 Huduma Centre users, established that system uptime, internet connectivity and hardware reliability significantly improved service transparency and timeliness ($R2 = 0.71$). Musyoka et al. (2023) in a longitudinal study of 250 employees of the Nairobi Huduma Centre found that secure servers, integrated platforms and stable networks made a significant difference in accessibility and user satisfaction ($p < 0.001$).

Kepha, Peterson and Kate (2023) in a quantitative study of 178 state corporations in Kenya found that IT strategy accounted for 58.7 percent of differences in service delivery outcomes, thus highlighting the primacy of technological investment. Kiprono and Cheruiyot (2024) in a further analysis using quasi-experimental methodology also showed that the use of AI-powered platforms such as chatbots and self-service kiosks improved the speed and accuracy of public services significantly ($F = 4.76$, $p = 0.012$) by streamlining workflows across service delivery points.

Njuguna and Karimi (2025) used hierarchical regression with data from 200 public managers and found that alignment with the Kenya Digital Masterplan 2022-2032 significantly increased the impact of ICT infrastructural on service performance ($R2$ change $= 0.11$, $p < 0.05$) and therefore corroborated that legislative coordination maximises infrastructural gains. Collectively, the reviewed studies support the importance of technological infrastructure in contemporary public administration as the cornerstone of efficiency, transparency and citizen-centred service delivery. Yet much of the existing research separates infrastructure from or ignores the moderating influence of policy frameworks and other components of transformation. This paper filled these gaps by placing technological infrastructure in a holistic context anchored on the Kenya Digital Masterplan 2022-2032, producing empirical evidence on how infrastructure improves the service delivery dimensions of accessibility, timeliness and user satisfaction across Huduma Centres.

2.3 Conceptual Framework

A conceptual framework refers to the structured representation of the key concepts and variables in a study and the presumed relationships among them. Figure 1 presents a conceptual framework.

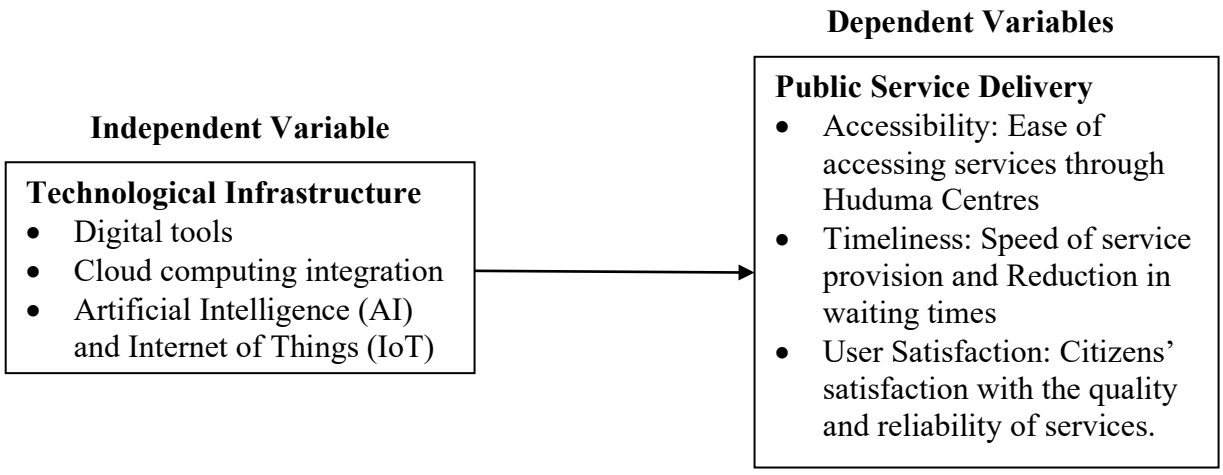

Figure 1: Conceptual Framework

3.0 Research Methodology

The study was guided by a pragmatic philosophical orientation, which formed the epistemological basis for its explanatory research design of mixed methods. Pragmatism was chosen because it focuses on problem-solving, real-world applicability, and methodological pluralism, recognising the existence of objective and subjective realities, without limiting the inquiry to a single research tradition (Clarke & Visser, 2019). This was particularly appropriate for investigating technological infrastructure and public service delivery in Huduma Centres

where complex technical systems are coupled with human experiences and institutional dynamics. The study used explanatory research design whereby quantitative and qualitative data were gathered simultaneously with more emphasis on the former. Semi-structured questionnaires were used to interview a stratified sample of 549 respondents from 9 Huduma Centres located in the Nairobi Metropolitan Area. 169 employees categorised as managers, heads of department and senior management and 380 customers were sampled using Cochran's (1977) formula for finite populations. Stratified sampling was used to ensure that there were proportional representations of different subgroups to increase representativeness and reduce sampling error (Baughan et al., 2023; Reddy & Khan, 2023). Quantitative data were analysed by using descriptive statistics, Pearson correlation, simple linear regression and hierarchical regression to test the effect of technological infrastructure on service delivery outcomes. The regression model was;

