Journal of Information, Technology and Data Science

Relationship Between Information Communication and Technology Adoption Processes and Performance of Public Building Construction Projects in Kenya

Simiyu Dolphine Nanjala & Prof. Thomas Senaji

ISSN: 2617-3573

Stratford Peer Reviewed Journals and Book Publishing
Journal of Information, Technology and Data Science
Volume 10||Issue 1||Page 71-93||July ||2026|
Email: info@stratfordjournals.org ISSN: 2617-3573

Relationship Between Information Communication and Technology Adoption Processes and Performance of Public Building Construction Projects in Kenya

[1]Simiyu Dolphine Nanjala & [2]Prof. Thomas Senaji

[1]Postgraduate student, Jomo Kenyatta University of Agriculture and Technology (JKUAT)
[2]Lecturer, Jomo Kenyatta University of Agriculture and Technology (JKUAT)

How to cite this article: Nanjala, S. D., & Senaji, T. (2026). Relationship Between Information Communication and Technology Adoption Processes and Performance of Public Building Construction Projects in Kenya. ***Journal of Information, Technology and Data Science, 10*** **(1), 71-93. https://doi.org/10.53819/81018102t5446**

Abstract

The Sustainable Development Goals call for adequate and suitable housing by 2030, yet the performance of public building construction projects continues to be unsatisfactory globally and in Kenya specifically. The relationship between ICT adoption and performance of public building construction projects remains insufficiently investigated empirically. This study examined the relationship between ICT adoption in design, procurement, supervision, and modern construction methods and the performance of public building construction projects in Kenya. A survey of 105 National Construction Authority Category 1 building contractors who participated in public building construction projects between 2015 and 2020 was conducted using structured questionnaires, with data analyzed using descriptive statistics and Chi-square tests. The findings established that ICT adoption in procurement and modern construction methods had the most significant positive relationship with quality, cost, and time performance. The study recommends that the government and contracting organizations should invest in ICT infrastructure, structured skills training, and awareness programs on modern construction methods to improve public building construction project performance in Kenya.

Keywords: *Information Communication and Technology, Adoption Processes, Performance, Public Building Construction Projects, Kenya*

1.0 Background of the Study

The global construction market is estimated to be worth over $3.2 trillion annually, contributing 2–3% of developing countries' GDP and 5–7% of developed nations' GDP. Since public building projects are primarily funded through taxpayer money, citizens rightfully expect value for these investments. However, public building contractors across the world have consistently demonstrated poor performance. The organizations responsible for overseeing these projects have equally proven ineffective and inefficient in resolving persistent performance challenges. Consequently, many construction projects continue to fall short on critical performance metrics, including cost control, schedule adherence, and overall delivery standards. Contributing factors include client obstructions, material shortages, design and drawing modifications, variation orders,

additional works, delayed decision-making, changes to the Bill of Quantities, and late receipt of drawings (UNRWA, 2006).

Performance failures in public construction projects extend beyond technical challenges to encompass organizational and contextual factors. In developing countries, performance problems are further compounded by weaknesses in project management, poor coordination between participants, inadequate monitoring and feedback mechanisms, and deficient leadership skills. Political, economic, and cultural issues represent three additional critical indicators of building project failure (UNRWA, 2006). Recognizing and measuring organizational performance is therefore essential in today's competitive global markets. Effective performance measurement enables organizations to attract future investment, increase share value, and recruit high-caliber employees. It also determines how an organization's achievements are communicated to and interpreted by potential investors, customers, and employees in the broader marketplace (DETR, 2006).

Performance indicators have historically been formulated to communicate organizational achievements to stakeholders. These indicators have traditionally concentrated on financial metrics, such as return on investment, sales per employee, and profit per unit of production. However, Fox et al. (2008) caution that financial measures are useful but tend to reflect past performance and capture only what is easily quantifiable. The apparent inadequacy of purely financial measures for evaluating contemporary business performance has been widely acknowledged in academic literature (Arditi & Mochtar, 2006). This recognition has driven the development of more comprehensive performance measurement frameworks that capture non-financial dimensions of organizational effectiveness, particularly in industries such as construction where multiple performance dimensions operate simultaneously and must be assessed collectively for meaningful evaluation.

The building construction sector plays a pivotal role in societal advancement and national economic development. National economies significantly shape the construction industry's overall performance (Navon, 2005). Key Performance Indicators (KPIs) provide a structured framework for assessing this performance, enabling clients to demand efficiency, quality, safety, and timely delivery from contractors. Regular clients expect continuous year-on-year improvements in cost and time performance, alongside quality outputs. The established KPI framework encompasses seven core groups: time, cost, quality, client satisfaction, client changes, business performance, and health and safety (DETR, 2006). These indicators support benchmarking initiatives, allowing clients to compare potential suppliers and enabling supply chain companies to identify their strengths, weaknesses, and capacity for improvement over time.

