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STRATEGIC TECHNOLOGICAL INNOVATIONS AND OPERATIONAL PERFORMANCE OF TELEVISION BROADCASTING COMPANIES IN KENYA

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ABSTRACT

This study examined the relationship between strategic technological innovations and operational performance of television broadcasting companies in Kenya and assessed the moderating role of the regulatory environment. Specifically, the study focused on digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations. Diffusion of Innovations Theory anchored the study, supported by the Resource-Based View, Two-Sided Market Theory and Institutional Theory. A positivist philosophy and descriptive cross-sectional explanatory design were adopted. A census targeted 100 respondents across 13 television stations in Kenya. Primary data were collected using a structured questionnaire, with 95 usable responses obtained, representing a 95% response rate. Data were analysed using descriptive statistics, Pearson correlation, simple linear regression and hierarchical moderated regression in SPSS version 29. Diagnostic tests confirmed that the required regression assumptions were satisfied. Digital broadcasting platforms positively and significantly predicted operational performance ($B = 0.545$, $p < 0.001$), accounting for 28.1% of the variation. Intelligent data-driven technologies were also a significant positive predictor ($B = 0.485$, $p < 0.001$), explaining 20.2% of the variation, while digital advertising innovations significantly predicted operational performance ($B = 0.347$, $p < 0.001$), explaining 12.1%. The interaction between strategic technological innovations and the regulatory environment was positive and statistically significant ($B = 0.427$, $p = 0.005$), contributing an additional 4.4% to the explained variation. The findings indicate that strategic technological innovations are positively associated with operational performance and that the regulatory environment moderates this relationship. The study recommends integrating digital distribution channels, strengthening data governance and security, enhancing staff analytical capabilities and expanding cross-platform advertising. Regulators should maintain clear, predictable and consistently enforced requirements that support responsible technological innovation.

Key Words: *Digital Broadcasting, Intelligent Data-Driven Technologies, Digital Advertising Innovations*

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INTRODUCTION

Kenya's television broadcasting industry is experiencing technological transformation as audience behaviour shifts toward mobile and online content consumption. Traditional broadcasting faces growing relevance and financial challenges from digital disruption (Cetin, 2025). African broadcasters also experience operational pressure from global platforms, declining advertising revenues and costly analogue workflows (Wete-Wabo & Kihara, 2023). In Kenya, intense competition, audience fragmentation and continuing digital disruption have further complicated industry operations, requiring broadcasters to adapt technologies and strategies to remain relevant, competitive and financially sustainable.

Digital broadcasting platforms are central to Kenya's technological transformation because they provide new opportunities for content distribution, audience engagement and revenue diversification. Evidence shows that moving from analogue to digital channels improves operational flexibility, signal quality and market reach (Lee, 2021). Kenya's digital migration programme enabled broadcasters to expand delivery through digital terrestrial transmission and internet-based platforms, changing how audiences access free-to-air and subscription television services (CAK, 2022). These platforms have therefore become important for improving accessibility and broadcasting competitiveness.

Television broadcasters are adopting data-driven technologies to improve production and audience engagement. Artificial intelligence and machine learning support recommendation, editing and predictive analytics (Arakkal & Menon, 2024). They can improve speed and reduce errors and strengthen decisions, although adoption remains uneven from skills shortages and limited funding (Iordache, 2024). Kenya's digital economy blueprint prioritizes cloud computing, enabling virtualized production and cloud content management (Kotlinska, 2024). Cloud infrastructure can reduce costs, improve reliability and support platform delivery (Andersen et al., 2021).

Digital advertising innovations are reshaping revenue generation within Kenya's broadcasting industry. Studies identify targeted advertising, programmatic buying and cross-platform integration as developments transforming audience monetization (Wete-Wabo & Kihara, 2023). Advertisers prefer measurable, data-driven and interactive channels, creating pressure on broadcasters to move beyond television advertising models. Adopting digital advertising technologies can therefore strengthen sustainability and competitiveness by helping broadcasters respond to changing market expectations and competition (Andersen et al., 2021). These approaches support audience targeting, revenue planning and financial resilience.

Overall, technological innovations are interconnected drivers of operational transformation in Kenya's television broadcasting industry. Digital broadcasting platforms increase reach and accessibility, intelligent data-driven technologies strengthen efficiency and decision-making, while digital advertising innovations support revenue diversification and sustainability. However, their contribution to operational performance may depend on the regulatory environment governing technology adoption, compliance and implementation. Examining these technologies collectively is therefore important for understanding operational outcomes, particularly how regulatory frameworks may moderate their effects within Kenya's competitive television broadcasting industry.

Strategic technological innovations refer to the deliberate adoption and application of technologies to support organisational priorities and improve operational performance. Unlike routine technology adoption, the strategic dimension focuses on aligning technological resources with organisational goals and operational processes. Küng (2020) observed that technological change in media organisations increasingly requires alignment between digital capabilities and organisational strategy. Picard (2021) similarly argued that media organisations gain greater value when digital investments support efficiency, audience reach and competitiveness. In this study, the construct was examined through digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations, representing key technological areas for improving operational performance.

In recent empirical scholarship, the regulatory environment is increasingly treated as a moderating force that shapes how the strategic technological innovation translates into organizational performance. As a moderator, regulation influences the strength and direction of technology–performance relationships by setting legal boundaries, compliance expectations, and enforcement practices that guide organizational behavior (Singh & Hess, 2021). Studies show that regulatory clarity and stability can enhance performance outcomes by reducing uncertainty, supporting standardization, and legitimizing innovation, thereby allowing firms to deploy digital technologies more effectively (Blind, 2021; Rana et al., 2022). Where regulations are coherent and supportive, organizations are more likely to realize improvements in efficiency, reliability and responsiveness from technology investments. In contrast, restrictive or ambiguous regulatory requirements often weaken these effects by increasing compliance costs and limiting managerial discretion in technology use (Singh & Hess, 2021).

Operational performance is conceptualized as an organization's ability to efficiently and reliably transform inputs into services or outputs while maintaining quality, continuity, and stakeholder responsiveness. Contemporary literature views it as a multidimensional construct encompassing efficiency, reliability, speed, adaptability, and outcome consistency, particularly in technology-intensive sectors such as media and broadcasting (Ketokivi & Mahoney, 2020; Hitt et al., 2021). In service industries, it reflects uninterrupted delivery, risk management, and alignment with changing customer expectations and market conditions (Dubey et al., 2020).

Kenya's television broadcasting industry has transformed from a state-controlled sector into a competitive landscape comprising public, private, and community broadcasters. Liberalization in the 1990s enabled private stations to enter the market and diversify content offerings (Muriungi & Sakwa, 2022). The industry supports information dissemination, education, entertainment, and democratic engagement. It operates under Communications Authority of Kenya oversight for licensing, spectrum allocation, and broadcasting standards. The landscape includes free-to-air stations, pay-TV providers, and FM radio stations, reflecting urban concentration and regional outreach (Nyabuga & Booker, 2020; Muriungi & Sakwa, 2022).

Statement of the Problem

Kenya's broadcasting industry is undergoing technological transformation, yet operational performance remains strained. Despite digital migration and multi-platform content delivery, broadcasters experience production delays, unreliable signal transmission and declining audience engagement (Ndonye & Wanyama, 2023). Attempts to integrate artificial intelligence into newsroom and production processes have been constrained by limited technical capacity and infrastructure, reducing expected operational benefits (Muya, 2024). Studies across African media systems similarly show that digital tools are often adopted without alignment to operational needs, limiting improvements in workflow efficiency and output quality (Ogada et al., 2022).

The industry shows disparities in technological readiness and integration, widening performance differences among broadcasters. Leading media houses have invested in cloud-based editing, automated production and audience analytics, while mid-sized and regional broadcasters still rely on analogue or fragmented digital systems (Ndonye & Wanyama, 2023). Uneven adoption contributes to differences in production speed, content quality and distribution reliability (Odera, 2024). Research shows poorly structured digitalisation can create inefficiencies, inconsistent workflows and weak technology returns (Amutete, 2020). Limited operational audits also mean technology investments may lack evidence of measurable outcomes, creating misalignment between technological tools and operational goals (Muya, 2024).

Conceptually, existing research often treats broadcasting digital transformation broadly, without distinguishing digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations, limiting understanding of their individual effects on operational performance (Amutete, 2020; Ogada et al., 2022). Methodologically, studies frequently rely on descriptive or qualitative approaches, with

limited inferential analysis of relationships between technology adoption and operational outcomes (Ndonye & Wanyama, 2023; Odera, 2024). Regulatory influences are also rarely tested empirically as moderating or mediating variables (Muya, 2024). Kenyan studies largely focus on migration, audience behaviour and compliance, leaving limited evidence connecting strategic technology adoption with efficiency, reliability, revenue and responsiveness. This justifies an integrated model examining emerging technologies, regulatory environment and operational performance.

Purpose of the Study

The purpose of this study was to analyse the effect of strategic technological innovations on operational performance of television broadcasting companies in Kenya.

Objectives of the Study

- To examine the effect of digital broadcasting platforms on the operational performance of television broadcasting companies in Kenya.
- To assess the effect of intelligent data-driven technologies on the operational performance of television broadcasting companies in Kenya.
- To evaluate the effect of digital advertising innovations on the operational performance of television broadcasting companies in Kenya.
- To evaluate the moderating effect of regulatory environment on the relationship between strategic technological innovation and operational television performance of broadcasting companies in Kenya.

