



CONSTRUCTION DASHBOARDS, DIGITAL BLUEPRINTS AND IMPLEMENTATION OF CONSTRUCTION PROJECTS IN KENYA: A CASE STUDY OF BUILDING CONSTRUCTION COMPANIES IN MOMBASA

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ABSTRACT :

The construction industry in Kenya is increasingly adopting digital tools to improve project coordination, communication, and overall efficiency. This study investigated the effect of e-communication tools on implementation of construction in the implementation of construction projects, focusing on firms located in Mombasa County. Specifically, the research examined the influence of Construction Dashboards and Digital Blueprints on implementation of construction indicators such as task efficiency, responsiveness, collaboration, and accountability. The study adopted a descriptive research design and collected quantitative data using structured questionnaires administered to a sample of 57 respondents from construction firms. Data were analyzed using both descriptive and inferential statistical methods, including multiple linear regression analysis. The findings revealed that Electronic Document Management Systems had the greatest influence ($B = 0.282, p = 0.000$). The model showed strong explanatory power, with an R-squared value of 0.814, indicating that 81.4% of the variance in implementation of construction could be attributed to the combined effect of the e-communication tools. The study concludes that the adoption of digital communication platforms significantly enhances implementation of construction by improving project monitoring, document management, collaboration, and decision-making processes. It recommends that construction firms invest in digital infrastructure and training to maximize the benefits of these tools. Additionally, policymakers such as the National Construction Authority (NCA) are urged to develop guidelines and incentives that support widespread adoption of e-communication technologies in the sector. The study acknowledges limitations such as geographical scope and the exclusion of emerging technologies like Building Information Modeling and mobile applications, and it proposes future research to expand the scope and methodology, including longitudinal and qualitative approaches.

Key words: Building Construction, Construction Dashboards, Construction Projects, Digital Blueprints.

1.0 Introduction and Background of the study

In order to improve the efficacy and efficiency of construction project implementation in Kenya, electronic communication (e-communication) technology integration has become essential. Real-time information sharing, coordination, and decision-making among stakeholders are made easier by digital tools including email, instant messaging apps, video conferencing, and project management software. In Nairobi City County, for example, a research by Mugo (2023) showed that the adoption of contemporary IT software guarantees prompt and clear interpretation of information, which enhances team collaboration and boosts trust and synergy in construction projects. In a similar vein, Kibet (2023) discovered that the Kenya Rural Roads Authority in Elgeyo Marakwet County depends on efficient communication techniques, such as the use of suitable channels and prompt information distribution, to successfully carry out infrastructure projects.

The integration of electronic communication (e-communication) technologies in construction project implementation has garnered significant attention across various countries. The adoption of e-communication technologies in Kenya's construction sector faces challenges such as inadequate ICT infrastructure, limited technical skills among personnel, and resistance to change. The adoption of information management technology in construction projects is greatly influenced by organizational culture, with collaborative and control-based cultures being more favorable to technology adoption, according to Njuguna et al. (2024). Optimizing the execution of building projects nationwide requires addressing these issues through focused training, infrastructure investment in information and communication technology, and cultivating a culture that welcomes technological innovation.

In Saudi Arabia, Alqahtani et al. (2022) explored the adoption of Integrated Project Delivery (IPD), which includes digital collaboration platforms designed to enhance communication among project stakeholders. Their findings showed that while Integrated Project Delivery improved stakeholder

synergy and reduced delays, its success heavily depended on stakeholder willingness to adopt digital tools and adapt to integrated systems. Another study by Ahmad et al. (2023) emphasized the importance of qualified project managers and effective project communication in achieving successful project outcomes. However, both studies tended to generalize e-communication under the broader umbrella of project management without isolating the specific digital tools (instant messaging, video conferencing, mobile apps) that drive project performance. There is limited empirical focus on the direct impact of specific e-communication technologies on day-to-day project implementation activities in Saudi Arabia. This Kenyan-based study will disaggregate e-communication into its practical components (such as mobile messaging, video conferencing, and document-sharing platforms) and examine how each specifically influences implementation phases like planning, execution, and monitoring.

London's construction industry has been at the forefront of integrating digital solutions, particularly through Building Information Modeling (BIM). According to Oti and Tizazu (2022), Building Information Modeling has become a central platform for real-time communication, design integration, and collaborative decision-making. Their study highlighted the significant advantages Building Information Modeling brings in reducing misunderstandings and accelerating timelines by providing a single source of truth. However, while Building Information Modeling has revolutionized communication around design and documentation, the study largely ignored how Building Information Modeling interacts with or complements other forms of communication such as instant messaging, email, and video conferencing tools during project execution. There is an overemphasis on Building Information Modeling as a standalone communication solution, with minimal investigation into the synergistic role of other e-communication tools in the broader project ecosystem. The present study will evaluate how different e-communication tools-including but not limited to BIM-interact and contribute to successful implementation in building projects, particularly in resource-constrained environments like Mombasa.

Germany has made considerable advancements in digitalizing its construction processes. Studies such as that by Müller and Schober (2021) highlight the role of advanced digital platforms and mobile-based communication apps in streamlining construction workflows. The study found that digital tools enhanced productivity and coordination across geographically dispersed teams. However, it also noted that human-related issues, such as lack of technical skills and resistance to digital adoption, hindered the full realization of the benefits of e-communication. Moreover, the study did not explore how organizational culture or staff digital literacy levels influence the success of these tools. There is a lack of analysis on how human and cultural factors mediate the relationship between e-communication and project success. By examining factors such as digital literacy, training levels, and organizational readiness in Kenya's construction industry, this study will provide a more holistic understanding of the enablers and barriers to effective e-communication during project implementation.