$Y = B_0 + BX + e$

Where technological infrastructure was the independent variable and service delivery was the dependent variable. The qualitative data from open-ended questionnaire answers was thematically analysed to contextualise and enhance the quantitative data to capture the experiential dimensions of infrastructure-driven service delivery (Creswell & Creswell, 2022). Ethical approvals were granted from Daystar University ISERC and NACOSTI, where full compliance with Kenya Data Protection Act 2019 was observed and participant confidentiality, informed consent and data security were maintained throughout the research process.

4.0 Introduction

This chapter presents the data presentation, analysis and discussion of findings. It begins with the pretesting, response rate, followed by descriptive statistics, correlation analysis, regression analysis and finally qualitative analysis.

4.1 Pretesting of the Research Instrument

Pretesting of the research instrument was carried out at Huduma Centre Nakuru and Huduma Centre Naivasha and involved 17 employees and 38 customers, for a total of 55 respondents representing ten percent of the planned sample of the main study. These respondents were excluded from the main study to avoid bias. The main purpose was to evaluate the validity and reliability of the questionnaire prior to full scale data collection. Construct validity for technological infrastructure and service delivery constructs was determined using Kaiser Meyer Olkin measures of sampling adequacy and Bartlett's Test of Sphericity. Technological infrastructure had a KMO value of 0.618 and a significance of 0.000, while the service delivery constructs of accessibility, timeliness and user satisfaction had KMO values of 0.626, 0.579 and 0.620 respectively, all of which met the minimum threshold of 0.5. The aggregate KMO of 0.620 and the significance of 0.006 by Bartlett's test confirmed that the data was appropriate for factor analysis for all the measured constructs.

Factor analysis supported construct validity for both technological infrastructure and service delivery items, with all extraction values greater than the recommended value of 0.4 (Stevens, 2002). Technological infrastructure had the highest factor loadings ranging from 0.899 to 0.989, and accessibility items ranged from 0.806 to 0.856, timeliness from 0.809 to 0.904, and user satisfaction from 0.820 to 0.909, which confirmed strong item-construct alignment across all dimensions of service delivery. Face and content validity was determined through supervisor review and pretest participant feedback, with all 55 respondents confirming that items were clearly worded and directly relevant to their daily service experiences at Huduma

Centres. Reliability assessment with the help of Cronbach's alpha showed that technological infrastructure scored 0.897, accessibility 0.873, timeliness 0.734 and user satisfaction 0.772 which were above the acceptable threshold of 0.7 set by Nunnally (1978). The overall aggregate reliability of 0.842 confirmed the retention of all items in the main study.

4.2 Response Rate

Table 1 presents the response rate obtained from the survey conducted among employees and customers at Huduma Centres within the Nairobi Metropolitan Area. A total of 518 questionnaires were distributed, out of which 479 were duly completed and returned, representing a 73.2 percent response rate. The remaining 39 questionnaires, equivalent to 7.5 percent, were not returned. To ensure consistency, both frequencies (n) and percentages (%) have been reported across all categories in this and subsequent descriptive tables. The figures represent respondents, not services, as the analysis was based on the number of participants who successfully completed and returned the research instrument. This high response rate demonstrates strong participant engagement and enhances the reliability and representativeness of the data collected.