Research Hypotheses

- H_{01}: There is no statistically significant effect of digital broadcasting platforms on the operational performance of television broadcasting companies in Kenya.
- H_{02}: There is no statistically significant effect of intelligent data-driven technologies on the operational performance of television broadcasting companies in Kenya.
- H_{03}: There is no statistically significant effect of digital advertising innovations on the operational performance of television broadcasting companies in Kenya.
- H_{04}: There is no statistically significant moderating effect of regulatory environment on the relationship between strategic technological innovation and operational performance of television broadcasting companies in Kenya.

LITERATURE REVIEW

Theoretical review

Diffusion of Innovations Theory

Everett Rogers introduced the Diffusion of Innovations Theory in 1962 and refined it through later publications, including the fifth edition in 2003. The theory explains innovation adoption as a gradual process within a social system. Individuals progress through five stages: gaining knowledge, forming attitudes, deciding to adopt, implementing the innovation and confirming the decision. Rogers (2003) argued that adoption depends on perceived relative advantage, compatibility, complexity, trialability and observability. These assumptions are relevant because digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations require managers to assess benefits, risks and workflow compatibility before adoption. The theory therefore supports Objectives 1, 2, and 3, examining how technological innovations influence operational performance in Kenyan broadcasting companies.

Recent empirical studies demonstrate the continued relevance of Diffusion of Innovations in digital and platform-based industries. Zhai, Ding and Zhang (2021) applied the theory to digital media platforms and found that perceived relative advantage and observability significantly predicted organizational uptake. Similarly, Polisetty, Sowmya, and Pahari (2023) used the theory to examine digital technology

implementation in media firms, showing that trialability and compatibility reduced resistance and accelerated integration. However, the theory has been criticized for underemphasizing institutional pressures and regulatory constraints, assuming linear adoption processes and overlooking power asymmetries (Al-Razgan et al., 2021). Critics also argue that adopter categories can oversimplify organizational differences, concerns relevant to regulated broadcasting industries.

Resource-Based View Theory

The Resource-Based View (RBV) originated from Wernerfelt (1984) and was developed by Barney (1991) to explain performance differences among firms in the same industry. Rather than focusing only on external conditions, RBV emphasizes firm-specific resources and capabilities. Barney (1991) argued that sustainable competitive advantage arises when resources are valuable, rare, difficult to imitate and supported by the organization, forming the VRIO framework. In this study, RBV supports Objective 2 by explaining how intelligent data-driven technologies influence operational performance. Analytics systems, automation, artificial intelligence and proprietary data can become strategic resources when integrated into scheduling, content management and advertising workflows that competitors cannot easily replicate.

Recent empirical research confirms RBV's relevance in digital environments. Mikalef et al. (2020) found that analytics capabilities improve operational performance when embedded in organizational processes and supported by managerial expertise. Similarly, Ferraris et al. (2022) showed that firms strategically orchestrating data-driven capabilities achieve greater responsiveness and efficiency than those adopting similar technologies without effective integration. These findings reinforce RBV's assumption that performance gains depend less on technology ownership than on how resources are structured and leveraged. In broadcasting, this explains why firms using similar digital tools may differ in transmission reliability, content optimization and advertising yield.

Two-Sided Market Theory

Two-Sided Market Theory was developed by Rochet and Tirole (2003) to explain how platforms create value by facilitating interactions between two interdependent user groups. The theory emphasizes indirect network effects, where growth on one side increases value for the other. In broadcasting, these sides are audiences and advertisers. Larger or targeted audiences attract advertisers, while advertising revenue supports content production and audience retention. The theory supports Objective 3, examining digital advertising innovations and operational performance. Programmatic advertising, audience segmentation, automated ad placement and cross-platform campaign management strengthen coordination between these market sides.

Recent studies demonstrate the theory's relevance in digital media markets. Hagiu and Wright (2020) show that platforms managing cross-side network effects strategically achieve greater efficiency and value creation than those treating each side independently. Similarly, Li, Xie, and Zhang (2021) found that data-driven advertising systems improve performance by reducing transaction costs and enhancing matching between advertisers and audiences. These findings suggest advertising technologies reshape platform dynamics beyond revenue generation. In broadcasting, digital advertising innovations integrate analytics, pricing algorithms and inventory management into workflows, influencing operational efficiency, campaign turnaround time and resource allocation.

Institutional Theory

Institutional Theory originates from Meyer and Rowan (1977) and was developed by DiMaggio and Powell (1983). It assumes organizations operate within social and regulatory systems creating coercive, normative and mimetic pressures. Coercive pressures arise from laws and regulations, normative pressures from professional standards, and mimetic pressures from imitation under uncertainty. Organizations respond to these pressures to gain legitimacy and stability. In this study, Institutional Theory supports examination of regulatory environment as a moderating variable, explaining how regulatory structures influence broadcasting firms' adoption and operationalization of emerging technologies.

Recent research applies Institutional Theory in regulated and technology-intensive industries. Brammer, Branicki and Linnenluecke (2021) demonstrate that institutional pressures shape strategic responses in regulated sectors. Similarly, Zhang and Yang (2022) show that firms under strong regulatory oversight adapt technological and operational practices to maintain legitimacy and compliance. These studies reinforce that regulation not only constrains firms but also shapes organizational routines and strategic choices. In broadcasting, licensing, content standards, spectrum use and digital compliance represent institutional forces influencing how technologies are implemented and integrated into operations.

Empirical Review

Lotz (2020) conducted a large-scale study of television broadcasters in the United States and Western Europe examining how multi-platform distribution influenced operational performance during the shift from linear broadcasting to digital platforms. Using mixed methods combining firm-level surveys and operational indicators, the study found that integrated digital platforms improved content reuse efficiency and scheduling flexibility. However, smaller broadcasters struggled because of limited technical capacity and skills shortages. While the comparative design provided useful insights, reliance on self-reported performance measures raised response bias concerns, supporting the need for objective and standardized operational indicators.

Mikalef et al. (2020) conducted a firm-level study across European media and service organizations examining Big Data Analytics Capability (BDAC) and operational performance. Using senior-manager survey data and structural equation modeling (SEM), the study found that BDAC improved operational efficiency, decision speed and process coordination. Analytics-driven insights reduced uncertainty and supported resource allocation. However, treating media firms within the broader service sector limited broadcasting-specific conclusions. Perceptual performance measures also raised common method bias concerns, indicating the need for sector-specific studies using objective operational indicators.

Busch et al. (2020) examined Programmatic Advertising (PA) using transaction-level data from European digital advertising markets. Econometric analysis showed that PA reduced transaction time and administrative workload, enabling faster campaign execution and better inventory utilization. The authors found that automation improved advertising placement speed and accuracy. However, the study focused mainly on digital advertising intermediaries rather than broadcasters, limiting its ability to explain how programmatic systems influence internal operational coordination within broadcasting organizations.

Larasati (2024) examines how broadcasting regulations tied to DVB-T2 standards influence measurable service quality outcomes. Using field measurements of signal strength, bit error rate and modulation error ratio across transmission points, the study finds alignment between regulatory thresholds and actual signal performance. Its use of objective engineering indicators demonstrates that technical regulation has operational implications for broadcasters. However, the study remains technically focused and excludes firm-level decisions, investments and financial outcomes. It also does not test whether regulation conditions relationships between technology adoption and broader operational indicators such as cost efficiency or revenue stability, leaving organizational-level moderation unexplored.