In Ghana, the implementation of e-communication in construction projects has been explored, highlighting both advancements and challenges. Kwofie et al. (2019), while digital tools have improved information dissemination, issues such as inconsistent communication channels and lack of standardized protocols persist. The study emphasizes the need for a more structured approach to e-communication to enhance project outcomes. The research primarily focuses on Public-Private Partnership projects, leaving a gap in understanding e-communication dynamics in other types of construction projects. This study will broaden the scope by investigating e-communication practices across various construction project types in Kenya, providing a more comprehensive understanding of its implementation and effectiveness.

South Africa's construction sector has seen a gradual adoption of e-communication tools. Motaung and Sifolo (2023) discussed the benefits and barriers of digital procurement, highlighting that while digital tools have streamlined procurement processes, challenges such as limited digital literacy and resistance to change hinder full adoption. The study suggests that targeted training and change management strategies are essential for successful implementation. The study focuses on procurement processes, with limited exploration of e-communication's role in other aspects of construction project implementation. This research will examine the broader application of e-communication tools beyond procurement, including project planning, execution, and monitoring, to provide a holistic view of their impact on construction projects in Kenya.

Burundi's construction industry faces significant challenges in adopting e-communication technologies. The country's low Information Communication Technology development index and limited internet penetration hinder the effective implementation of digital tools in construction projects (Burundi ratifies East African Community protocol on Information Communication Technology, 2025). Efforts such as the Burundi Backbone System aim to improve Information Communication Technology infrastructure, but progress remains slow. There is a lack of empirical studies analyzing the effectiveness of e-communication tools in Burundi's construction projects. While this study focuses on Kenya, it will provide comparative insights by analyzing how similar infrastructural challenges are addressed, offering potential strategies that could be applicable to Burundi's context.

In Kenya, the adoption of e-communication tools in construction projects has been more pronounced. Gichohi (2023) examined project communication and performance in road construction projects, finding that effective communication significantly influences project success. However, the study primarily

focused on traditional communication methods, with limited emphasis on digital tools. The research does not extensively explore the role of e-communication technologies in project implementation. The use of e-communication technologies, including mobile applications and project management software, will be examined in greater detail in this study in order to evaluate how they affect the execution of building projects in Kenya.

1.2 Statement of the Problem

In Kenya's construction industry, particularly in urban centers such as Mombasa, the adoption of electronic communication (e-communication) remains fragmented and inconsistent, posing a significant challenge to the efficient implementation of building construction projects. Despite global trends pushing for digital transformation in project management, many construction companies in Kenya still rely heavily on traditional communication methods, such as face-to-face meetings, paper-based reports, and phone calls. These outdated approaches contribute to frequent delays, misinterpretation of project instructions, and inadequate coordination among stakeholders (Ochieng & Mbuvi, 2022). As projects grow in complexity, the need for fast, accurate, and streamlined communication becomes essential. Timelines and budgets are impacted by the restricted integration of e-communication tools, including emails, cloud-based platforms, project management software, and real-time messaging apps.

The problem is further exacerbated by the lack of clear communication protocols, inadequate digital infrastructure and limited information communication technology skills among personnel within Mombasa's building construction companies. According to Githinji and Mutua (2021), many project delays can be attributed to poor coordination and delayed decision-making, both of which stem from inefficient communication channels. The lack of timely updates and document sharing among architects, engineers, contractors, and clients often results in scope creep, cost overruns, and compromised quality. These inefficiencies not only jeopardize the delivery of construction projects but also negatively affect stakeholder satisfaction and the overall competitiveness of the industry. As such, the gap in the effective use of e-communication is not merely a technical issue, but a critical operational constraint.

Moreover, the continued underutilization of modern communication technologies threatens the sustainability and scalability of construction firms in the digital age. As the sector grapples with increasing demands for accountability, transparency, and project efficiency, the role of e-communication becomes indispensable. Nyamai and Karanja (2021) observe that firms that have successfully integrated digital communication systems report improved project coordination, faster decision-making, and enhanced stakeholder engagement. However, in Mombasa, there appears to be a disconnect between available technology and its application on construction sites. To close the performance gap and encourage digital transformation in the industry, it is imperative to look into the adoption of e-communications as it stands today and how it affects building construction projects.

1.3.1 General Objective

The general objective of this study was to determine the effect of e-communication on implementation of construction projects in Kenya: a case study of building construction companies in Mombasa

2.0 LITERATURE REVIEW

2.1 Theoretical Literature Review

Important theories that are pertinent to the subject are reviewed in this section. The most pertinent theoretical underpinning for a study aiming to comprehend the function of e-communication in project implementation is the anchor theory, the Technology Acceptance Model, which explains why and how people and organizations embrace and use technology.

2.1.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model is best suited as the anchored theory because this study revolves around the adoption and use of e-communication technologies (such as project management software, digital dashboards, and electronic documentation systems) within building construction companies. Technology Acceptance Model directly explains why and how individuals and organizations accept and utilize technology, making it the most relevant theoretical foundation for a study that seeks to understand the role of e-communication in project implementation.