The construction industry holds particular significance in the economic development of developing nations, especially in Sub-Saharan Africa's expanding economies (Ibironke, 2008). An efficient construction sector is a fundamental prerequisite for effective national development, as building, civil, and industrial engineering works are major contributors to Gross Fixed Capital Formation, Gross Domestic Product, and national employment (Oyewobi & Ogunsemi, 2010). However, measuring performance within this sector remains inherently complex. Each contractor differs in terms of location, design specifications, delivery methods, administrative structures, and project participants (Alwi et al., 2008). Recognizing the most significant impacting factors within any contracting organization allows measures to be designed and implemented to overhaul and

improve contractor performance on an ongoing and sustainable basis.

Construction industry performance problems in developing economies can be characterized across three distinct layers. The first involves shortages or inadequacies in industry infrastructure, primarily relating to the supply of resources. The second involves problems caused by clients and their consultants. The third involves challenges arising from contractor incompetence and inadequacies. Okuwoga (2008) specifically identified poor budgetary and time control as central to performance failures. Long et al. (2004) further noted that incompetent designers and contractors, poor estimation, inadequate change management, social and technological challenges, site-related issues, and improper techniques and tools all contribute to performance problems in large construction projects. Physical infrastructure advancement, including buildings, roads, and bridges, remains a reliable indicator of a country's overall economic growth trajectory.

Construction project performance is further undermined by waste generated throughout the building process. Oyewobi and Ogunsemi (2010) identified major waste categories as reworks and repairs, defects, poor material allocation, unnecessary material handling, and material wastage. Rework is defined as the unnecessary effort of redoing a process or activity that was incorrectly implemented in the first instance. It results from errors, omissions, failures, poor communication, and inadequate coordination between project participants. Beyond increasing direct project costs, rework erodes profit margins and contributes significantly to both time and cost overruns (Oyewobi et al., 2011). Performance indicators are therefore indispensable tools for measuring, monitoring, and benchmarking construction outcomes and form the cornerstone of any organization's movement toward best practice in the delivery of building construction projects.

Information and Communication Technology (ICT) has increasingly become a critical enabler across all sectors of the economy, including the construction industry. ICT is understood from multiple perspectives; from a functionalist standpoint, it serves as a neutral provider of input for decision-making (Adriaanse & Voordijk, 2005). It encompasses tools ranging from computer-aided design (CAD) and Building Information Modeling (BIM) to online procurement systems and collaborative platforms such as SharePoint. These technologies facilitate information sharing, improve supervision and inspection processes, and enable knowledge management across construction projects. Despite ICT's demonstrated potential to improve efficiency and project performance, its adoption in Kenya's public building construction sector remains insufficiently documented in empirical literature, underscoring the critical need for this study (Weippert et al., 2003). ICT management can be applied in different areas in the construction industry because it is an enabler in all sectors of the economy. ICT infuses efficiency in all sectors but the level of its adoption in the public building construction industry is less documented in empirical literature. Thus, the aim of this study was to determine the relationship between ICT and the performance of publicbuilding construction projects in Kenya.

1.1 Statement of the Problem

Management of construction projects remains a significant challenge due to the risks and uncertainties inherent in the sector. Kenya has experienced persistent poor workmanship in public building construction projects, resulting in building collapses, loss of lives, and erosion of public confidence in local contractors. The deterioration of construction quality in Kenya is further compounded by inadequate government enforcement and the proliferation of unqualified practitioners in the sector. Government planning departments have failed to sufficiently police and

enforce building supervision standards. Consequently, many developers have been misguided by unqualified quacks, resulting in structurally deficient buildings that endanger occupants. A 2014 Questworks study examining 254 samples from 24 construction sites found that builders routinely reduce quantities of concrete and steel to cut costs and maximize profits, with low-income residents bearing the greatest impact. Despite ICT's demonstrated capacity as an enabler of efficiency across all economic sectors, its adoption in Kenya's public building construction industry remains poorly documented empirically, and its relationship with project performance has received insufficient scholarly investigation.

The persistent poor performance of public building construction projects in Kenya, evidenced through reported accidents, official audit reports, and direct observations, served as the primary impetus for this study. The study examined the relationship between ICT adoption and the performance of public building projects in Kenya, with a focus on preventing cost overruns, time delays, and shoddy workmanship. It also explored ICT-based solutions applicable to design, procurement, supervision, and industrialized building systems. Policy makers, departmental planners, project contractors, managers, and consultants stand to benefit from the study's conclusions. Specifically, this research sought to answer two broad questions: what is the current status of ICT adoption in public building construction projects, and what is the relationship between ICT adoption and the performance of public building construction projects in Kenya?

1.2 Study Objectives

i. To explore the relationship between ICT adoption in the design process and performance of public building construction projects in Kenya.

ii. To find out the relationship between ICT adoption in the procurement process and performance of public building construction projects in Kenya.

iii. To determine the relationship between ICT adoption in the supervision process and the performance of public building construction projects in Kenya.

iv. To investigate the relationship between industrialized building systems adoption on performance of public building construction projects in Kenya.