Conceptual Framework

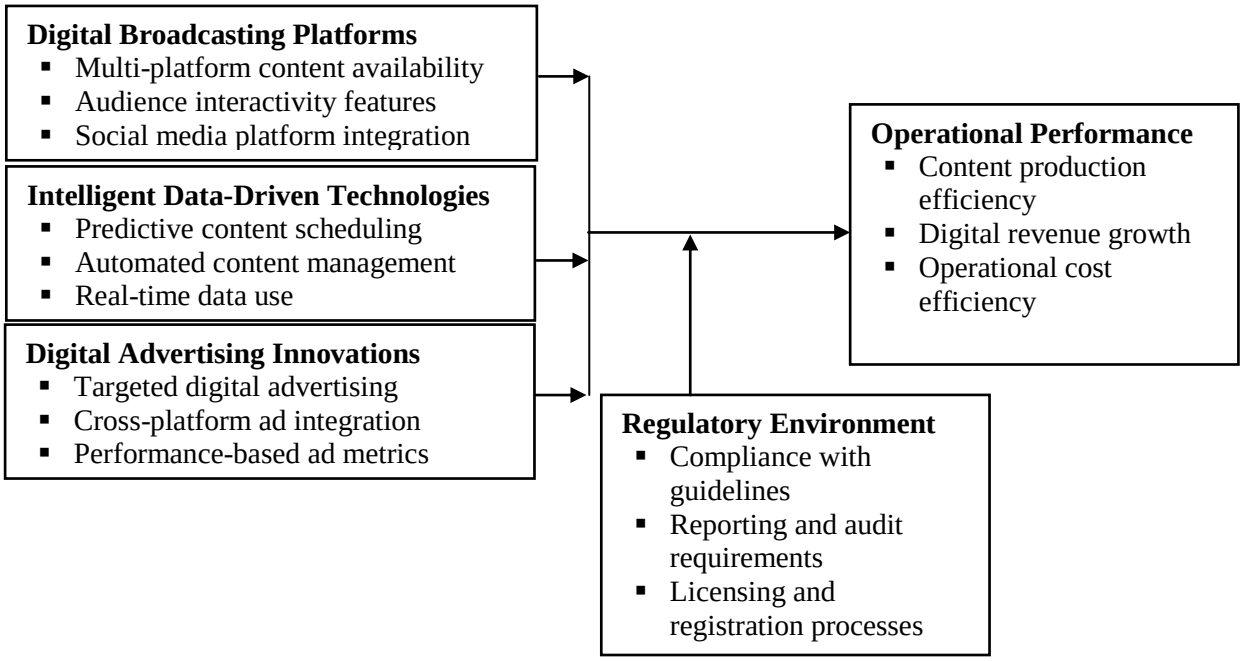


Figure 1: Conceptual framework

METHODOLOGY

The study adopted a positivist research philosophy based on the view that phenomena existed independently of the researcher and could be objectively measured. This supported empirical evidence and statistical procedures to examine relationships among study variables. The study adopted a descriptive cross-sectional explanatory research design. Data were collected from the target population at a single point to examine relationships between strategic technological innovations and operational performance of television broadcasting companies in Kenya. The study population comprised television broadcasting stations representing widely viewed national and local-language channels in Kenya. The study covered 13 stations, categorized into six national broadcasters with nationwide coverage and programming for broad audiences, and seven local-language stations primarily serving regional audiences. The study used a structured questionnaire as the primary data collection instrument. The study relied exclusively on primary data to examine the influence of strategic technological innovations on operational performance of television broadcasting companies in Kenya. Primary data were appropriate because the study measured current organizational practices, technology use and performance outcomes directly from respondents rather than historical records. Data were collected through a structured procedure designed to promote consistency and reliability. Following research proposal approval, ethical clearance was obtained from the Daystar University Institutional Scientific and Ethics Review Committee. Three simple linear regression models were used to test the first three null hypotheses:

Model 1: $Y = \beta_0 + \beta_1 X_1 + \varepsilon$
Model 2: $Y = \beta_0 + \beta_2 X_2 + \varepsilon$
Model 3: $Y = \beta_0 + \beta_3 X_3 + \varepsilon$

Where:
Y = Operational Performance
X_1 = Digital Broadcasting Platforms
X_2 = Intelligent Data-Driven Technologies

X_3 = Digital Advertising Innovations
β_0 = Constant
β_1, β_2, β_3 = Regression coefficients
ε = Error term

The moderating effect of the regulatory environment was tested using the three-step approach by Baron and Kenny (1986). A composite technological innovation index (TI) was first be computed.
Step 1: $Y = \beta_0 + \beta_1 TI + \varepsilon$
Step 2: $Y = \beta_0 + \beta_1 TI + \beta_2 M + \beta_3 (TI \, xM) + \varepsilon$

Where M represents the regulatory environment. Moderation was established if the interaction term β_3 was statistically significant. Variables were mean-centered prior to creating the interaction term.

FINDINGS

Descriptive Analysis

This section presents the descriptive findings on digital broadcasting platforms, intelligent data-driven technologies, digital advertising innovations, the regulatory environment and operational performance. Means and standard deviations were used to summarize respondents' views and determine the general response patterns for each study variable.

Digital Broadcasting Platforms

Table 1 presents the descriptive findings on the use of digital broadcasting platforms among television broadcasting companies in Kenya. The statements assessed content distribution, transmission reliability, audience access, social media integration, streaming and mobile platforms, and the contribution of platform integration to operational efficiency. All 95 respondents provided complete responses, as shown by the valid listwise count.

Table 1: Digital Broadcasting Platforms

Statement	N	Mean	Std. Deviation
Our organization distributes content across multiple digital platforms.	95	3.2105	1.20190
Digital broadcasting systems support reliable content transmission.	95	3.2947	1.28720
Audiences can easily access our content through digital platforms.	95	3.2421	1.25237
Social media platforms are integrated into our broadcasting activities.	95	3.6316	1.28868
Streaming and mobile platforms complement traditional broadcasting.	95	3.4737	1.16548
Digital platform integration has improved operational efficiency.	95	3.3895	1.17866
Aggregate Mean and Standard Deviation		3.3737	1.22905

Source: Researcher (2026)

Social media integration received the strongest assessment, with a mean of 3.6316, falling within the agreement range and showing that social media had become part of broadcasting activities in many companies. However, responses were widely spread, reflected by the standard deviation of 1.28868. This suggests social media integration was more established in some companies. Respondents also agreed that streaming and mobile platforms complemented traditional broadcasting, recording a mean of 3.4737. The lower standard deviation of 1.16548 indicated greater consistency, although differences persisted.

Digital platform integration to operational efficiency recorded a mean of 3.3895, slightly below the agreement range. Respondents were largely undecided whether platform integration had generated clear efficiency gains. The standard deviation of 1.17866 indicates gains were not experienced uniformly. A similar pattern emerged for reliable content transmission, which recorded a mean of 3.2947 and standard deviation of 1.28720. While some respondents benefited from dependable digital systems, others may have continued experiencing transmission difficulties.

Ease of audience access through digital platforms recorded a mean of 3.2421, while content distribution across multiple platforms received the lowest mean of 3.2105. Both scores fell within the neutral range, suggesting that digital access and multi-platform distribution had not been fully achieved across companies. Their standard deviations of 1.25237 and 1.20190 reveal differences in experiences. Some broadcasters may have developed broader digital reach, whereas others continued operating with limited platform coverage.

The combined mean of approximately 3.374 indicates a moderate level of digital broadcasting platform adoption. Although social media, streaming and mobile platforms were visible in broadcasting operations, their contribution to reliable transmission, audience access and operational efficiency was less firmly established. Standard deviations ranging from 1.16548 to 1.28868 confirm that digital capabilities varied across companies. These differences provide a basis for determining whether digital platform adoption influenced operational performance.

Intelligent Data-Driven Technologies

Table 2 presents the descriptive findings on the adoption of intelligent data-driven technologies among television broadcasting companies in Kenya. The statements examined the use of audience analytics, data-informed content scheduling, automated content management, real-time operational data, artificial intelligence and data security systems. All 95 respondents answered the statements, indicating that there were no missing observations.

Table 2: Intelligent Data-Driven Technologies

Statements	N	Mean	Std. Deviation
Audience analytics are used to support programming decisions.	95	3.2000	1.16327
Data insights guide content scheduling in our organization.	95	3.1474	1.23743
Automated systems improve efficiency in content management.	95	3.2000	1.27663
Real-time data supports operational decision-making.	95	3.2526	1.18473
Artificial intelligence tools assist in content optimization.	95	3.3053	1.24690
Data security systems effectively protect operational information.	95	2.9158	1.16385
Aggregate Mean and Standard Deviation		3.1702	1.21214

Source: Researcher (2026)

Artificial intelligence tools for content optimization received the highest mean score of 3.3053. Although higher than other items, it remained within the neutral range, indicating uncertainty about their use across organizations. The standard deviation of 1.24690 shows considerable differences in experiences, suggesting that artificial intelligence applications were more developed in some broadcasting companies. Real-time data use in operational decision-making followed with a mean of 3.2526 and standard deviation of 1.18473. This indicates moderate and varied use of real-time information across the companies and operational units.

Audience analytics and automated content-management systems each attained a mean of 3.2000. Respondents were therefore neither clearly in agreement nor disagreement that these technologies supported programming decisions and content-management efficiency within the selected broadcasting companies. Audience analytics had a standard deviation of 1.16327, while automated content management recorded 1.27663. The wider spread suggests greater differences in automated system application across companies. Data insights in content scheduling recorded a mean of 3.1474 and standard deviation of 1.23743, indicating uncertainty and uneven reliance on data when scheduling content and allocating programming resources.

Data security systems received the lowest mean of 2.9158. Although within the neutral range, this indicates weaker confidence in existing systems' ability to protect operational information. The standard deviation of 1.16385 shows varied experiences of data security. This finding is important because audience analytics, artificial intelligence and real-time data applications depend on secure collection, processing and storage of information required for daily broadcasting operations.

The combined mean of approximately 3.170 indicates moderate adoption of intelligent data-driven technologies. None of the item means reached the agreement range, suggesting these technologies were not firmly embedded across television broadcasting companies. Standard deviations ranging from 1.16327 to 1.27663 further show differences in adoption and use. These differences provided a basis for examining whether intelligent data-driven technologies influenced operational performance.

Digital Advertising Innovations

Table 3 presents the descriptive findings on digital advertising innovations among television broadcasting companies in Kenya. The statements assessed audience-based advertising, programmatic advertisement placement, cross-platform campaign coordination, use of digital performance metrics, advertising efficiency and revenue growth. All 95 respondents completed the statements, confirming that the analysis was based on the full set of usable questionnaires.

Table 3: Digital Advertising Innovations

Statements	N	Mean	Std. Deviation
Digital advertising is customized for specific audience segments.	95	2.9684	1.28372
Programmatic systems are used in advertisement placement.	95	3.1684	1.20859
Advertising campaigns are coordinated across multiple platforms.	95	2.9053	1.20349
Digital metrics are used to evaluate advertising performance.	95	3.2105	1.14757
Digital advertising tools improve advertising efficiency.	95	3.0632	1.12808
Digital advertising innovations contribute to revenue growth.	95	3.3579	1.35203
Aggregate Mean and Standard Deviation		3.1123	1.22058

Source: Researcher (2026)

Digital advertising innovations' contribution to revenue growth received the highest mean score of 3.3579. Although near the agreement threshold of 3.41, it remained neutral. Respondents were therefore not fully convinced that digital advertising generated consistent revenue growth. The standard deviation of 1.35203, highest in the table, reveals substantial differences in experiences. Some broadcasters realized financial benefits, while others achieved limited returns.