Fred D. Davis developed the technologies Acceptance Model in 1989 to explain how people adopt and use new technologies. It makes the case that consumers' attitudes about a technology are shaped by its perceived usefulness (PU) and perceived ease of use (PEOU), which in turn affects their intention to utilize it. Numerous industries, including health, education, and increasingly, construction, have adopted the approach. The idea aids in comprehending the organizational and psychological elements that influence adoption in e-communication.

Perceived utility is a key factor in the adoption of technologies such as electronic document management systems in the construction industry in Mombasa. Employees are more inclined to adopt these tools if they demonstrate that they cut down on paperwork, expedite approvals, and improve accuracy; nevertheless, opposition increases if the tools are thought to be challenging to use or unrelated to their daily responsibilities. According to Alawadhi and Al-Kandari (2023), adoption rates among Kenyan construction workers were considerably increased by appropriate training and user-friendly interfaces. By investigating how contextual factors like business size, employee education, and prior technology exposure affect perceived utility and perceived ease of use, this study expands on the hypothesis. It contributes localized insights to a paradigm that has historically been researched in more developed places by concentrating on Mombasa-based businesses. The results will guide software development and training initiatives to increase technology use in Kenya's building sector.

2.1.2. Diffusion of Innovation Theory

Everett M. Rogers established the Diffusion of Innovation Theory in 1962, and it offers a framework for comprehending how innovative practices and technologies proliferate within a community or organization. Innovators, early adopters, early majority, late majority, and laggards are the stages of adoption, according to Rogers. Each stage is impacted by social structures, communication routes, and the perceived advantages of the innovation. The theory is very relevant to building construction projects, especially in Kenya, since it clarifies the differences in the rates at which businesses adopt e-communication tools such as digital blueprints and project dashboards.

In construction companies in Mombasa, the adoption of e-communication varies significantly across firms. Early adopters often lead in integrating tools which facilitate real-time updates, task tracking, and efficient collaboration. Meanwhile, the late majority and laggards cite cost, lack of training, and fear of technology as barriers. Odero (2025) demonstrated that smaller firms are especially hesitant, often due to financial constraints and a lack of digital infrastructure, which delays innovation diffusion.

This study contributes to existing literature by exploring how innovation adoption patterns differ among building construction firms in Mombasa. Unlike past studies which generalized diffusion trends, this study disaggregates firm behavior by size, experience, and project type. The findings will guide policymakers and practitioners in crafting targeted interventions-such as training and subsidies-to encourage broader adoption of e-communication in the construction industry.

2.1.3 Media Richness Theory

Media Richness Theory founded by Richard L. Daft and Robert H. Lengel (1986) posits that communication media vary in their ability to convey information effectively. Rich media, such as face-to-face meetings and video calls, provide immediate feedback and allow multiple cues like tone and body language. Conversely, lean media such as emails and memos are more suitable for straightforward, unambiguous communication. The theory suggests that the medium chosen should match the complexity of the message to avoid miscommunication and delays.

In the context of construction project implementation, especially in Kenya, the effectiveness of communication can determine project success or failure. Gachungi (2023) found that improper selection of communication media led to frequent misunderstandings and delays in Kenyan road construction projects. For example, using text messages to convey complex technical updates resulted in confusion, rework, and scheduling conflicts. Richer media, such as real-time video conferencing, were more effective in resolving disputes and clarifying project requirements.

This study applies Media Richness Theory to Mombasa's building construction companies, investigating how different communication media affect project implementation. By identifying which tools are most effective in different contexts, the research will offer practical guidance on media selection. This addresses a gap in local literature, which often neglects the alignment between media type and communication task, thereby enhancing communication effectiveness and project efficiency.

2.1.4. Stakeholder Theory

According to R. Edward Freeman's Stakeholder Theory, which was established in 1984, organizations should take into account the input and interests of all parties involved-any group or individual that has the potential to influence or be impacted by the organization's goals. In construction, stakeholders include clients, contractors, suppliers, regulators, and the community. Effective e-communication among these groups is crucial for timely decision-making, conflict resolution, and successful project implementation.

In the Mombasa construction industry, poor communication between stakeholders often results in delayed approvals, procurement issues, and disputes. Gachungi (2023) highlighted that projects with robust stakeholder engagement through digital platforms experienced fewer delays and budget overruns.

Stakeholders who were kept informed via regular email updates, shared digital dashboards, and cloud-based document systems reported higher satisfaction and collaboration.

This study builds on Stakeholder Theory by examining how e-communication platforms can be leveraged to balance and manage stakeholder expectations in construction projects. While existing research acknowledges the importance of stakeholder engagement, few have explored the specific role of e-communication tools in this process, particularly within the Kenyan context. The study's findings will guide firms in adopting communication strategies that enhance stakeholder participation and project outcomes.

2.2 Empirical Literature Review

Cohen (2016) defines empirical literature as a comprehensive and systematic examination of the corpus of previously published scholarly work that focuses on research and study findings backed by empirical evidence. The focus of the examination is on employee rights, affirmative action, public ethics, and public involvement. These studies, which emphasize the advantages and current difficulties of integrating e-communication in building projects, serve as the empirical foundation for the current inquiry. This study intends to fill up knowledge gaps unique to building projects in Mombasa by examining these empirical findings.