2.0 Literature Review

This chapter reviewed the literature that focused on the area of influence of ICT on performance of public building projects. The chapter commenced by reviewing theories that inform the discussion on ICT adoption and usage. It then dealt with empirical studies that focus on the influence of ICT adoption on performance of public building projects.

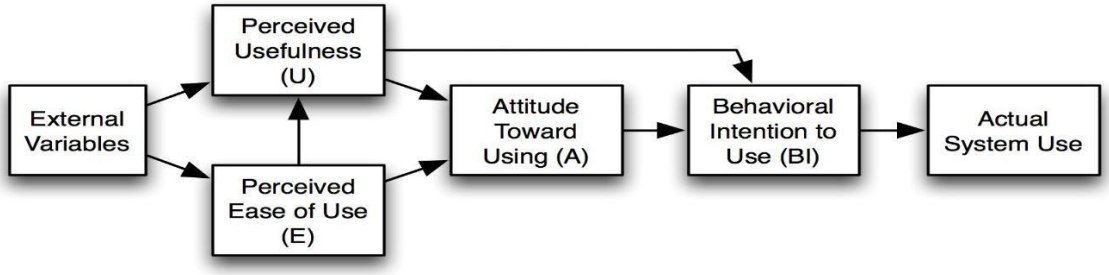
2.1 Theoretical Framework

A theory is a set of interrelated principles and definitions that present a systematic view of phenomena by specifying relationship among variables with the purpose of explaining natural phenomena (Charmaz, 2006). The most well-known theory and models which apply in technology adoption have been Technology Acceptance Model (TAM) (Davis 1989) and the Goal Setting Theory (Locke 1960). Each of these theories is discussed in detail below. The Technology Acceptance Model is an information systems theory that models how users cometo accept and use a technology. It suggests that when users are presented with a new technology,a number of factors

Stratford Peer Reviewed Journals and Book Publishing
Journal of Information, Technology and Data Science
Volume 10||Issue 1||Page 71-93||July ||2026|
Email: info@stratfordjournals.org ISSN: 2617-3573

influence their decision about how and when they will use it. This is as shownin figure 1 below.

Figure 1: Technology Acceptance Model



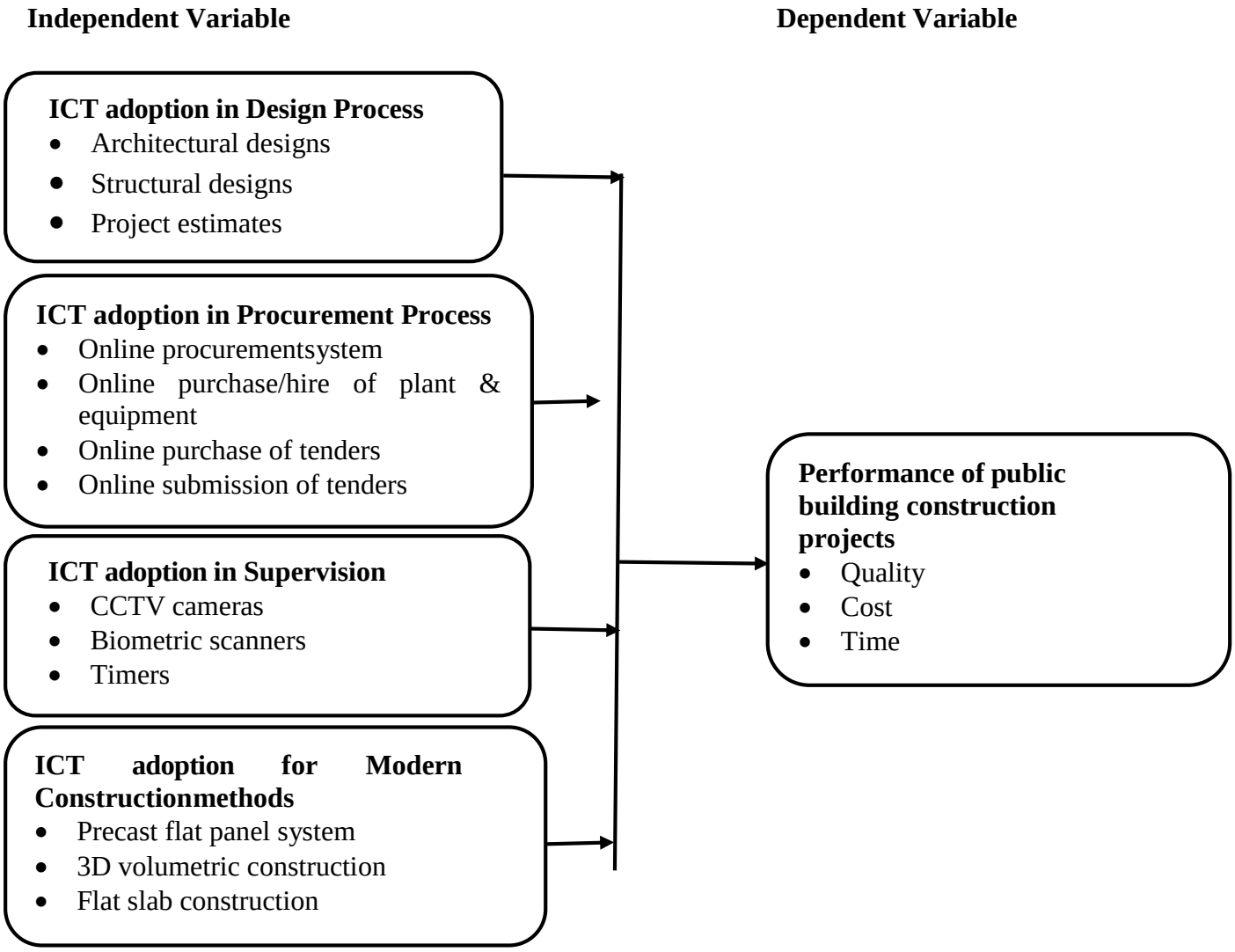
Source: The Technology Acceptance Model, version 1. (Davis 1989)