Table 1: Response rate

Category	Target Respondents	Actual Respondents	Response Rate (%)
Pretest (Nakuru)	55	55	100%
Main Study	549	402	73.2%
Employees	169	138	81.7%
Customers	380	264	69.5%

Source: Field Data (2025)

The study employed rigorous methodological procedures, including pretesting to validate research instruments. The pretest was conducted at Huduma Centres in Nakuru County with 55 respondents (17 employees and 38 customers), achieving a 100% response rate. This complete participation during pretesting eliminated non-response bias in instrument validation and confirmed that the questionnaire design was accessible to both employee and customer groups. For the main study, the sample size of the study was 549 respondents across nine Huduma Centres in the Nairobi Metropolitan Area, comprising Nairobi, Kiambu, Machakos, and Kajiado counties. The study demonstrated strong participant engagement with a robust response rate among both employees and customers in the public service delivery centers. Participants achieved a 73.2% response rate with 402 respondents out of the targeted 549 individuals, comprising 138 employees (81.7% response rate from 169 targeted) and 264 customers (69.5% response rate from 380 targeted), representing solid participation given the operational nature of digital transformation research in active service delivery environments.

The employee response rate of 81.7% was notably higher than the customer response rate of 69.5%, reflecting the greater accessibility and engagement of staff compared to transient service users. The overall 73.2% response rate exceeds widely accepted thresholds for survey research validity and generalizability. According to Babbie (2016), response rates above 50% are considered adequate for analysis and reporting, while rates above 60% are considered good, and those above 70% are considered very good for social science research. Similarly, Dillman et al. (2014) note that response rates above 60% are sufficient to provide adequate statistical

analysis. Nulty (2008) further supports that response rates above 60% minimize non-response bias and enhance the reliability of findings in educational and organisational research contexts.

This 73.2% response rate minimizes selection bias and enhances the reliability of findings within the specific context of public sector employees and service users in Kenya's metropolitan region. The response rate provides sufficient statistical power for meaningful analysis of digital transformation practices effectiveness, service delivery performance assessment, and Pearson correlation analysis and regression analysis between technological infrastructure, digital competencies, process automation and service delivery outcomes. The participation demonstrates that digital transformation research was considered relevant and important by managers, heads of departments, senior management, and customers across different service categories, supporting the validity of conclusions drawn about digital transformation impact and the role of government policy on service delivery among this population of public sector stakeholders in both urban and peri-urban settings within the Nairobi Metropolitan Area.

4.3 Descriptive Statistics

This section presents the descriptive statistics for all study variables, providing insights into the central tendencies and variability of responses from employees across nine Huduma Centres in the Nairobi Metropolitan Area. The analysis is organised according to the study's research objectives and examines the independent variables (digital transformation practices), the dependent variable (service delivery), and government policy. All variables were measured using a 5-point Likert scale where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. These statistics provide a summary of the responses regarding technological infrastructure, digital competencies, process automation, government policy, and service delivery.

4.3.1 Technological Infrastructure

The first objective of the study was to investigate the effect of technological infrastructure on service delivery among Huduma Centres in Nairobi Metropolitan Area, Kenya. The study examined technological infrastructure through digital tools availability, cloud computing integration and AI and IoT investment as outlined in the conceptual framework. The summary for technological infrastructure is presented in Table 2.

Table 2: Descriptives Statistics for Technological Infrastructure

Question	Mean (M)	Std. Dev. (SD)
The digital tools and systems in this Huduma Centre are sufficient and well-integrated.	4.12	0.351
The digital infrastructure (servers, internet, systems) is consistently reliable.	4.04	0.466
The ICT systems at this Centre contribute to improved service delivery.	4.11	0.335
Overall Mean / SD	4.09	0.384

Source: Field Data (2025)

The overall mean score for technological infrastructure was M = 4.09 with a standard deviation (SD) = 0.38, indicating that most respondents agreed that technological infrastructure is well-

established across Huduma Centres, with low variability in responses. This suggests that the centres generally have a solid technological foundation, though minor differences exist in staff experiences across the centres. System integration and sufficiency recorded the highest mean (M = 4.12) above the overall mean, indicating that respondents agreed that digital tools and systems in Huduma Centres are sufficient and well-integrated. The relatively low variability (SD = 0.35) reflects consistent agreement among staff, implying that respondents share a common view regarding the adequacy of technological systems.

ICT contribution to service delivery achieved a mean of M = 4.11, slightly above the overall mean, suggesting that most respondents acknowledged that ICT systems significantly enhance service delivery. The standard deviation (SD = 0.34) indicates strong consensus that the ICT infrastructure contributes to better efficiency, accuracy, and accountability. Infrastructure reliability recorded the lowest mean (M = 4.04), which still indicates general agreement that digital infrastructure is reliable. However, the higher variability (SD = 0.47) suggests that some centres experience intermittent challenges with network stability and system uptime, pointing to uneven infrastructure performance across locations.