Digital metrics to evaluate advertising performance followed with a mean of 3.2105. Its standard deviation of 1.14757 shows differing views, though responses were more closely distributed. Programmatic advertisement placement recorded a mean of 3.1684 and standard deviation of 1.20859. Both means fell within neutral range, indicating that digital performance measurement and automated placement were used moderately rather than firmly established across broadcasting companies.

Respondents were undecided about whether digital advertising tools improved advertising efficiency, reflected by a mean of 3.0632. The standard deviation of 1.12808 was the lowest among the six items, showing consistency. Advertisement customization for specific audience segments attained a mean of 2.9684 and standard deviation of 1.28372. This wider spread indicates that audience-targeting capabilities differed among broadcasters. Coordination of advertising campaigns across multiple platforms received the lowest mean of 2.9053. This suggests uncertainty about whether advertising activities were effectively coordinated across television, websites, social media and streaming platforms. Its standard deviation of 1.20349 confirms that cross-platform coordination differed across firms. Low assessments of audience customization and campaign coordination indicate areas where digital advertising practices remained weak.

The combined mean of approximately 3.112 placed digital advertising innovations within neutral range, indicating an emerging but uneven level of adoption. Standard deviations ranging from 1.12808 to 1.35203 show that application and perceived benefits varied across television broadcasting companies. Digital advertising offered revenue and efficiency opportunities, but programmatic placement, audience segmentation and cross-platform coordination were not consistently adopted. These findings provided a useful basis for examining whether digital advertising use influenced performance.

Regulatory Environment

Table 4 presents descriptive findings on Kenya's television broadcasting regulatory environment. The statements assessed regulatory communication, compliance requirements, monitoring, licensing predictability, enforcement consistency and regulatory contribution to operational stability. All 95 respondents completed the statements, confirming full coverage of usable responses.

Table 4: Regulatory Environment

Statements	N	Mean	Std. Deviation
Broadcasting regulations are clearly communicated to industry players.	95	3.2526	1.22012
Compliance requirements for broadcasters are well defined.	95	2.9895	1.17142
Regulatory authorities regularly monitor compliance.	95	3.1474	1.22881
Licensing procedures are structured and predictable.	95	3.1263	1.17819
Broadcasting standards are consistently enforced across the industry.	95	3.1579	1.29085
The regulatory environment supports stability in broadcasting operations.	95	3.2632	1.28171
Aggregate Mean and Standard Deviation		3.1562	1.22852

Source: Researcher (2026)

The regulatory environment's contribution to stability in broadcasting operations received the highest mean score of 3.2632. Although within the neutral range, this suggests that respondents acknowledged some regulatory contribution to operational stability without expressing firm agreement. The standard deviation of 1.28171 reveals variation, indicating that regulatory stability was more evident in some broadcasting companies than others. Clear communication of broadcasting regulations followed with a mean of 3.2526 and standard deviation of 1.22012. Respondents were similarly undecided about regulatory communication, suggesting that access to regulatory information was not uniform across the industry.

Consistent enforcement of broadcasting standards recorded a mean of 3.1579. The standard deviation of 1.29085, the highest among the six items, points to marked differences in how broadcasters experienced enforcement. Some respondents may have encountered consistent application of standards, while others experienced less predictable enforcement. Regular compliance monitoring by regulatory authorities attained a mean of 3.1474 and standard deviation of 1.22881. These results reflected uncertainty and varied exposure to regulatory monitoring across companies.

Licensing procedures received a mean of 3.1263, indicating that respondents neither agreed nor disagreed that procedures were structured and predictable. Its standard deviation of 1.17819 shows differing licensing experiences, although responses were less dispersed than those concerning enforcement and monitoring. Definition of compliance requirements attracted the lowest mean of 2.9895. This indicates uncertainty about whether broadcasters clearly understood their obligations. The standard deviation of 1.17142, the lowest in the table, indicates greater consistency in this uncertainty.

The combined mean of approximately 3.156 placed the regulatory environment within the neutral range. Respondents therefore did not firmly agree that regulations were communicated, compliance requirements well defined, licensing predictable or standards consistently enforced. Standard deviations ranging from 1.17142 to 1.29085 show varied regulatory experiences across television broadcasting companies. The findings portray a regulatory system offering some direction and stability but not experienced consistently across the industry.

The regulatory environment was examined as a moderator of the relationship between strategic technological innovations and operational performance. Clear requirements, predictable licensing procedures and consistent enforcement could give broadcasters greater confidence when investing in digital platforms, artificial intelligence, audience analytics and digital advertising systems. Descriptive results did not establish whether

moderation occurred, but provided a foundation for inferential analysis of whether regulation changed the strength of the relationship between strategic technological innovation and operational performance.

Operational Performance

Table 5 presents the descriptive findings on the operational performance of television broadcasting companies in Kenya. The statements assessed content production efficiency, adherence to broadcast schedules, audience reach, audience engagement, operational cost efficiency and revenue performance. All 95 respondents completed the statements, confirming that the analysis was based on the entire set of usable questionnaires.

Table 5: Operational Performance

Statements	N	Mean	Std. Deviation
Content production processes are completed efficiently.	95	3.4737	1.21902
Broadcast schedules are consistently achieved on time.	95	3.3684	1.18549
Audience reach has improved through digital operations.	95	3.4105	1.18047
Digital platforms have strengthened audience engagement.	95	3.1789	1.22890
Technology adoption has improved operational cost efficiency.	95	3.5053	1.31985
Digital innovations have contributed to improved revenue performance.	95	3.3789	1.35410
Aggregate Mean and Standard Deviation		3.3860	1.24797

Source: Researcher (2026)

Technology adoption and operational cost efficiency received the highest mean score of 3.5053, within the agreement range. Respondents believed technology helped their organizations manage operating costs efficiently across the selected broadcasting companies in Kenya. The standard deviation of 1.31985 reveals variation, indicating that cost-efficiency gains were more evident in some broadcasting companies than others, possibly reflecting differences in investment and automation.

Efficient completion of content production processes followed with a mean of 3.4737, also within the agreement range. Respondents viewed production processes as efficient. The standard deviation of 1.21902 shows variation across companies. Audience reach through digital operations attained a mean of 3.4105, narrowly within the agreement range. Its standard deviation of 1.18047, the lowest in the table, suggests consistency about digital operations' contribution to audience reach.

The contribution of digital innovations to revenue performance recorded a mean of 3.3789. Despite approaching the agreement threshold, the score remained neutral. Respondents were therefore not convinced that digital innovations consistently improved revenue performance. The standard deviation of 1.35410 was the highest among the six items, revealing differences in financial outcomes across broadcasting companies. Some broadcasters may have developed effective digital revenue streams, while others had not obtained comparable returns.

Timely achievement of broadcast schedules received a mean of 3.3684, within the neutral range. The standard deviation of 1.18549 shows varied experiences, although assessments were more consistent than revenue and cost efficiency. This result suggests that timely scheduling had not been achieved uniformly across participating companies.

Audience engagement through digital platforms attracted the lowest mean of 3.1789. Respondents were uncertain whether digital platforms strengthened audience interaction. The standard deviation of 1.22890 indicates that engagement levels differed across companies. Some broadcasters may have used digital platforms to encourage participation, while others gained less engagement from their digital presence.

The combined mean of approximately 3.386 placed operational performance near the upper neutral boundary. Respondents recognized improvements in production efficiency, cost management and audience reach, but were less certain about engagement, schedule consistency and revenue performance. Standard deviations

ranging from 1.18047 to 1.35410 show that outcomes varied across companies. As the dependent variable, these differences provided a basis for examining whether digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations explained performance variation. Descriptive results did not establish these effects; correlation and regression analyses were subsequently used to assess them.

Correlation Analysis

Table 6 presents the Pearson correlation coefficients used to examine the direction and strength of the relationships between the independent variables, the moderating variable and operational performance. The analysis was based on 95 usable responses and applied a two-tailed significance level of 0.05. For interpretation, coefficients of approximately 0.10 were considered weak, those around 0.30 moderate and those approaching or exceeding 0.50 strong.

Table 6: Pearson Correlation Matrix

		(X_1)	(X_2)	(X_3)	(M)	(Y)
Digital Broadcasting Platforms (X_1)	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	95				
Intelligent Data Driven Technologies (X_2)	Pearson Correlation	.161	1			
	Sig. (2-tailed)	.120				
	N	95	95			
Digital Advertising Innovations (X_3)	Pearson Correlation	.256*	.175	1		
	Sig. (2-tailed)	.012	.090			
	N	95	95	95		
Regulatory Environment (M)	Pearson Correlation	.205*	.267**	.120	1	
	Sig. (2-tailed)	.047	.009	.245		
	N	95	95	95	95	
Operational Performance (Y)	Pearson Correlation	.530**	.450**	.348**	.406**	1
	Sig. (2-tailed)	.000	.000	.001	.000	
	N	95	95	95	95	95

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Source: Researcher (2026)

Digital Broadcasting Platforms had the strongest relationship with operational performance, recording a positive correlation of $r = 0.530$ with $p < 0.001$. This indicates a strong positive relationship, suggesting that companies with more developed digital platforms tended to report better operational performance. The coefficient represents approximately 28.1% shared variation. Distributing content through streaming services, mobile applications, websites and social media may improve accessibility, audience reach and broadcasting efficiency. These platforms may also complement traditional broadcasting by enabling faster content distribution and responsiveness to changing audience consumption patterns. Digital broadcasting platforms therefore appear important to operational performance among television broadcasting companies in Kenya.