In 1960's, Edwin Locke put forward the Goal-setting theory of motivation. It states that goal setting is essentially linked to task performance. It states that specific and challenging goals along with appropriate feedback contribute to higher and better task performance. This theory has five principles of goal setting namely; clarity, challenge, commitment, feedback and task complexity. Clarity is where the goal must be specific and clear while challenge shows that the goal must be realistic. An easy or tedious goal is demotivating. Commitment is where the employees have to understand and buy in to the goal from the outset. Feedback helps to keep the goal on track. Task complexity means that realistic timescales should be set, and the process broken down into sub-goals with regular reviews.

2.2 Conceptual framework

A conceptual framework is a logically developed and elaborated network of interrelationships among variables integral in the dynamics of a situation being investigated. It explains the theory underlying these relationships and describes the nature and direction of these relationships. A variable is a measurable characteristic that assumes different values among the subject. It is therefore a logical way of expressing a particular attribute in a subject (Mugenda, 2003). A dependent variable is the variable of the primary interest to the researcher. Mugenda and Mugenda (2003) also defines a conceptual framework is a diagrammatical representation that shows the relationship between dependent variable and independent variables.

Figure 2: Conceptual Framework



2.3 Empirical Literature Review

Prior to conducting this research, the researcher reviewed existing literature examining how technological and managerial factors influence the performance of public building construction projects. Studies assessed were coordinated around the budgeting, procurement, contractor performance, disbursement of public funds, and cost management processes. Regarding the budgeting process, Aftab (2011) identified inadequate allocation of money and time to the design phase as a primary contributor to construction cost overruns. Koushki (2005) attributed cost overruns to contractor-related issues, material challenges, and owners' financial constraints. Kaming (1997) further identified design changes, inadequate planning, unpredictable weather, and fluctuating material costs as major cost overrun drivers. Khaled (2005) outlined a comprehensive project control system encompassing budget estimating, preliminary scheduling, and control program updating during the pre-construction phase, followed by detailed design scheduling and milestone monitoring during the design phase.

Strong institutional frameworks and accountability mechanisms are essential for the efficient execution of budgetary allocations in public construction projects. Devarajan and Reinikka (2002) established that robust institutions enable adequate and timely utilization of public funds, which is the primary determinant of financial performance in public projects. Nwadiani and Igbineweka (2005) further noted that government departments serve as the main conduits for public spending, with budgetary allocations intended to ensure value for money through reconciliation of payments against approved budgets. Kaplan (2010) emphasized that uncertainty in construction planning is largely caused by the unavailability of funds in the required amounts and at appropriate times, which consequently inflates overall project costs. These findings collectively underscore the critical role of sound budgetary management in determining the performance outcomes of public building construction projects.

Procurement-related challenges have been widely identified as major contributors to time and cost overruns in Kenya's public building construction sector. Kagiri et al. (2008) observed that public building projects in Kenya are planned and executed by government ministries and their implementing agencies, making timely procurement critical for delivering anticipated infrastructure benefits. Multiple scholars including Mwandali (1996), Talukhaba (1988), Karimi (1998), and Musa (1999) identified poor communication, inexperienced project managers, procurement delays, inadequate planning, poor infrastructure, insufficient financial resources, and lengthy tendering methods as major contributors to project overruns. Khaled (2005) further detailed the tendering phase as encompassing tender scheduling, milestone allocation, and schedule monitoring, stressing that fair and equal treatment of all bidders during evaluation is fundamental to transparent and effective procurement outcomes in public construction projects.

Contractor performance failures and communication breakdowns have been extensively documented as critical factors undermining public building project delivery in Kenya. The Government of Kenya (2012) attributed poor performance of public building projects largely to mismanagement of funds and inefficient performance measurement systems. Jameson (2013) argued that project failures are fundamentally rooted in poor communication, while Raulea and Raulea (2014) established that 95% of project failures result from ineffective communication among project teams. Ugwa and Haupt (2007) further linked contractor failures to resource management weaknesses and political interferences. Legishion et al. (2013) noted that government manipulation of the public construction sector, including issuing projects without adequate financial commitment, has resulted in numerous construction firms remaining unpaid, further destabilizing the sector's performance across time, cost, and quality dimensions.