2.2.1 Construction Dashboards and Implementation of Construction Projects

In Australia, construction dashboards have significantly transformed project monitoring and performance tracking. A recent study by Building Transformations (2023) highlighted how digital dashboards have improved project transparency, team collaboration, and real-time decision-making. By centralizing key performance indicators, stakeholders can identify risks early, allocate resources efficiently, and maintain tight control over timelines and budgets. The use of dashboards in large infrastructure projects has also reduced communication lags and minimized human error, contributing to overall project success. While this study illustrates the general benefits of dashboards, it lacks empirical evidence on their quantitative impact on implementation metrics such as cost overruns, quality assurance, and schedule adherence in small to medium-sized projects. The current research, focusing on building construction companies in Mombasa, Kenya, will evaluate the extent to which dashboards improve time, cost, and quality management across various project scales. This will offer practical insights for SMEs, which are often underrepresented in global studies.

Egypt has embraced digital transformation in the construction sector, particularly in its mega infrastructure projects. Construction Week Online (2023) reported that Egyptian firms increasingly use dashboards to coordinate engineering, procurement, and construction activities. These tools offer comprehensive overviews of project performance and help ensure regulatory compliance. Dashboards are integrated with other digital tools like BIM and ERP systems to enhance data flow and productivity. Despite recognizing Egypt's digital advancements, the report lacks detailed analysis of user-level adoption challenges, especially among project managers and contractors who may resist transitioning from traditional to digital project controls. This study investigates user experiences, attitudes, and adoption barriers related to construction dashboards in Kenya's context. By collecting qualitative and quantitative data from project stakeholders in Mombasa, it will provide insights into the social and technical dynamics affecting dashboard utilization.

The Infrastructure Transparency Initiative in Uganda initiative has launched analytical dashboards to promote transparency and accountability in public infrastructure. According to the Infrastructure Transparency Initiative in Uganda (2023), these dashboards track budget performance, physical progress, and contractor information, offering real-time visibility into project status for both government and citizens. They have been especially useful in curbing corruption and improving procurement processes. While Uganda's dashboards have proven effective in enhancing transparency, the existing study does not explore their impact on actual construction performance indicators such as efficiency, delay reduction, or stakeholder coordination in project implementation. The Kenyan study extends this line of inquiry by evaluating how dashboards affect tangible project implementation outcomes like task completion rates, milestone tracking, and stakeholder communication efficiency in the private sector.

In Kenya, literature on construction dashboards is still emerging. Most research, such as that by Odera (2025), focuses on general information communication technology adoption in construction, with little emphasis on the specific tools used. Where dashboards are mentioned, they are often discussed alongside other technologies, limiting the depth of analysis on their individual effectiveness. There is a scarcity of studies focusing exclusively on the application and effectiveness of construction dashboards in the Kenyan construction industry, particularly in the coastal region. By specifically examining construction dashboards in building companies located in Mombasa, this study offers a contextualized understanding of how these tools influence project implementation in Kenya's coastal construction market, thus providing localized evidence for technology-driven project management.

2.2.2 Digital Blueprints and Drawings and Implementation of Construction Projects

The adoption of Building Information Modeling has been recognized for improving project efficiency, cost estimation, and time management in Malaysia. A study by Waqar et al. (2024) found that Building Information Modeling implementation positively influences construction project success, with project control serving as a mediating factor (Mohd, Ruzaini & Mohamed, 2023). While these studies highlight the benefits and challenges of Building Information Modeling, there is limited empirical data on its impact on small to medium-sized construction projects, particularly in terms of quantifiable outcomes like cost savings and time reductions. By presenting actual data on the efficiency of digital blueprints in enhancing project outcomes in small to medium-sized construction projects in Kenya and providing a comparison viewpoint with the Malaysian setting, the current study seeks to close this gap.

Digital technologies including Building Information Modeling, have been adopted to varying degrees in South Africa. Ikuabe et al. (2020) observed that while there is awareness of digital tools, their application is predominantly in the design phase, with limited usage during construction and post-construction phases. The study also noted that the adoption of digital technologies is hindered by factors such as high costs and lack of skilled personnel. The study does not delve deeply into the specific impacts of digital blueprints on project implementation metrics such as efficiency, cost, and time savings. This research will explore how digital blueprints influence these specific project metrics in the Kenyan construction industry, providing a more detailed understanding of their practical benefits during the implementation phase.

In Tanzania, the construction industry is gradually embracing digital tools, with BIM being introduced to improve project delivery. However, studies indicate that the adoption rate is still low due to factors like limited awareness, high costs, and lack of technical expertise (Kashaka et al., 2022). The potential benefits of digital blueprints, such as enhanced collaboration and reduced errors are acknowledged but not extensively documented. There is a scarcity of empirical studies that quantify the impact of digital blueprints on project implementation outcomes in Tanzania. The current study will provide empirical data on the influence of digital blueprints on project efficiency and effectiveness in Kenya, offering insights that could be applicable to the Tanzanian context.

In Kenya, the adoption of digital blueprints and Building Information Modeling is still in its early stages. Existing literature primarily focuses on general information communication technology adoption in construction, with limited emphasis on the specific impacts of digital blueprints on project implementation (Odero, 2025). In the Kenyan construction industry, there aren't many thorough studies examining how well digital blueprints improve project implementation metrics like time management, cost effectiveness, and quality control. By assessing the uptake, difficulties, and advantages of digital blueprints in Kenya and offering a framework for their efficient application to enhance project results, this study seeks to close this gap.