Intelligent Data-Driven Technologies recorded a positive and statistically significant correlation with operational performance of $r = 0.450$, $p < 0.001$. This represents a moderate positive relationship and approximately 20.3% shared variation. Organizations using audience analytics, automated content management, real-time operational data and artificial intelligence tools tended to report higher operational performance. Timely data can support programming decisions, content scheduling and resource allocation, while automation may reduce repetitive work and improve content management speed. The finding therefore supports the view that data-driven technologies enhance decision-making, operational efficiency and audience responsiveness within television broadcasting companies.

Digital Advertising Innovations were positively and significantly related to operational performance, with r = 0.348 and p = 0.001. The relationship was moderate but weaker than those for digital broadcasting platforms and intelligent data-driven technologies. The coefficient indicates approximately 12.1% shared variation. Companies using audience segmentation, programmatic advertisement placement, digital performance metrics and coordinated campaigns tended to report better operational outcomes. These technologies can improve advertisement targeting, reduce inefficient placement and provide measurable campaign information. The weaker relationship may reflect differences in adoption of advanced advertising practices. This is consistent with descriptive findings showing cautious assessments of customized advertising and cross-platform campaign coordination. Nevertheless, the significant positive relationship indicates that digital advertising innovations remain relevant to advertising efficiency and revenue performance.

The Regulatory Environment had a positive and statistically significant relationship with operational performance, with r = 0.406 and p < 0.001. This moderate relationship represents approximately 16.5% shared variation. The finding suggests that companies operating under clearly communicated regulations, defined compliance requirements, predictable licensing procedures and consistent enforcement tend to experience better operational performance. Regulatory clarity may support investment planning, resource allocation and technology adoption. A stable regulatory environment may also reduce interruptions arising from licensing disputes, penalties or unclear industry requirements.

Although the regulatory environment was designated as the moderating variable, its significant correlation with operational performance only establishes a direct bivariate association. It does not demonstrate that regulation changes the strength or direction of the relationship between strategic technological innovations and operational performance. Moderation must therefore be established through regression analysis by examining the interaction term between technological innovations and regulatory environment. A significant interaction coefficient would indicate that technology-related performance benefits vary according to regulatory conditions.

Relationships among predictor variables were comparatively low, with coefficients ranging from 0.120 to 0.267. The highest was between Intelligent Data-Driven Technologies and Regulatory Environment at r = 0.267, while several relationships were not statistically significant. This indicates that the variables captured distinct features of broadcasting operations rather than the same organizational practice. It also agrees with multicollinearity results in Table 16, where tolerance and VIF values remained within recommended thresholds. The technological innovation variables and regulatory environment could therefore be included in regression models without excessive overlap.

The findings provide preliminary evidence that strategic technological innovations are positively associated with operational performance among television broadcasting companies in Kenya. Digital Broadcasting Platforms showed the strongest association, followed by Intelligent Data-Driven Technologies and Digital Advertising Innovations. Regulatory Environment also showed a positive relationship with operational performance. These findings suggest that performance is associated with technological capabilities and regulatory conditions. However, Pearson correlation does not establish causality or isolate individual contributions. Multiple regression and moderation analyses are therefore required to determine individual effects and whether regulatory environment significantly moderates these relationships.

Regression Analysis

Regression analysis was conducted to determine the influence of digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations on the operational performance of television broadcasting companies in Kenya. The analysis also examined whether the regulatory environment moderated the relationship between strategic technological innovations and operational performance. The findings are presented using the model summary, analysis of variance and regression coefficients.

Effect of Digital Broadcasting Platforms on the Operational Performance of Television Broadcasting Companies in Kenya.

Table 7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.530[a]	.281	.274	.73988

a. Predictors: (Constant), Digital Broadcasting Platforms

Source: Researcher (2026)

Table 7 presents the regression model summary for the relationship between digital broadcasting platforms and operational performance of television broadcasting companies in Kenya. The model recorded an R value of 0.530, indicating a moderately strong relationship. The R Square value of 0.281 shows that digital broadcasting platforms explained 28.1% of variation in operational performance, while 71.9% was associated with other factors and random variation. The adjusted R Square of 0.274 indicates that approximately 27.4% of variation was explained after accounting for sample size and predictors. The small difference between R Square and adjusted R Square suggests stable explanatory power. The standard error of the estimate was 0.73988, representing the average difference between observed and predicted scores. These findings indicate that content distribution through digital channels, social media integration, and streaming and mobile platforms were meaningfully associated with operational performance among television broadcasting companies in Kenya.

Table 8: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.935	1	19.935	36.417	.000[b]
	Residual	50.910	93	.547		
	Total	70.846	94			

a. Dependent Variable: Operational Performance
b. Predictors: (Constant), Digital Broadcasting Platforms

Source: Researcher (2026)

Table 8 presents the analysis of variance results determining whether the regression model linking digital broadcasting platforms to operational performance was statistically significant. The model recorded an F-value of 36.417 with 1 and 93 degrees of freedom and a significance value below 0.001. Since this was below the 0.05 threshold, the model was statistically significant, indicating that digital broadcasting platforms significantly predicted operational performance. The regression sum of squares was 19.935, compared with residual and total sums of squares of 50.910 and 70.846, respectively, confirming meaningful explained variation. The findings therefore indicate that adoption and integration of digital broadcasting platforms were significantly associated with operational performance. Consequently, the null hypothesis that digital broadcasting platforms have no statistically significant influence on operational performance was rejected.

Table 9: Coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.547	.314		4.926	.000
	Digital Broadcasting Platforms	.545	.090	.530	6.035	.000

a. Dependent Variable: Operational Performance

Source: Researcher (2026)

Table 9 presents regression coefficients for the influence of digital broadcasting platforms on operational performance. The unstandardized coefficient was positive and statistically significant (B = 0.545, t = 6.035, p

< 0.001), indicating that adoption of digital broadcasting platforms significantly enhanced operational performance. Consequently, the first null hypothesis was rejected. The constant of 1.547 represents predicted operational performance when the platform score is zero, although this has limited practical meaning because zero falls outside the measurement scale. The findings indicate that content distribution through multiple digital channels, social media integration, and streaming and mobile platforms are positively associated with operational efficiency, audience reach and service delivery. Since $p < 0.05$, the null hypothesis that digital broadcasting platforms have no statistically significant influence on operational performance was rejected.

Effect of Intelligent Data-Driven Technologies on the Operational Performance of Television Broadcasting Companies In Kenya.

Table 10: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.450[a]	.202	.194	.77947

a. Predictors: (Constant), Intelligent Data Driven Technologies

Source: Researcher (2026)

Table 10 presents the regression model summary for the relationship between intelligent data-driven technologies and operational performance of television broadcasting companies in Kenya. The model recorded an R value of 0.450, indicating a moderate relationship. The R Square value of 0.202 shows that intelligent data-driven technologies explained 20.2% of variation in operational performance, while 79.8% was associated with other factors and random variation. The adjusted R Square of 0.194 indicates that the predictor explained approximately 19.4% after adjustment for sample size and predictors. The small difference suggests stable explanatory power. The standard error of the estimate was 0.77947, representing the average difference between observed and predicted performance scores. These findings suggest that audience analytics, automated content management, real-time operational data and artificial intelligence tools are meaningfully associated with operational performance, subject to confirmation through the corresponding ANOVA results.

Table 11: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.342	1	14.342	23.605	.000[b]
	Residual	56.504	93	.608		
	Total	70.846	94			

a. Dependent Variable: Operational Performance

b. Predictors: (Constant), Intelligent Data Driven Technologies

Source: Researcher (2026)

Table 11 reports the analysis of variance results for the regression model examining intelligent data-driven technologies and operational performance. The model recorded an F-value of 23.605 at 1 and 93 degrees of freedom, with $p < 0.001$. Since this was below 0.05, the model was statistically significant, confirming that intelligent data-driven technologies meaningfully predicted operational performance. The regression sum of squares was 14.342, compared with a residual sum of squares of 56.504 and total sum of squares of 70.846. The findings indicate that audience analytics, automated content management, real-time operational data and artificial intelligence applications were significantly associated with operational performance. Therefore, the null hypothesis that intelligent data-driven technologies have no statistically significant influence on operational performance was rejected.

Table 12: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.848	.326		5.661	.000
	Intelligent Data Driven Technologies	.485	.100	.450	4.858	.000

a. Dependent Variable: Operational Performance

Source: Researcher (2026)

Table 12 presents regression coefficients for the influence of intelligent data-driven technologies on operational performance of television broadcasting companies in Kenya. The unstandardized coefficient was positive and statistically significant (B = 0.485, t = 4.858, p < 0.001), indicating that adoption of intelligent data-driven technologies significantly enhanced operational performance. Consequently, the second null hypothesis was rejected. The constant of 1.848 represents predicted operational performance when intelligent data-driven technologies are zero, although its practical interpretation is limited because zero falls outside the measurement scale. The findings suggest that audience analytics, automated systems, real-time data and artificial intelligence tools support informed programming decisions, efficient content management and improved operational outcomes. Since p < 0.05, the null hypothesis that intelligent data-driven technologies have no statistically significant influence on operational performance was rejected.

Effect of Digital Advertising Innovations on the Operational Performance of Television Broadcasting Companies In Kenya

Table 13: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.348[a]	.121	.111	.81832

a. Predictors: (Constant), Digital Advertising Innovations

Source: Researcher (2026)

Table 13 presents the regression model summary for the relationship between digital advertising innovations and operational performance of television broadcasting companies in Kenya. The model recorded an R value of 0.348, indicating a moderate relationship. The R Square value of 0.121 shows that digital advertising innovations explained 12.1% of the variation in operational performance, while 87.9% was attributable to other factors and random variation. The adjusted R Square of 0.111 indicates that the model explained 11.1% of variation after accounting for sample size and predictors. The small difference between R Square and adjusted R Square suggests explanatory power. The standard error of 0.81832 represents the average difference between observed and predicted scores. Overall, the findings indicate that audience-targeted advertising, programmatic placement, cross-platform campaign coordination and digital performance metrics may contribute to operational performance, although significance requires confirmation through ANOVA results.