Local Kenyan studies reveal persistent gaps in ICT adoption and its demonstrated relationship with public building construction project performance. Musa (2012) found that human and resource management significantly affected building company performance, while Bundi (2011) established that political interference and inadequate fund allocation hindered procurement service delivery despite policy compliance. Kinuthia (2012) found that Kenyan construction firms faced significant challenges in adopting construction management software due to limited awareness and inadequate personnel skills, with uptake of industry-specific software remaining very low. Lucy (2012) confirmed that employee training, project size, management commitment, and cost-benefit considerations affected ICT adoption in Nairobi construction firms. Gachungi (2017) demonstrated that e-procurement significantly influenced road project management through trust-

building and removal of cartels, though findings were limited to road projects and did not address public building construction specifically.

3.0 Research Methodology

The study adopted a descriptive research design, which Kothari (2012) defines as concerned with describing the characteristics of a particular individual or group. Cooper and Schindler (2008) further note that descriptive studies seek answers to questions of who, what, when, where, and how. The target population comprised project managers of NCA Category 1 building contractors who participated in public building construction projects in Kenya between 2015 and 2020. Structured questionnaires were issued to 105 contractors drawn from across the country, with a team of three research assistants facilitating data collection. Primary data were collected using structured questionnaires comprising both open and closed-ended questions, supported by a research permit from the Government of Kenya and an authorization letter from JKUAT. Data collected was sorted, coded, and tabulated using the Statistical Package for Social Sciences (SPSS version 24), with results presented in tables and pie charts. Descriptive statistics, including measures of central tendency (mean) and dispersion (standard deviation), were used to describe all study variables. Initially, a linear regression model was specified as $y = B^0 + B^1X^1 + B^2X^2 + B_3X_3 + B_4X_4 + e$, where y represented performance of public building projects and X1 to X4 represented ICT adoption in design, procurement, supervision, and modern construction methods respectively. However, since the data did not satisfy linear relationship assumptions, the Chi-square test was adopted to examine associations between variables at a significance level of $p < 0.05$.

4.0 Data Findings, Analysis and Discussions

This chapter presents findings from questionnaires distributed to NCA Category 1 building contractors across Kenya. Chi-square tests were used to assess the relationship between ICT adoption and performance of public building construction projects. Performance, as the dependent variable, was measured through quality, cost, and time indicators. The independent variables were ICT adoption in design, procurement, supervision, and modern construction methods. Data was analyzed using SPSS version 24 and results are presented in statistical tables and figures. The chapter covers response rate, respondent characteristics, reliability testing, descriptive findings on ICT adoption levels across all four process areas, and inferential findings on associations between ICT adoption and each project performance dimension.

4.1 Respondent Characteristics

4.1.1 Response Rate

A total of 105 structured questionnaires were distributed to NCA Category 1 building contractors across Kenya. The table 1 below presents the response rate obtained from the data collection exercise.

Table 1: Response Rate

Response	Frequency	Response Rate
Returned	99	94%
Not returned	6	6%
Total	**105**	**100%**

As shown in Table 1, 99 out of 105 questionnaires were fully completed and returned, yielding a response rate of 94%. Only 6 questionnaires, representing 6%, were not returned. A response rate exceeding 50% is considered acceptable for research purposes (Kothari, 2009). The 94% response rate obtained in this study is therefore highly satisfactory and provides a sufficiently robust dataset for meaningful statistical analysis and drawing of reliable conclusions regarding the relationship between ICT adoption and performance of public building construction projects in Kenya.

4.1.2 Category of Contractors

The study targeted building contractors registered under NCA Category 1, as this category undertakes projects with unlimited contract amounts and represents contractors most likely to engage ICT in project execution. The table 2 below shows the category distribution of respondents.

Table 2: Category of Targeted Contractors

Category	Percentage
NCA 1	100%
Total	**100%**

Table 2 confirms that 100% of respondents were NCA Category 1 registered building contractors. This homogeneity in respondent category strengthens the validity of the study findings, as NCA 1 contractors handle the largest and most complex public building construction projects in Kenya. Their extensive project experience and exposure to ICT tools in day-to-day operations makes their responses highly relevant and credible for assessing the relationship between ICT adoption and public building construction project performance.

4.2 Reliability of Data Collection Instruments

Before full data collection, the research instrument was subjected to reliability and validity testing to determine its suitability. Cronbach's Alpha statistics were computed using SPSS version 24, with a threshold of 0.7 considered acceptable (Cooper & Schindler, 2008). The table 3 below presents the reliability test results for all study variables.