The findings of this study align with several previous studies that have underscored the pivotal role of technological infrastructure in enhancing public service delivery. Agyepong et al. (2019) found that robust ICT infrastructure improves public sector responsiveness and operational efficiency. Similarly, Abu-Shanab (2020) reported that investments in digital systems enhanced user satisfaction and reliability of government services in Jordan. Wanyoike et al. (2021) observed that infrastructural investments in county governments reduced service delays and improved responsiveness, while Mugo and Gikunda (2022) established that internet connectivity, hardware reliability, and system uptime were key enablers of transparency and timeliness in Huduma Centres.

Musyoka et al. (2023) confirmed that secure servers, integrated platforms, and network stability improved service accessibility and user satisfaction in Nairobi Huduma Centres. More recently, Kiprono and Cheruiyot (2024) demonstrated that AI-driven infrastructure enhanced speed and accuracy in public service delivery, while Njuguna and Karimi (2025) showed that aligning ICT infrastructure with the Kenya Digital Masterplan (2022–2032) strengthened the impact of digital systems on service outcomes. Collectively, these studies affirm that the quality, integration, and reliability of technological infrastructure are critical in achieving efficient, transparent, and citizen-centred service delivery, consistent with the findings of this study.

The quantitative evidence reveals that Huduma Centres in the Nairobi Metropolitan Area have made substantial progress in establishing a strong technological foundation for service delivery. Quantitatively, the high mean scores indicate positive perceptions of system integration and ICT contribution, while the significant regression coefficient confirms a measurable effect of infrastructure on service performance. The findings underscore that technological infrastructure is not merely a technical asset but a strategic enabler of efficient service delivery, transparency, and citizen trust. Strengthening network reliability, ensuring full system integration, and expanding investment in AI-driven solutions will be essential in sustaining and scaling digital transformation across Huduma Centres.

4.3.2 Service Delivery

Service delivery represented the dependent variable in this study, measured across three key dimensions as specified in the conceptual framework: accessibility (ease of accessing services through Huduma Centres), timeliness (speed of service provision and reduction in wait times),

and user satisfaction (citizens' satisfaction with the quality and reliability of services). The summary for service delivery is presented in Table 3

Table 3: Descriptive Statistics for Service Delivery

Question	Mean (M)	Std. Dev. (SD)
Services are easily accessible through digital platforms at this Huduma Centre.	4.24	0.56
The system enables me to deliver services without requiring citizens to make physical visits.	4.08	0.62
Digital services at this centre face minimal barriers to delivery.	4.07	0.59
Services are provided faster through digital platforms than through manual processes.	4.22	0.55
Waiting times have significantly decreased with digital service adoption.	4.24	0.56
The Centre meets expected service delivery timelines through digital systems.	4.03	0.54
Our customers are satisfied with the quality of services offered through digital platforms.	4.30	0.55
The digital service platforms are easy to use and navigate.	4.28	0.51
Our customers are satisfied with the reliability of digital services at this Huduma Centre.	4.22	0.51
Overall Mean / SD	4.19	0.56

Source: Field Data (2025)

The overall mean for service delivery was M = 4.19 with a standard deviation (SD) = 0.56, suggesting that most respondents agreed that digital transformation had significantly improved service delivery in Huduma Centres, with moderate variability in perceptions across locations. Customer satisfaction with service quality recorded the highest mean (M = 4.30, SD = 0.55), indicating broad consensus that digital platforms provide reliable, high-quality services. Platform usability also rated highly (M = 4.28, SD = 0.51), showing that respondents found digital systems intuitive and easy to navigate, thus enhancing user experience. Accessibility and reduced waiting times both achieved M = 4.24, suggesting that services have become easier to access and that queue times have significantly decreased with digitalization. Timeline adherence registered the lowest mean (M = 4.03), which, though positive, indicates some challenges in maintaining consistent service timelines across centres.

The findings of this study align with several existing studies that define and explain the dynamics of service delivery in the digital governance context. Alvarenga et al. (2020) describe service delivery as the execution of public services through structured interactions between institutions and beneficiaries to achieve policy objectives. Similarly, the OECD (2024) defines it as the capacity of public agencies to deliver timely, efficient, and satisfactory services that meet citizen needs. Sharma et al. (2023) conceptualize service delivery as a multidimensional construct integrating inclusivity, efficiency, and user experience as indicators of public value in digital governance.