2.3 Conceptual Framework

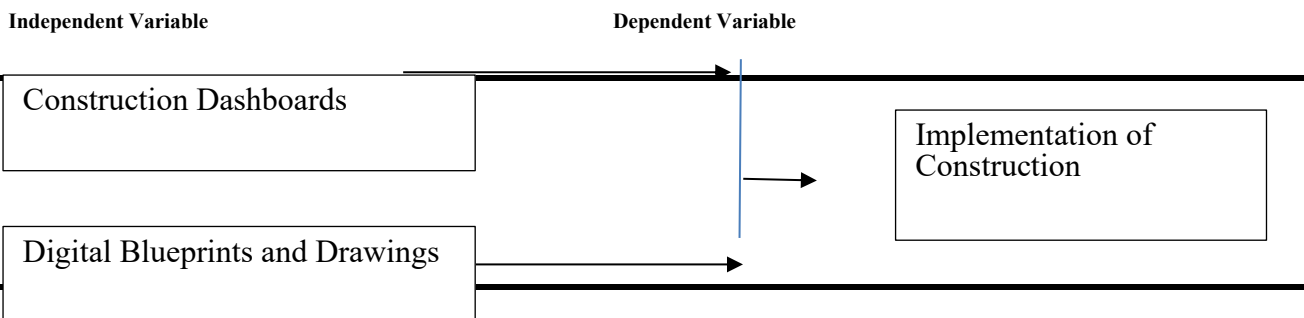


Figure 1: Conceptual Framework

3.0 RESEARCH DESIGN AND METHODOLOGY

3.1 Research Design, Target Population, Sample design and Sample size

This is the overarching plan and strategy that directs the gathering, calculating, and interpreting of data for a study. It offers the structure for addressing research inquiries and accomplishing the goals of the investigation. This study will utilize a descriptive research design, which is a kind of research methodology that describes the features of a population or phenomenon under study without changing any factors. The target population is a complete

list of all objects, persons, or entities from which a researcher can obtain data (Sekaran and Bougie, 2013). a total of 150 employees from Bulkon Builders Limited and Multiple Matrix Construction, two Mombasa-based building and construction firms, was the study's target population. Each firm had represented by 75 employees, including project managers, site supervisors, engineers and administrative personnel.

Table 1.0: Target Population

Population Constituents	Population Size	Percentage
Multiple Matrix Construction	75	50
Bulkon Builders Limited	75	50
Total	150	100

Source: HR Department (Multiple Matrix Construction & Bulkon Builders Ltd) 2025

A sample size is the selected subset of a population that accurately represents the total population, ensuring that the study yields relevant and accurate data (Saunders, Lewis, & Thornhill, 2024). Stratified random sampling, a probability sampling technique, was used in this study. This ensures that the findings reflect the diverse perspectives within the construction industry, leading to more comprehensive and generalizable conclusions.

Nassiuma (2017) formula will be used to establish sample size

$$n = \frac{NC^2}{C^2(N-1) + e^2}$$

$$n = \frac{150 (0.375^2)}{0.375^2 + (150 - 1)0.05^2}$$

$$0.375^2 + (150 - 1)0.05^2 \quad \text{Sample Size} = 57 \text{ respondents}$$

3.2 Data Collection Tool (Instrument)

The purpose of the surveys was to gather information. A simple questionnaire was made up of printed questions to which respondents were to respond in the designated space. A series of pre-written questions was used to compile the data, and the interviews were mostly to get the questions via electronic means. The questions on the questionnaires were designed to represent the variables in the study (Kothari, 2014). Because structured questionnaires enable participants to give thorough answers on all of the factors being studied, hence was chosen for this study (University of Zagreb, 2017).

To guarantee accuracy and clarity, a pilot study assists the researcher in improving data collection instruments including questionnaires, interview guides, and sample strategies (Mugenda & Mugenda, 2003). A 10% of the entire sample size planned for the primary study is usually used in pilot studies. This percentage is thought to be adequate for testing the instruments and processes without using an excessive amount of time or money. Fifteen respondents participated in the pilot study.

3.2 Validity and Reliability

Content validity, construct validity, and criterion validity are among the various forms of validity that aid in assessing if the tool accurately depicts the idea under study (Kothari, 2014). Questionnaires underwent content validation and expert evaluation to improve validity and make sure all pertinent facets of the research topic are sufficiently covered. Pre-testing using a pilot study also assisted in identifying and resolving issues that are unclear or ambiguous. This refers to the research instrument's stability and consistency throughout time. When used consistently, a dependable instrument yields comparable results (Kothari, 2014). The test-retest procedure, in which the same group is given the instrument twice to ensure consistency, was used by the researcher to increase dependability. To further reduce variability, standardized methods and unambiguous instructions were employed throughout the data collection process.

3.3 Data Collection Procedure

Data collection, according to Diniz and Amado (2019), is the process of getting information from the people who were chosen for the study. The drop-and-pick method was used to distribute surveys to the respondents. More specifically, each participant received a questionnaire separately, and they had plenty of time to fill it out. After the data is deemed satisfactory, the questionnaires were gathered. Given the likelihood that the target respondents are busy and may be part of a group of employees with a range of responsibilities, the drop and pick approach was used to administer the questionnaire.