Table 14: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.569	1	8.569	12.796	.001[b]
	Residual	62.277	93	.670		
	Total	70.846	94			

a. Dependent Variable: Operational Performance
b. Predictors: (Constant), Digital Advertising Innovations

Source: Researcher (2026)

Table 14 presents the analysis of variance results assessing whether the regression model linking digital advertising innovations to operational performance was statistically significant. The model recorded an F-

value of 12.796 with 1 and 93 degrees of freedom and a significance value of 0.001. Since this value was below the 0.05 threshold, the regression model was statistically significant, indicating that digital advertising innovations significantly predicted operational performance. The regression sum of squares was 8.569, while the residual sum of squares was 62.277, out of a total of 70.846.

Thus, although the model explained a meaningful proportion of performance variation, most variation remained attributable to factors outside the model. Nevertheless, audience-targeted advertising, programmatic placement, cross-platform coordination and digital metrics significantly influenced operational performance. Therefore, the null hypothesis that digital advertising innovations have no statistically significant influence on operational performance was rejected, confirming the stated relationship.

Table 15: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	2.306	.313		7.357	.000
	Digital Advertising Innovations	.347	.097	.348	3.577	.001

a. Dependent Variable: Operational Performance

Source: Researcher (2026)

Table 15 presents coefficients for the influence of digital advertising innovations on operational performance among television broadcasting companies in Kenya. The unstandardized coefficient was positive and significant ($B = 0.347$, $t = 3.577$, $p < 0.001$), indicating that digital advertising innovations enhanced operational performance. Consequently, the third null hypothesis was rejected. The constant of 2.306 represents the predicted operational performance score when digital advertising innovations are held at zero, although its interpretation is limited because zero falls outside the study's measurement scale. The use of customized advertising, programmatic placement, coordinated campaigns and digital performance metrics positively influence efficiency, revenue generation and operational performance. Since the significance value was below 0.05, the null hypothesis was rejected, confirming the influence of digital advertising innovations.

Moderating Effect of Regulatory Environment

This section examines whether the regulatory environment moderates the relationship between strategic technological innovations and operational performance of television broadcasting companies in Kenya. Strategic technological innovations were measured using a composite index comprising digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations. Hierarchical moderated regression was conducted by entering strategic technological innovations first, regulatory environment second, and their interaction term last. A statistically significant interaction term would indicate that the relationship between strategic technological innovations and operational performance varies depending on the prevailing regulatory environment.

Table 16: Model Summary for the Joint Moderation Effect

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.647	.419[a]	.413	.66540	.419	67.017	1	93	<.001
2	.687	.472[b]	.460	.63788	.053	9.195	1	92	.003
3	.718	.516[c]	.500	.61378	.044	8.368	1	91	.005

a. Predictors: (Constant), Strategic Technological Innovations (centred)

b. Predictors: (Constant), Strategic Technological Innovations (centred), Regulatory Environment (centred)

c. Predictors: (Constant), Strategic Technological Innovations (centred), Regulatory Environment (centred), Technological Innovations × Regulatory Environment

d. Dependent Variable: Operational Performance

Table 16 presents the hierarchical regression model examining whether the regulatory environment moderates the relationship between strategic technological innovations and operational performance. Model 1 recorded R = 0.647 and explained 41.9% of variation, with $p < 0.001$, confirming statistical significance. Adding the centred regulatory environment in Model 2 increased R Square from 0.419 to 0.472, an additional 5.3%, which was statistically significant (F Change = 9.195, p = 0.003). Thus, the regulatory environment contributed meaningfully to operational performance beyond strategic technological innovations in Kenya.

In Model 3, adding the interaction term increased R Square from 0.472 to 0.516, explaining an additional 4.4%, with the change statistically significant (F Change = 8.368, p = 0.005). The final model explained 51.6% of variation, while adjusted R Square of 0.500 indicated substantial explanatory power after accounting for predictors and sample size. The standard error declined from 0.66540 in Model 1 to 0.61378 in Model 3, indicating improved predictive accuracy. These findings show that the relationship between strategic technological innovations and operational performance varied significantly according to the regulatory environment. Therefore, the null hypothesis was rejected, confirming significant moderation for television broadcasting companies in Kenya, while the direction of moderation was established from the interaction coefficient presented in the coefficients table and interpreted accordingly.

Table 17: ANOVA for the Joint Moderation Effect

Model	Source	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.672	1	29.672	67.017	.000[b]
	Residual	41.176	93	.443		
	Total	70.848	94			
2	Regression	33.413	2	16.707	41.059	.000[c]
	Residual	37.435	92	.407		
	Total	70.848	94			
3	Regression	36.566	3	12.189	32.354	.000[d]
	Residual	34.282	91	.377		
	Total	70.848	94			

a. Dependent Variable: Operational Performance

b. Predictors: (Constant), Strategic Technological Innovations (centred)

c. Predictors: (Constant), Strategic Technological Innovations (centred), Regulatory Environment (centred)

d. Predictors: (Constant), Strategic Technological Innovations (centred), Regulatory Environment (centred), Technological Innovations × Regulatory Environment

Source: Researcher (2026)

Table 17 presents the analysis of variance results for the hierarchical regression models examining the joint moderating effect of the regulatory environment. Model 1, containing centred Strategic Technological Innovations, was statistically significant, $F(1, 93) = 67.017$, $p < 0.001$, indicating that technological innovations significantly predicted operational performance. Model 2, after adding the centred Regulatory Environment, remained significant, $F(2, 92) = 41.059$, $p < 0.001$, demonstrating that both variables jointly improved prediction of operational performance. The final model, incorporating Strategic Technological Innovations, Regulatory Environment and their interaction term, was also significant, $F(3, 91) = 32.354$, $p < 0.001$. The regression sum of squares increased from 29.672 in Model 1 to 36.566 in Model 3, while residual sum of squares declined from 41.176 to 34.282.

The reduction in unexplained variation indicates improved model performance after adding the regulatory environment and interaction term. Although ANOVA confirms that the final model was statistically significant, moderation specifically depends on the significant R Square change and interaction coefficient. Considered alongside Table 28, the results support the conclusion that the regulatory environment

significantly moderates the relationship between strategic technological innovations and operational performance among television broadcasting companies in Kenya and strengthens the model's explanatory predictive power overall.

Table 18: Coefficients for the Joint Moderation Effect

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.386	.068		49.598	.000
	Strategic Technological Innovations (centred)	.980	.120	.647	8.186	.000
2	(Constant)	3.386	.065		51.737	.000
	Strategic Technological Innovations (centred)	.876	.120	.578	7.314	.000
	Regulatory Environment (centred)	.263	.087	.240	3.032	.003
3	(Constant)	3.331	.066		50.654	.000
	Strategic Technological Innovations (centred)	.905	.116	.598	7.825	.000
	Regulatory Environment (centred)	.251	.084	.229	3.006	.003
	Technological Innovations × Regulatory Environment	.427	.148	.212	2.893	.005

Dependent variable: Operational Performance.

Source: Researcher (2026)

Table 18 presents the regression coefficients for the joint moderating effect of the regulatory environment on the relationship between strategic technological innovations and operational performance. In Model 1, Strategic Technological Innovations had a positive and statistically significant coefficient ($B = 0.980$, $\beta = 0.647$, $t = 8.186$, $p < 0.001$), indicating that technological innovation significantly predicted operational performance before regulation was introduced. In Model 2, Strategic Technological Innovations remained significant ($B = 0.876$, $\beta = 0.578$, $t = 7.314$, $p < 0.001$), while the Regulatory Environment also contributed positively and significantly ($B = 0.263$, $\beta = 0.240$, $t = 3.032$, $p = 0.003$).

In the final model, Strategic Technological Innovations remained positive and significant ($B = 0.905$, $\beta = 0.598$, $t = 7.825$, $p < 0.001$). The Regulatory Environment was also significant ($B = 0.251$, $\beta = 0.229$, $t = 3.006$, $p = 0.003$). Most importantly, the interaction term was positive and statistically significant ($B = 0.427$, $\beta = 0.212$, $t = 2.893$, $p = 0.005$), indicating that a supportive regulatory environment strengthened the relationship between strategic technological innovations and operational performance. Thus, clearer regulations, predictable licensing, consistent enforcement and stable compliance requirements enhanced the performance benefits of technological innovation.

The constant of 3.331 represents predicted operational performance when both centred variables were zero, corresponding to their respective mean levels. The final regression equation was $Y = 3.331 + 0.905X + 0.251M + 0.427XM$, where Y represents Operational Performance, X represents centred Strategic Technological Innovations, M represents the centred Regulatory Environment and XM represents their interaction. Since the interaction was significant at the 0.05 level, the null hypothesis that the Regulatory Environment does not significantly moderate the relationship between Strategic Technological Innovations and Operational Performance was rejected. This finding confirms that regulatory conditions are not merely contextual factors but shape how effectively technological investments translate into operational

improvements, providing empirical support for the study's proposed moderating relationship among Kenyan broadcasters.