Idrus et al. (2024) further established that digitized service systems promote transparency, accountability, and responsiveness in public institutions. In addition, Tripathi et al. (2020) found that technology integration enhances administrative coordination and strengthens citizen engagement by minimizing bureaucratic bottlenecks. Collectively, these studies affirm that well-designed digital service frameworks significantly improve public sector performance, efficiency, and citizen trust—corroborating the findings of the current study in the Huduma Centres context. In summary, the results confirmed that service delivery performance at Huduma Centres has been substantially enhanced through digital transformation. Quantitative data showed high mean scores across all indicators-accessibility, timeliness, and user satisfaction-while regression results established that digital transformation practices collectively explained over 64 percent of the variance in service delivery outcomes. In conclusion, service delivery in Huduma Centres within the Nairobi Metropolitan Area has been markedly improved by digital transformation initiatives.

4.4 Correlation Analysis

Correlation analysis examines the association between independent and dependent variables. The correlation results are presented in Table 4

Tabe 4: Correlation analysis

		Service delivery	Technological infrastructure
Service delivery	Pearson Correlation	1.000	
	Sig. (2-tailed)		
Technological infrastructure	Pearson Correlation	.669**	1.000
	Sig. (2-tailed)	0.000	

Note: ** The correlation is statistically significant at the 0.05 level ($p < 0.05$)

Source: Field Data (2025)

The correlation results presented in Table 4 provide valuable insights into the association between digital transformation practices, government policy, and service delivery among Huduma Centres. The study found that technological infrastructure is positively and statistically significantly associated with service delivery ($r=0.669$, $p=0.000$), indicating that Huduma Centres that effectively implement robust digital tools, cloud computing integration, and advanced ICT systems are more likely to achieve better service delivery outcomes. These findings align with empirical studies from the literature review. Musyoka et al. (2023) found that ICT infrastructure significantly improved accessibility and user satisfaction ($p < 0.001$), supporting the strong correlation between technological infrastructure and service delivery observed in this study.

4.5 Regression Analysis

The regression analysis was conducted to investigate the effect of technological infrastructure on service delivery among Huduma Centres in the Nairobi Metropolitan Area, Kenya. The regression analysis for technological infrastructure is presented in Table 5, which shows the model fitness results.

Table 5: Model fitness for Technological Infrastructure and Service Delivery

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.669a	0.447	0.443	0.2371277

a Predictors: (Constant), Technological Infrastructure

Source: Field Data (2025)

The R Square value of 0.447 indicates that approximately 44.7% of the variance in service delivery can be explained by technological infrastructure. This suggests that a substantial proportion of service delivery performance in Huduma Centres is influenced by the availability and quality of technological infrastructure. The model shows a strong relationship, indicating that improvements in technological infrastructure are likely to lead to notable improvements in service delivery outcomes.

Table 6: Analysis of Variance (ANOVA) for Technological Infrastructure and Service delivery

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.193	1	6.193	110.132	.000b
	Residual	7.647	136	0.056		
	Total	13.84	137			

a Dependent Variable: Service Delivery

b Predictors: (Constant), Technological Infrastructure

Source: Field Data (2025)

The ANOVA results in Table 6 show that the model is statistically significant, with F = 110.132 and p = 0.000. This confirms that technological infrastructure significantly predicts service delivery. The p-value (p = 0.000) indicates that the observed relationship between technological infrastructure and service delivery is statistically significant, and not due to random chance. This finding reinforces the conclusion that technological infrastructure plays a key role in influencing the quality-of-service delivery in Huduma Centres.

Table 7: Regressions of Coefficients for Technological Infrastructure and Service Delivery

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.484	0.257		5.779	0.000
	Technological Infrastructure	0.650	0.062	0.669	10.494	0.000

Source: Field Data (2025)

The resulting simple regression model is:

$Y = 1.484 + 0.650X$

The regression coefficient results in Table 7 show that technological infrastructure has a significant positive effect on service delivery ($\beta = 0.650$, $p = 0.000$). This indicates that for each one-unit increase in technological infrastructure, service delivery increases by 0.650 units.

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Since the p-value is less than 0.05, we reject the null hypothesis (H_{01}), confirming there is a statistically significant effect of technological infrastructure on service delivery among Huduma Centres in Nairobi Metropolitan Area, Kenya. This shows that technological infrastructure is a key driver of service delivery performance, highlighting its role in improving the speed, efficiency, and quality of services delivered in the Huduma Centres.