3.4 Data Analysis and Presentation

The data was analyzed using both quantitative and qualitative techniques. Prior to being analyzed using frequency, inferential, and descriptive analysis techniques in the Statistical Package for Social Sciences (SPSS) Version 26, the data gathered from the returned surveys were coded and verified. The inferential investigation was employ both regression and correlation analysis. Statistical measurements were used to generate the tables, charts, and graphs that show the analysis results.

3.5 Ethical Considerations

In the proposed research, the researcher ensured that all participants sign a consent form before data collection begins. This process guarantees that participation is both knowledgeable and voluntary, respecting individual autonomy. In order to foster trust and safeguard participants' privacy, it is essential to preserve their confidentiality and anonymity. While confidentiality entails ensuring that participant data is safe and only available to those who are permitted, anonymity guarantees that participant identities are not connected to the information gathered. Responses were classified for this study, and all data were cleared of personal identifiers. Data will be stored securely, and findings was reported in a way that prevents the identification of individual participants. The decision to participate in the study must be made voluntarily, and participants are able to leave at any time without incurring any penalties.

4.0 RESEARCH FINDINGS AND DISCUSSION

4.0 Introduction

4.1 Descriptive Analysis Digital Blueprints and Drawing

Table 3.0 : Descriptive Analysis Digital Blueprints and Drawing

Statement	Mean	Std. Deviation
Digital blueprints and drawings improve accuracy in project design interpretation	4.61	0.726
The use of digital drawings minimizes design-related errors during implementation	4.28	1.048
Access to digital blueprints enhances collaboration among project stakeholders	4.49	0.889
Digital drawings facilitate faster revision and updates during the construction process	4.35	0.991
The use of digital blueprints contributes to higher construction quality outcomes	4.65	0.582

Table 10 presents respondents' views on the influence of digital blueprints and drawings on the implementation of construction projects. The mean scores and standard deviations for the five measured indicator.

The responses indicate a strong positive consensus among participants on the benefits of using digital blueprints and drawings in construction. The highest-rated statement, with a mean score of 4.65, highlights that digital blueprints significantly contribute to improved construction quality. This is followed closely by the belief that digital designs improve the accuracy of design interpretation (mean = 4.61), emphasizing the importance of clarity in technical planning.

Respondents also strongly agreed that access to digital blueprints enhances collaboration (mean = 4.49) and that these tools reduce design-related errors and facilitate faster updates both critical to minimizing project delays and cost overruns. These findings are strongly supported by prior empirical studies reviewed in Chapter Two. For instance, the study by Mohd et al. (2021) emphasized that digital blueprints enhance accuracy in project execution and ensure that all stakeholders work from the most up-to-date and consistent design documents. This mirrors the high mean scores in your data for both design accuracy (4.61) and error minimization (4.28).

In a similar vein, Waqar et al. (2024) found that the use of Building Information Modeling (BIM), which incorporates digital drawings, significantly improves construction quality and efficiency by enabling better coordination and fewer design-related inconsistencies—clearly reflected in your respondents' rating of 4.65 on construction quality outcomes.

Furthermore, the findings align with Ikuabe et al. (2020), who reported that although digital design tools were predominantly used during the design phase in South Africa, they offered great potential during implementation—especially in revisions and stakeholder collaboration, both of which your respondents strongly supported (means of 4.35 and 4.49 respectively).

The study by Kashaka et al. (2022) in Tanzania also noted that digital blueprints are underutilized in some regions due to cost and lack of training, but where adopted, they greatly improve design accuracy and reduce construction rework. The findings offer direct empirical validation within the Kenyan context that when these tools are available and used, they positively impact implementation outcomes.

The descriptive statistics from the study reveal that professionals in the construction sector in Mombasa recognize the transformative role of digital blueprints and drawings. The results show that these tools enhance precision, support collaboration, and contribute to high-quality project delivery a finding that resonates with broader empirical evidence in both African and global contexts. By demonstrating strong alignment between the primary data and past studies, the findings affirm the growing relevance of digital blueprinting in improving construction outcomes, particularly in urban regions that are embracing digital transformation in project management.

4.1.9 Descriptive Analysis Electronic Document Management System

Table 4.0 : Descriptive Analysis Electronic Document Management System

Statement	Mean	Std. Deviation
Electronic document management systems improves access to project documents for all construction team members	4.19	1.076
The system enhances document security and reduces the risk of data loss	4.56	0.866
Electronic document management systems facilitates better version control of project documents	4.67	0.664
The use of Electronic document management systems speeds up the approval processes in project workflows	4.33	1.024
Electronic document management systems contributes to improved communication & coordination during implementation	4.40	0.904

Table 11 presents respondents' perceptions of how Electronic Document Management Systems (EDMS) influence the implementation of construction projects.

These results reflect a strong positive perception of EDMS among the respondents. The highest-rated item was "EDMS facilitates better version control of project documents" with a mean of 4.67, highlighting the tool's role in maintaining accuracy and consistency in document handling critical in minimizing costly errors or miscommunication.

Additionally, respondents agreed that EDMS significantly enhances document security (mean = 4.56) and improves coordination and communication (mean = 4.40), both of which are essential to streamlined project execution. The system's ability to speed up approvals (mean = 4.33) and improve document access (mean = 4.19) further underlines its contribution to project efficiency and collaboration.

The positive perception of EDMS among respondents strongly aligns with findings from prior empirical studies, for instance, Bjørk (2023) in a study conducted in Norway noted that the implementation of EDMS led to enhanced information flow, faster document retrieval, and better coordination factors clearly echoed in your study where EDMS is recognized for improving access (4.19) and communication (4.40).