Table 3: Reliability Statistics

Variable	Cronbach's Alpha	No. of Items	Comments
ICT adoption in design	0.920	3	Accepted
ICT adoption in procurement	0.866	4	Accepted
ICT adoption in supervision	0.886	3	Accepted
ICT adoption for modern construction methods	0.878	3	Accepted
Performance of public building construction projects	0.901	3	Accepted

As shown in Table 3, all five variables recorded Cronbach's Alpha values well above the 0.7 threshold. ICT adoption in design recorded the highest value of 0.920, while performance of public building construction projects recorded 0.901. ICT adoption in procurement, supervision, and modern construction methods recorded 0.866, 0.886, and 0.878 respectively. These values confirm strong internal consistency across all constructs, indicating that the questionnaire was a reliable and valid instrument for measuring the study variables and that the data collected was suitable for further statistical analysis.

4.3 Adoption of ICT in Public Building Construction Projects

4.3.1 ICT Adoption in the Design Process

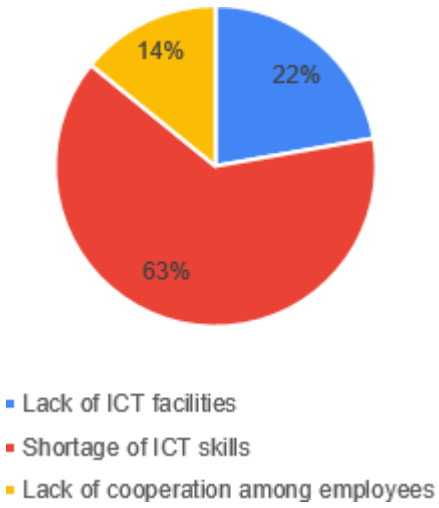
The study investigated the extent to which respondents used ICT tools in the design process, covering architectural designs, structural designs, and project cost estimation. Table 4 presents the descriptive statistics on respondents' level of agreement with ICT use in the design process.

Table 4: Respondents' Level of Agreement on Use of ICT Tools in the Design Process

Statement	Mean	SD
We use ICT tools in the preparation of architectural designs	4.434	0
We use ICT tools in the preparation of structural designs	4.434	0
We use ICT tools in the preparation of project estimates	4.434	3.9

Table 4 shows that respondents strongly agreed that ICT tools were used across all three design process activities, each recording a mean of 4.434. The zero standard deviation for architectural and structural design items indicates unanimous agreement among respondents. Despite high adoption levels, respondents identified challenges in using ICT tools in the design process, which are presented in Figure 3 below.

Figure 3: Challenges of using ICT tools in the design process



Stratford Peer Reviewed Journals and Book Publishing
Journal of Information, Technology and Data Science
Volume 10||Issue 1||Page 71-93||July ||2026|
Email: info@stratfordjournals.org ISSN: 2617-3573

Figure 3 reveals that shortage of ICT skills was the most prevalent challenge, cited by 63% of respondents. Lack of cooperation among employees was identified by 22%, while inadequate ICT facilities accounted for 14%. These findings suggest that while ICT adoption in the design process is high, human capacity constraints represent the most significant barrier. Targeted training programs and institutional investment in ICT skills development are therefore essential to sustaining and improving ICT utilization in the design process of public building construction projects in Kenya.

4.3.2 ICT Adoption in the Procurement Process

The study investigated respondents' use of ICT tools across four key procurement activities: material purchasing, plant and equipment hire, tender document purchase, and tender submission. Table 5 presents the findings on ICT adoption in the procurement process.

Table 5: Respondents' Level of Agreement on Use of ICT Tools in the Procurement Process

Statement	Mean	SD
We use ICT tools in the purchase of public building construction materials	3.564	—
We use ICT tools in the purchase/hire of construction plant & equipment	3.483	—
We use ICT tools in the purchase of tender documents	3.526	—
We use ICT tools in the submission of tender documents	3.483	0.039

As shown in Table 5, respondents agreed that ICT tools are used across all four procurement activities, with means ranging from 3.483 to 3.564. Material purchasing recorded the highest mean of 3.564, while plant hire and tender submission each recorded 3.483. Challenges encountered in the procurement process are illustrated in Figure 4 below.

Figure 4: Challenges of using ICT tools in the procurement process

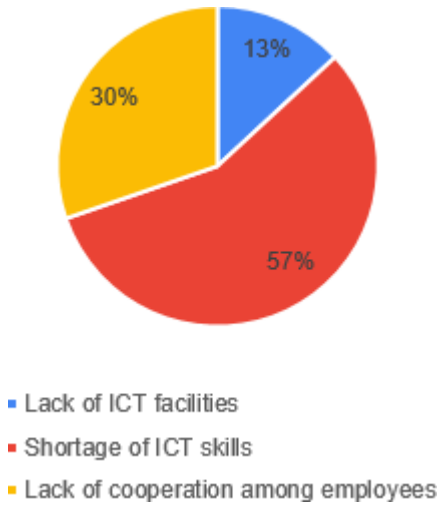


Figure 4 shows that shortage of ICT skills was the leading challenge, cited by 57% of respondents. Lack of cooperation among employees was identified by 30%, while inadequate ICT facilities were cited by 13%. Unlike the design process where skills shortage dominated, the procurement process also reflects significant organizational resistance to ICT adoption. These findings highlight

Stratford Peer Reviewed Journals and Book Publishing
Journal of Information, Technology and Data Science
Volume 10||Issue 1||Page 71-93||July ||2026|
Email: info@stratfordjournals.org ISSN: 2617-3573

the need for both capacity building interventions and organizational change management strategies to improve ICT utilization in procurement within Kenya's public building construction sector.