4.6 Qualitative Data Analysis

The qualitative analysis of open-ended responses from both employees and customers provides comprehensive insights into the lived experiences of digital transformation at Huduma Centres. The analysis revealed significant infrastructure challenges that affected both employee efficiency and customer satisfaction. Employees identified system reliability as their most persistent challenge, with frequent reports of system downtimes, network failures, and slow internet connectivity disrupting service provision. These technical issues were particularly problematic during peak service periods when customer demand was highest. Staff highlighted inadequate Wi-Fi coverage, overloaded ICT systems, and insufficient technical support as major barriers to optimal service delivery. Equipment failures, including slow servers, unreliable backup systems, and compatibility issues across different devices and platforms, created workflow disruptions that affected both staff productivity and customer experience.

Customers experienced these infrastructure challenges directly, though their responses suggested greater tolerance for temporary technical issues than might be expected. While customers noted occasional system failures, slow internet connections, and equipment malfunctions, they generally viewed these as temporary setbacks rather than fundamental flaws in the digital approach. Customer responses indicated that when systems functioned properly, the benefits significantly outweighed occasional technical difficulties. However, customers did express frustration with system downtimes during critical service moments and noted that technical issues sometimes forced them to seek manual assistance, defeating the efficiency gains that digital systems were designed to provide.

The infrastructure challenges highlighted the critical importance of comprehensive digital ecosystem planning and investment. Both employees and customers emphasized that partial digitization often created more problems than solutions, with incompatible systems and inadequate integration causing confusion and inefficiency. The responses revealed that successful digital transformation required not just individual technology implementations but coordinated infrastructure development that ensured seamless connectivity, adequate bandwidth, and robust backup systems. The analysis also showed that infrastructure reliability directly impacted user confidence and adoption rates, with repeated technical failures creating lasting skepticism about digital services even among initially enthusiastic users.

5.0 Conclusion

The study concludes that technological infrastructure demonstrates significant impact on service delivery effectiveness among all digital transformation practices examined. The regression analysis results show that technological infrastructure has a significant positive effect on service delivery ($\beta = 0.650$, $p = 0.000$), explaining 44.7% of the variance in service delivery outcomes. This finding aligns with the Technology-Organization-Environment Framework's technological dimension and supports previous research by Agyepong et al. (2019) and Musyoka et al. (2023), who found similar positive relationships between ICT infrastructure and service outcomes. The strong correlation between technological infrastructure and service delivery confirms that investments in digital infrastructure yield

measurable improvements in accessibility, timeliness and user satisfaction. However, reliability challenges persist across different centres, requiring ongoing attention to system stability and maintenance to ensure sustained performance.

6.0 Recommendations

The study recommends that Huduma Centres should focus on strengthening the technological infrastructure by ensuring that digital systems are regularly updated, adequately maintained and supported by reliable internet connectivity and backup protocols to prevent service disruptions. Network reliability and hardware upgrades should be made on a strategic basis based on their direct impact on accessibility, timeliness and user satisfaction. The ICT Authority of Kenya should enforce uniform standards of digital infrastructure across all Huduma Centres and set up centralised performance monitoring systems that will allow for immediate intervention when system failures occur. Concurrently, the Communications authority should arrange contractual agreements on service levels with telecommunication providers to ensure a minimum level of bandwidth services with special focus on underserved peri-urban areas such as Kajiado where connectivity gaps continue to be a major factor in hindering equitable service delivery. Emerging technologies like 5G and satellite internet should be explored in order to close ongoing disparities in connectivity across the Nairobi Metropolitan Area.

The study further recommends that the Ministry of Information, Communication and Digital Economy come up with a detailed digital transformation roadmap that explicitly aligns the Kenya Digital Masterplan 2022-2032 with operational infrastructure requirements of individual Huduma Centres, including timelines, resource allocation scenarios and accountability frameworks. A dedicated Digital Transformation Fund to support centres with the most acute infrastructure challenges in order to ensure delivery of policy commitment to real and sustained improvements to services at facility level. The National Treasury should give priority to multi-year funding for infrastructure development and allow for public-private partnerships that would increase technological capacity while maintaining public oversight. County governments within the Nairobi Metropolitan Area should create special digital transformation units to ensure that they are aligned with national digital policies at the local level, manage the integration of infrastructure and champion peer learning networks to encourage collaborative problem-solving and knowledge sharing across all Huduma Centres.

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