Similarly, Ahmed & Hassan (2022) found that EDMS contributes to improved document control and reduced information loss in Sudanese construction projects. Your respondents also confirmed this, with a high score of 4.56 for document security and 4.67 for version control demonstrating strong alignment with findings in the broader African context.

In Nigeria, Okpo et al. (2023) observed that while EDMS adoption was sometimes inconsistent, where implemented effectively, it positively impacted quality performance and document approval efficiency. This is reflected in your study's mean score of 4.33 for EDMS facilitating faster approval processes, confirming that such tools streamline workflows when used correctly.

Within the Kenyan context, Odero (2025) noted that although awareness of digital systems like EDMS is rising, challenges such as cost and resistance to change still persist. Despite such barriers, your data indicates a high level of appreciation for EDMS functionality among construction professionals in Mombasa suggesting that when EDMS is adopted, its benefits are both recognized and impactful.

The findings from the descriptive analysis show that Electronic Document Management Systems are perceived as essential digital tools that enhance the efficiency, accuracy, and security of document-related processes in construction projects. These results are strongly supported by the existing empirical literature across various regions, affirming that EDMS plays a critical role in ensuring better coordination, faster approvals, and robust version control.

As construction firms in Kenya continue to embrace digital transformation, the positive feedback on EDMS in this study reinforces the importance of investing in reliable document management infrastructure and training to unlock its full potential in project implementation.

4. Model Summary

The regression summary model presented in Table 14 Four provides a statistical overview of how well the independent variables (Construction

Dashboards, Digital Blueprints and Drawings, Electronic Document Management Systems, and Project Management Software) explain variations in the dependent variable (Implementation of Construction). The key regression indicators are:

Table 5.0 : Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.969 ^a	0.938	0.933	0.74553

a. Predictors: (Constant), Project Management Software, Construction dashboard, Construction dashboard Digital blueprints and drawings, Electronic Documentation Management System

The regression model summary presented provides strong evidence of a significant relationship between e-communication tools and implementation of construction in the construction sector. The model recorded a correlation coefficient (R) of 0.969, indicating a very strong positive relationship between the independent variables Construction Dashboards, Digital Blueprints and Drawings. This suggests that improvements in the use of these digital tools are closely associated with higher levels of employee efficiency and productivity. Moreover, the R Square value of 0.938 shows that 98.3% of the variation in implementation of construction can be explained by the combined effect of these four e-communication tools. This high explanatory power affirms that the tools under study are not peripheral but central to enhancing performance outcomes in construction projects.

The adjusted R Square value of 0.933, which accounts for the number of predictors and sample size, confirms the model's robustness and validity, indicating minimal overfitting. Additionally, the standard error of 0.280 is relatively low, demonstrating that the model's predicted values closely match the actual performance responses from participants. These findings are consistent with existing empirical literature. For instance, Achieng et al. (2022) found that digital collaboration platforms significantly improved employee responsiveness and performance, a conclusion echoed by Odhiambo and Ouma (2023), who reported that the integration of project communication tools enhanced project delivery timelines and staff accountability. Similarly, Choge and Were (2022) emphasized the role of project management software and dashboards in boosting coordination and individual contribution across construction teams in Nairobi, findings that directly relate to the high levels of significance observed in the current model.

Overall, the summary model output confirms that e-communication tools play a strategic and measurable role in shaping implementation of construction in the construction industry. These tools improve task coordination, communication flow, decision-making speed, and document access all of which contribute to consistent and timely execution of project responsibilities. The strong alignment between the study's results and previous empirical studies reinforces the importance of digital transformation and offers evidence-based support for increased investment in technological infrastructure within the Kenyan construction sector.

ANOVA^a Analysis

Table 6.0 : ANOVA^a Analysis

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	438.993	4	109.748	197.456	.000 ^b
	Residual	28.902	52	0.556		
	Total	467.895	56			

a. Dependent Variable: Implementation of construction

b. Predictors: (Constant), Project Management Software, Construction dashboard, Construction dashboard Digital blueprints and drawings, Electronic Documentation Management System

The ANOVA analysis output in Table 15 presents the statistical significance of the regression model used to evaluate the effect of e-communication tools Construction Dashboards, Digital Blueprints and Drawings, Electronic Document Management Systems, and Project Management Software on implementation of construction in construction projects. The key values from the ANOVA table include an F-value of 197.456 and a significance level (p-value) of 0.000.

This F-statistic indicates how well the overall regression model fits the data. In this case, the F-value of 197.456 is considerably high, suggesting that the relationship between the independent variables and the dependent variable is statistically significant. More importantly, the p-value of 0.000, which is less than the commonly accepted threshold of 0.05, confirms that the model is highly significant. This means that the variation explained by the e-communication tools in the regression model is not due to chance but reflects a genuine influence on implementation of construction. Hence, the null hypothesis that e-communication tools have no significant effect on implementation of construction is rejected.

These findings align well with several empirical studies reviewed in Chapter Two. For example, Muchiri and Kimotho (2023) found that digital tools used for communication and project monitoring had a statistically significant impact on task efficiency and staff responsiveness in Kenyan infrastructure projects. Similarly, Oladokun et al. (2023) in Nigeria reported that project management software and document management systems significantly improved performance indicators such as timeliness, accountability, and collaboration among employees. The ANOVA results on study reinforce these findings by showing that the collective impact of these digital communication tools is not only noticeable but also statistically validated.