Table 20: Summary of Hypothesis Testing

Hypothesis	Test Results	Decision	Conclusion
H_{01}: There is no statistically significant effect of digital broadcasting platforms on the operational performance of television broadcasting companies in Kenya.	B = .545, β = .530, t = 6.035, p < .001	Reject H_{01}	Digital broadcasting platforms had a positive and statistically significant effect on operational performance.
H_{02}: There is no statistically significant effect of intelligent data-driven technologies on the operational performance of television broadcasting companies in Kenya.	B = .485, β = .450, t = 4.858, p < .001	Reject H_{02}	Intelligent data-driven technologies had a positive and statistically significant effect on operational performance.
H_{03}: There is no statistically significant effect of digital advertising innovations on the operational performance of television broadcasting companies in Kenya.	B = .347, β = .348, t = 3.577, p = .001	Reject H_{03}	Digital advertising innovations had a positive and statistically significant effect on operational performance.
H_{04}: There is no statistically significant moderating effect of regulatory environment on the relationship between strategic technological innovation and operational performance of television broadcasting companies in Kenya.	Interaction: B = .427, β = .212, t = 2.893, p = .005; ΔR^2 = .044, F Change = 8.368	Reject H_{04}	The regulatory environment had a positive and statistically significant moderating effect on the relationship between strategic technological innovations and operational performance.

Source: Researcher (2026)

Table 20 summarises decisions after testing the four null hypotheses at the 0.05 significance level. The first null hypothesis was rejected because digital broadcasting platforms significantly affected operational performance (B = 0.545, β = 0.530, t = 6.035, p < 0.001). The second was rejected following the effect of intelligent data-driven technologies (B = 0.485, β = 0.450, t = 4.858, p < 0.001). Similarly, digital advertising innovations significantly influenced operational performance (B = 0.347, β = 0.348, t = 3.577, p = 0.001), leading to rejection of the third null hypothesis. Digital broadcasting platforms recorded the strongest standardized coefficient, followed by intelligent data-driven technologies and digital advertising innovations. The fourth null hypothesis was rejected because the interaction between strategic technological innovations and the regulatory environment was positive and significant (B = 0.427, β = 0.212, t = 2.893, p = 0.005).

Discussion of Findings

Effect of Digital Broadcasting Platforms on the Operational Performance of Television Broadcasting Companies in Kenya

The study found that digital broadcasting platforms had a statistically significant effect on operational performance. The correlation coefficient of 0.530 indicated a strong relationship, while the regression model showed that platforms explained 28.1% of performance variation. The positive coefficient (B = 0.545, β = 0.530, p < 0.001) indicated that greater adoption and integration improved performance. The first null hypothesis was rejected. Among the three dimensions, digital broadcasting platforms recorded the strongest standardized coefficient.

The descriptive findings explain this relationship. Social media integration received the highest assessment, followed by streaming and mobile platforms complementing traditional broadcasting. These capabilities allow broadcasters to extend content beyond scheduled transmission, reach audiences through several channels and

maintain interaction after programmes. Digital platforms can improve content reuse, audience accessibility and coordination between production and distribution. These benefits are reflected through wider audience reach, efficient content delivery and more effective use of broadcasting resources.

The finding supports Lotz (2020), who found that integrated digital platforms improved content reuse and scheduling flexibility among broadcasters in the United States and Europe. It also agrees with Trappel and Tomaz (2021), who found that digital transmission systems reduced service interruptions and maintenance costs. Helmond et al. (2021) showed that social media integration increased audience reach and reduced promotion costs. Wohn and Freeman (2020) established that interactive features improved scheduling accuracy and responsiveness.

The result differs partly from Mare (2020), who found that digital platforms expanded audience access in African broadcasting companies but produced limited operational gains because of high implementation costs and inadequate technical capacity. The present study demonstrates that digital broadcasting platforms contribute meaningfully overall to television broadcasting performance in Kenya. However, unexplained performance variation indicates that digital platforms cannot improve operations independently of technical skills, reliable infrastructure, adequate financing and effective managerial integration.

The finding supports Diffusion of Innovations Theory, particularly its proposition that adoption is influenced by relative advantage, compatibility and observability. Broadcasters are more likely to embed digital platforms when benefits are visible through improved audience access, content transmission and workflow efficiency. The coefficient suggests that digital platforms have moved beyond experimental adoption and are becoming part of broadcasting operations. Their contribution nevertheless depends on effective alignment with production systems, employee capabilities and audience requirements.

Effect of Intelligent Data-Driven Technologies on the Operational Performance of Television Broadcasting Companies in Kenya

Intelligent data-driven technologies had a positive effect on operational performance. The correlation coefficient of 0.450 showed a moderate relationship, while regression results indicated that these technologies explained 20.2% of variation in operational performance. The positive coefficient ($B = 0.485$, $\beta = 0.450$, $p < 0.001$) led to rejection of the second null hypothesis. Television broadcasting companies using analytics, automation, real-time artificial intelligence tended to report better operational outcomes overall.

Descriptive results showed moderate use of data-driven technologies. Artificial intelligence tools for content optimization received the highest mean, while data security systems received the lowest assessment. This suggests that broadcasters are applying technologies to programming and content management, but data governance and security capabilities remain less developed. These gaps may limit reliance on data for programming and commercial decisions.

The result is consistent with Mikalef et al. (2020), who found that big data analytics capabilities improved operational efficiency, decision speed and process coordination. Ciampi et al. (2021) similarly established that data analytics enhanced operational responsiveness. The findings also support Dubey et al. (2021), who associated real-time analytics with improved agility, process integration and cost efficiency. Ferraris et al. (2022) further reported that organizations combining analytics with automation achieved higher efficiency and lower coordination costs.

The result also reflects Napoli's (2021) finding that audience analytics enable media organizations to align content output with audience demand. In television broadcasting, viewing patterns, programme preferences and engagement can guide content scheduling and resource allocation. Automated systems can reduce repetitive work, while real-time dashboards enable managers to identify technical or audience-related problems before disruptions. However, the moderate relationship suggests that data systems require managerial interpretation, skilled personnel and security arrangements before their value can be realized.

The Resource-Based View provides a useful explanation for this finding. Analytics platforms, audience information, artificial intelligence applications and automated content systems can become valuable resources when embedded in broadcasting routines. Their value does not arise merely from ownership but from combining technology with employee expertise, data governance and managerial decision-making. Broadcasting companies that build these capabilities are better positioned to translate data into efficient content production, scheduling and audience responsiveness.

Effect of Digital Advertising Innovations on the Operational Performance of Television Broadcasting Companies in Kenya

The study found that digital advertising innovations had a positive and statistically significant effect on operational performance. The correlation coefficient of 0.348 indicated a moderate positive relationship, while regression results showed that digital advertising innovations explained 12.1% of variation in operational performance. The regression coefficient was positive and significant ($B = 0.347$, $\beta = 0.348$, $p = 0.001$), leading to rejection of the third null hypothesis. The findings indicate that digital advertising systems contribute to performance, although their relationship was weaker than those of digital broadcasting platforms and intelligent data-driven technologies.

The descriptive results help explain this comparatively weaker contribution. Respondents gave the highest assessment to the contribution of digital advertising innovations to revenue growth, while cross-platform campaign coordination received the lowest assessment. Customized advertising for specific audience segments also received a cautious evaluation. This suggests that broadcasters recognize the commercial potential of digital advertising, but advanced practices such as audience segmentation, programmatic placement and cross-platform coordination have not been adopted uniformly across television broadcasting companies.

The result agrees with Busch et al. (2020), who found that programmatic advertising reduced transaction time and administrative workload while improving advertising inventory utilization. Lambrecht and Tucker (2020) similarly established that targeted advertising reduced wasted impressions and supported efficient use of advertising space. The finding also supports Li et al. (2021), who reported that platform-based advertising systems improved coordination among sales, scheduling and performance-monitoring functions. Anderl et al. (2021) further found that cross-platform advertising integration reduced duplication and improved alignment between content schedules and advertising delivery.

The positive relationship also corresponds with Wiesel et al. (2021), who found that performance-based advertising metrics strengthened pricing accuracy, campaign adjustment and inventory allocation. These practices can improve commercial efficiency by allowing television companies to monitor campaign results and respond when advertisements fail to achieve intended reach. However, successful application requires reliable audience data, analytical expertise and coordination between programming and commercial departments. The relatively small proportion of explained variation may therefore reflect incomplete integration of these supporting capabilities and differences in technological readiness.

Two-Sided Market Theory reinforces this interpretation. Television broadcasting companies connect audiences and advertisers, with value on each side depending partly on participation and engagement on the other. Digital advertising innovations strengthen this connection by matching advertisers with relevant audience segments and enabling campaign performance measurement. When broadcasters attract and understand audiences, advertising inventory becomes more valuable, supporting revenue generation and financing content production. Weak targeting or fragmented cross-platform coordination may therefore limit these network benefits.

The Moderating Effect of Regulatory Environment on The Relationship Between Strategic Technological Innovation and Operational Television Performance of Broadcasting Companies in Kenya.

The hierarchical regression results established that the regulatory environment had a positive and statistically significant moderating effect on the relationship between strategic technological innovations and operational performance. Strategic Technological Innovations initially explained 41.9% of variation in operational performance. Adding the Regulatory Environment increased explained variation to 47.2%, while introducing the interaction term raised it to 51.6%. The interaction accounted for an additional 4.4%, and this increase was statistically significant. The positive interaction coefficient ($B = 0.427$, $\beta = 0.212$, $p = 0.005$) led to rejection of the fourth null hypothesis.

Performance benefits from strategic technological innovations became stronger as the regulatory environment improved. Defined compliance requirements, predictable licensing procedures and consistent enforcement can provide broadcasters with certainty to invest in technology. Conversely, unclear rules or inconsistent enforcement may delay investment, increase compliance costs and weaken technological returns. Regulation therefore affects how technological capabilities translate into performance.