4.3.3 ICT Adoption in the Supervision Process

The study examined ICT tool usage across three supervision activities: mixing of construction materials, time management, and personnel record keeping on site. Table 6 presents respondents' level of agreement on ICT use in the supervision process.

Table 6: Respondents' Level of Agreement on Use of ICT Tools in the Supervision Process

Statement	Mean	SD
We use ICT tools in the mixing of construction materials	3.414	0.012
We use ICT tools in time management	3.414	—
We use ICT tools in personnel record keeping on site	3.434	—

Table 6 shows that respondents agreed that ICT tools are used across all three supervision activities. Personnel record keeping recorded the highest mean of 3.434, while materials mixing and time management each recorded 3.414. Challenges experienced in the supervision process are illustrated in Figure 5 below.

Figure 5: Challenges of using ICT tools in the supervision process

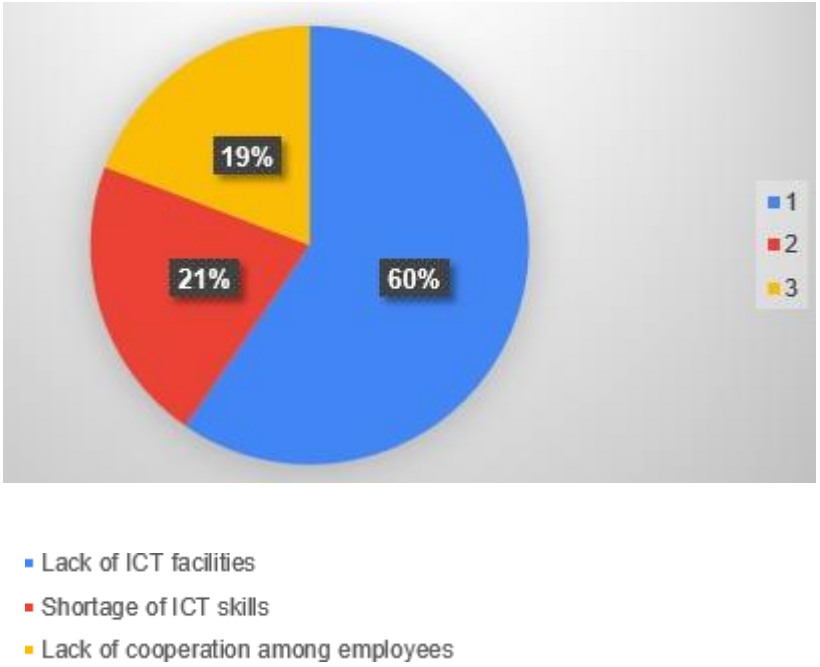


Figure 5 reveals a distinct challenge pattern in supervision compared to other process areas. Lack of ICT facilities ranked highest at 60%, followed by shortage of skills at 21%, and lack of employee cooperation at 19%. This indicates that infrastructure deficiency, rather than human

capacity, is the primary constraint to effective ICT adoption in supervision. Investment in physical ICT infrastructure such as CCTV systems, biometric scanners, and site management software is therefore the most critical intervention needed to improve ICT adoption in the supervision of public building construction projects.

4.3.4 ICT Adoption for Modern Construction Methods

The study investigated ICT tool usage in three modern construction method activities: fabrication of precast flat panel systems, fabrication of 3D volumetric modules, and design of flat slab construction. Table 7 presents respondents' level of agreement on ICT use in modern construction methods.

Table 7: Respondents' Level of Agreement on Use of ICT Tools in Modern Construction Methods

Statement	Mean	SD
We use ICT tools in the fabrication of precast flat panel system	3.434	0
We use ICT tools in the fabrication of 3D volumetric modules	3.434	0
We use ICT tools in the design of flat slab construction	3.434	0

Table 7 shows that respondents agreed that ICT tools are used across all three modern construction activities, each recording a uniform mean of 3.434 with a standard deviation of zero, indicating strong consensus among respondents. Challenges in this area are illustrated in Figure 6 below