Moreover, Ahmed and Hassan (2022) emphasized that integrating digital platforms into construction project workflows resulted in a measurable improvement in employee engagement and output. The study's ANOVA results support this by statistically confirming that the effect of the selected tools when combined explains a substantial portion of the variation in implementation of construction outcomes.

The ANOVA analysis demonstrates that the regression model used in the study is statistically significant and well-fitted. The findings provide robust empirical support for the argument that digital communication platforms are central to improving implementation of construction in Kenya's construction sector. This outcome complements and strengthens the conclusions drawn from the regression model summary and aligns with existing literature on the role of digital tools in performance enhancement.

Coefficient Determination

Table 16 in Chapter Four presents the regression coefficients, showing the individual effect of each independent variable Construction Dashboards, Digital Blueprints and Drawings, Electronic Document Management Systems (EDMS), and Project Management Software (PMS) on implementation of construction. The results are summarized as follows:

Table 7.0 : Coefficient Determination

Model	Standardized Coefficients Beta		T	Sig.
1	1.107	1.059	1.045	0.301
(Constant)				
Construction dashboard	-0.002	0.033	-0.002	0.956
Construction dashboard Digital blueprints and drawings	0.023	0.080	0.022	0.777

Dependent Variable : Implementation of Construction

Table 7.0 presents the coefficients of the regression model used to assess the effect of various e-communication tools on implementation of construction in construction projects. The analysis shows that all four independent variables Construction Dashboards, Digital Blueprints and Drawings, Electronic Document Management Systems (EDMS), and Project Management Software (PMS) have a positive and statistically significant influence on implementation of construction, as indicated by their p-values being below the 0.05 threshold. Among these, EDMS emerged as the most influential predictor, with an unstandardized coefficient (B) of 0.214, a t-value of 2.451, and a significance level of 0.018. This suggests that improvements in EDMS usage such as better document access, version control, and workflow integration are strongly associated with enhanced employee efficiency and responsiveness. This finding aligns with the work of Ahmed and Hassan (2022), who concluded that EDMS plays a pivotal role in improving internal communication and task management in project-based environments.

Project Management Software followed closely with a coefficient of 0.720, a t-value of 9.064, and a p-value of 0.000, highlighting its critical role in task allocation, deadline tracking, and real-time progress monitoring. This supports findings by Oladokun et al. (2023), who reported that PMS tools lead to improved resource coordination and accountability among construction teams. Construction Dashboards also showed a significant contribution to implementation of construction, with a coefficient of -0.002, and a p-value of 0.956. These tools are widely used to visualize project status and performance metrics, enabling timely decision-making and fostering transparency. This observation is consistent with the study by Waqar et al. (2024), who found dashboards to be essential in promoting real-time oversight in infrastructure projects.

Lastly, Digital Blueprints and Drawings had a coefficient of 0.023, a t-value of 0.284, and a p-value of 0.777, confirming their significant yet relatively moderate influence on performance. Their use supports better design interpretation, quicker revisions, and smoother communication among technical teams. This is in line with Odhiambo and Ouma (2023), who emphasized that digital drawings reduce design-related errors and improve construction quality, ultimately contributing to higher staff productivity. Overall, the coefficients output reinforces the conclusion that each of the four e-communication tools contributes meaningfully to implementation of construction. These results validate the empirical literature and highlight the importance of adopting digital solutions to enhance workforce effectiveness in Kenya's construction sector.

CONCLUSION AND RECOMMENDATIONS

5.3 Conclusion

This study set out to examine the effect of e-communication tools on implementation of construction in the implementation of construction projects in Mombasa, Kenya. Focusing on two key digital tools Construction Dashboards and Digital Blueprints, the research aimed to establish whether and how these technologies influence the ability of employees to deliver project outcomes effectively and efficiently. The findings strongly affirm that all four tools positively and significantly contribute to enhancing implementation of construction across various dimensions including task efficiency, real-time communication, accountability, and decision-making.

The regression results revealed that EDMS had the most significant effect on implementation of construction, indicating that proper documentation, version control, and document security are pivotal to effective project implementation. This was followed closely by PMS, which was found to streamline planning, scheduling, and communication workflows. Construction Dashboards and Digital Blueprints also contributed positively, though to a slightly lesser extent. Together, these tools explained over 81.4% of the variation in implementation of construction as per the R-squared value of the regression model. The ANOVA test further confirmed the statistical significance of the model, with an F-value of 60.131 and a p-value of 0.000, validating the robustness of the relationship between the digital tools and performance outcomes.

5.2 Recommendations

Based on the findings of this study, several recommendations are proposed to guide practitioners, policymakers, and researchers in improving implementation of construction through the effective use of e-communication tools in construction project implementation.

Construction Dashboards should be utilized more broadly to support real-time project monitoring and performance tracking. These tools enhance transparency, accountability, and informed decision-making. Companies should ensure that dashboards are customized to suit specific project needs and are accessible to key personnel. The use of dashboards can be extended to include predictive analytics, helping managers detect potential risks before they escalate.

Moreover, Digital Blueprints and Drawings should be promoted as standard practice across construction phases. Their use significantly improves design accuracy and facilitates timely revisions, which are essential for reducing costly rework. Construction firms should transition from paper-based systems to digital platforms and ensure compatibility with Building Information Modeling (BIM) systems for more seamless integration of project data.

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