The finding is consistent with Larasati (2024), who demonstrated that compliance with technical broadcasting standards was positively associated with signal quality and operational reliability. It supports Obia (2023), who observed that regulatory changes reshape technology investment, content moderation and platform interoperability decisions. Sulistijanto et al. (2025) found that inconsistent enforcement caused scheduling disruptions, financial penalties and advertising revenue instability. The findings indicate that clear regulation can reduce disruptions and strengthen the operational value of technological investment.

The result also reflects Wu et al. (2022), whose study showed that regulatory influence depended on organizational conditions and did not operate uniformly across firms. Although their study focused on environmental regulation and green innovation, this research demonstrates that regulation conditions the relationship between technological innovation and operational performance in Kenyan television broadcasting.

Institutional Theory provides a explanation for this finding. Broadcasting companies face coercive pressures from licensing rules, content requirements and standards, alongside normative expectations concerning professional conduct and service quality. Predictable regulatory expectations can encourage organizations to standardize operations and align technologies with reporting, monitoring and content-management requirements. Regulation should therefore not be viewed as a constraint; a environment can enable innovation to generate efficiency, audience and revenue outcomes.

The moderation finding applies to the combined Strategic Technological Innovations index, comprising digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations. It demonstrates that the regulatory environment conditions their relationship with operational performance, rather than establishing separate moderation effects for each dimension. The finding provides evidence that technology investment and regulation are interconnected determinants of operational performance among television broadcasting companies in Kenya.

Summary of Key Findings

- The study found moderate adoption of digital broadcasting platforms among television broadcasting companies. Social media integration and complementary use of streaming and mobile platforms received the strongest assessments, while multi-platform content distribution was comparatively lower. Digital broadcasting platforms had the strongest relationship with operational performance, explaining 28.1% of its variation. The coefficient was positive and statistically significant ($B = 0.545$, $\beta = 0.530$, p

< 0.001). These platforms improved audience reach, content accessibility and operational efficiency. The first null hypothesis was therefore rejected.

- The findings showed moderate adoption of intelligent data-driven technologies among television broadcasting companies. Artificial intelligence tools for content optimization received the highest assessment, while data security systems received the lowest. These technologies explained 20.2% of the variation in operational performance and had a positive, statistically significant coefficient ($B = 0.485$, $\beta = 0.450$, $p < 0.001$). Audience analytics, automated content management, real-time information and artificial intelligence supported programming, resource allocation and operational responsiveness. However, weaknesses in data security and uneven analytics application limited performance gains. The second null hypothesis was therefore rejected.
- Digital advertising innovations were applied less consistently than the other technological dimensions. Respondents acknowledged their contribution to revenue growth and advertising efficiency, but customized advertising and the coordination of campaigns across multiple platforms remained comparatively weak. Digital advertising innovations explained 12.1% of the variation in operational performance and recorded a positive and statistically significant coefficient ($B = 0.347$, $\beta = 0.348$, $p = 0.001$). The findings showed that programmatic advertisement placement, audience targeting, digital performance metrics and coordinated advertising systems contributed to efficient advertising operations and revenue generation. The third null hypothesis was consequently rejected.
- The regulatory environment made a direct and moderating contribution to operational performance. Strategic technological innovations initially explained 41.9% of the variation in performance. Adding the regulatory environment increased explained variation to 47.2%, while the interaction term raised it to 51.6%. The interaction accounted for an additional 4.4% and was positive and statistically significant ($B = 0.427$, $\beta = 0.212$, $p = 0.005$). Regulatory communication, defined compliance requirements, predictable licensing procedures and consistent enforcement strengthened the relationship between strategic technological innovations and operational performance. The fourth null hypothesis was therefore rejected.

CONCLUSIONS AND RECOMMENDATIONS

The study concludes that digital broadcasting platforms have become a central operational capability for television broadcasting companies. They allow broadcasters to distribute content beyond traditional transmission channels, reach audiences through mobile and streaming services and extend programme engagement through social media. Their contribution depends on the extent to which the different platforms are integrated with production, scheduling and audience-management systems.

Digital platform adoption alone cannot guarantee improved operational performance. The benefits are greater when broadcasters maintain reliable transmission infrastructure, possess adequate technical expertise and coordinate content across platforms. Television companies that treat digital platforms as part of their core operating model are therefore better positioned to improve content accessibility; audience reach and workflow efficiency than those that use them as separate promotional channels.

The study concludes that intelligent data-driven technologies predicted operational performance by supporting faster and more informed decisions. Audience analytics can guide content scheduling, while automation reduces repetitive work and improves consistency in content management. Real-time information also enables broadcasting managers to identify technical and audience-related problems before they cause prolonged operational disruptions.

The value of these technologies depends on the quality of the supporting organizational capabilities. Weak data security, limited analytical skills and poor integration of data into managerial decisions can reduce the

benefits of artificial intelligence and analytics systems. Television broadcasting companies must therefore develop technology, employee capability and data governance together. Intelligent systems create operational value when their outputs are understood, trusted and applied in everyday decisions.

The study concludes that digital advertising innovations contribute to operational performance by improving how broadcasters identify audiences, allocate advertising inventory and evaluate campaign results. Programmatic placement and performance metrics can shorten advertising processes, reduce manual work and enable commercial teams to respond more quickly to advertiser requirements. These capabilities can strengthen revenue performance while improving coordination between programming and advertising departments.

The comparatively weaker adoption of targeted and cross-platform advertising shows that television companies have not fully realized the potential of digital advertising. Fragmented audience information and limited coordination across television, streaming, websites and social media can prevent broadcasters from presenting advertisers with an integrated offering. Digital advertising will make a stronger operational contribution when it is linked to dependable audience data, coordinated campaign management and transparent performance measurement.

The study concludes that the regulatory environment shapes the extent to which strategic technological innovations predicted operational performance. Regulation is not merely a compliance burden imposed on television broadcasting companies. When regulatory requirements are clear, predictable and consistently enforced, they provide the certainty needed for technology investment, infrastructure planning and long-term operational decisions.

A supportive regulatory environment strengthens the gains obtained from digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations. Unclear licensing conditions, inconsistent enforcement and frequent regulatory changes can produce the opposite effect by increasing costs and delaying implementation. Technological innovation and regulation should therefore be treated as interconnected elements of broadcasting performance rather than as separate managerial and policy concerns.

Television broadcasting companies should adopt integrated technological investment strategies linking digital broadcasting platforms, intelligent data-driven technologies and digital advertising systems with core operations. Management should strengthen content distribution across streaming services, mobile applications, websites and social media while investing in reliable transmission systems and skilled technical personnel. Broadcasters should also improve data security, establish access controls and train programming, technical and commercial staff in audience analytics, automation and responsible artificial intelligence use.

Companies should address underutilized digital advertising innovations by developing audience-segmentation capabilities, expanding programmatic advertisement placement and coordinating campaigns across television and online channels. Technology projects should incorporate compliance reviews during planning so that licensing, content, data protection and reporting requirements are addressed before implementation. These measures can help broadcasters realise greater operational value from technology while reducing implementation delays, security risks, fragmented investments and regulatory challenges, while strengthening coordination across departments and technology partners for sustainable implementation outcomes.

The Communications Authority of Kenya and the Ministry responsible for information and digital technologies should establish a clear, predictable regulatory environment that supports responsible technological innovation in broadcasting. Since regulatory clarity strengthens the performance benefits of technological adoption, regulators should communicate licensing conditions, technical standards, digital content requirements, data obligations and advertising rules clearly, while providing reasonable implementation timelines for regulatory changes. Regulations should be developed through consultation with

national, local-language, public and commercial broadcasters to reflect differences in financial and technical capacity.

Regulators should apply requirements consistently, publish transparent licensing and renewal procedures and provide formal channels for timely clarification. Regulatory sandboxes could enable broadcasters to test emerging artificial intelligence, streaming and advertising technologies under controlled conditions before permanent rules are introduced. These measures would protect public interests while providing broadcasting companies with sufficient certainty to plan, finance and implement technological investments effectively.

Academic researchers should examine technological innovation in broadcasting as distinct but related capabilities rather than a single broad construct. The findings showed that digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations make different contributions to operational performance. Future studies should therefore develop models and measurement instruments that preserve these distinctions while examining their complementarities. Researchers should also combine questionnaire data with objective indicators such as system reliability, content-production time, audience engagement, digital revenue and operating costs. Since the regulatory environment moderated the combined relationship, future studies should test whether its influence differs across individual technological dimensions. This would generate more precise evidence for broadcasting management, policy development and theory building.

Suggestions for Areas for Further Research

- Future studies should examine strategic technological innovations in radio stations, online-only media organizations, streaming companies and other creative industries to determine whether the findings apply beyond television broadcasting companies.
- Comparative studies should be conducted in other East African countries to establish how differences in broadcasting regulation, digital infrastructure and market development influence the relationship between technological innovations and operational performance.
- Longitudinal research should follow broadcasting companies over several years to determine how operational performance changes before, during and after the implementation of major technological investments.
- Future researchers should combine perception-based questionnaire data with objective indicators such as system downtime, production turnaround time, audience growth, digital advertising revenue and operating costs to strengthen the measurement of operational performance.
- Further studies should test the moderating effect of the regulatory environment separately for digital broadcasting platforms, intelligent data-driven technologies and digital advertising innovations rather than relying only on a combined technological innovation index.
- Future research should examine organizational readiness, cybersecurity capability, leadership support, financial capacity and employee digital competence as possible mediating or moderating variables in the relationship between strategic technological innovations and operational performance.

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