Figure 6: Challenges in the use of ICT in Modern Construction Methods

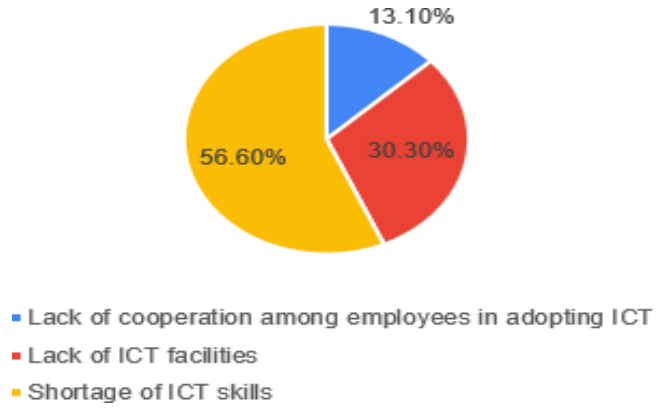


Figure 6 shows that shortage of ICT skills was cited by 57% of respondents as the leading challenge. Lack of ICT facilities was identified by 30%, while lack of employee cooperation accounted for 13%. The low overall adoption ranking combined with prominent skills and infrastructure barriers suggests that modern construction methods remain underutilized in Kenya's public building sector. Creating awareness of the advantages of modern methods over traditional construction approaches, alongside targeted workforce training, is essential for improving uptake.

Stratford Peer Reviewed Journals and Book Publishing
Journal of Information, Technology and Data Science
Volume 10||Issue 1||Page 71-93||July ||2026|
Email: info@stratfordjournals.org ISSN: 2617-3573

4.3.5 Performance of Public Building Construction Projects

The study measured project performance across three dimensions: quality, cost, and time. These constitute the dependent variable of the study. Table 8 presents respondents' level of agreement on performance outcomes when ICT tools were utilized in project execution.

Table 8: Respondents' Level of Agreement on Performance of Public Building Construction Projects

Statement	Mean	SD
The completed building was of high quality	3.387	0.065
The building was completed within the budgeted cost	3.398	—
The building was completed within the specified time	3.505	—

As shown in Table 8, respondents agreed that ICT tool usage positively influenced all three performance dimensions. Time performance recorded the highest mean of 3.505, followed by cost performance at 3.398, and quality performance at 3.387. These findings affirm that ICT tools add strategic value to construction output (Kauffman, 2016). Table 9 below summarizes the overall ranking of ICT adoption across all four independent variables by mean score.

Table 9: Ranking of Independent Variables by Mean

Variable	Mean	Rank
ICT adoption in the design process	4.434	1
ICT adoption in the procurement process	3.514	2
ICT adoption in the supervision process	3.421	3
ICT adoption for modern construction methods	3.343	4

Table 9 confirms that ICT adoption in the design process was the most prevalent, ranked first with a mean of 4.434, followed by procurement (3.514), supervision (3.421), and modern construction methods (3.343). This ranking reflects the maturity of ICT use in design compared to other process areas. However, the relatively lower adoption levels in supervision and modern construction methods indicate significant room for improvement, particularly in infrastructure provision, staff training, and organizational commitment to ICT-driven construction methodologies.

4.4 Relationship Between ICT Adoption and Performance of Building Construction Projects

4.4.1 Classification of Cases

To enable Chi-square analysis, the study data was transformed into binary format. Responses scored 1–3 were coded as 0 (low performance/adoption) and scores of 4–5 were coded as 1 (high performance/adoption). Cross-tabulations were generated for overall performance, quality, cost, and time against each ICT adoption variable, as presented in Tables 10 to 13 below.

Stratford Peer Reviewed Journals and Book Publishing
Journal of Information, Technology and Data Science
Volume 10||Issue 1||Page 71-93||July ||2026|
Email: info@stratfordjournals.org ISSN: 2617-3573

Table 10: Crosstab-Overall Performance vs ICT Adoption

Variable	Category	Performance = 0	Performance = 1	Total
Design process	0	0	1	1
	1	55	43	98
Total		**55**	**44**	**99**
Procurement	0	36	10	46
	1	19	34	53
Total		**55**	**44**	**99**
Supervision	0	23	11	34
	1	32	33	65
Total		**55**	**44**	**99**
Modern construction	0	39	8	47
	1	16	36	52
Total		**55**	**44**	**99**

Table 11: Crosstab- Quality vs ICT Adoption

Variable	Category	Quality = 0	Quality = 1	Total
Design process	0	0	1	1
	1	53	45	98
Total		**53**	**46**	**99**
Procurement	0	37	9	46
	1	16	37	53
Total		**53**	**46**	**99**
Supervision	0	26	8	34
	1	27	38	65
Total		**53**	**46**	**99**
Modern construction	0	41	6	47
	1	12	40	52
Total		**53**	**46**	**99**

Table 12: Crosstab — Cost vs ICT Adoption

Variable	Category	Cost = 0	Cost = 1	Total
Design process	0	0	1	1
	1	56	42	98
Total		**56**	**43**	**99**
Procurement	0	36	10	46
	1	20	33	53

Variable	Category	Cost = 0	Cost = 1	Total
Total		**56**	**43**	**99**
Supervision	0	24	10	34
	1	32	33	65
Total		**56**	**43**	**99**
Modern construction	0	39	8	47
	1	17	35	52
Total		**56**	**43**	**99**

Table 13: Crosstab — Time vs ICT Adoption

Variable	Category	Time = 0	Time = 1	Total
Design process	0	0	1	1
	1	48	50	98
Total		**48**	**51**	**99**
Procurement	0	34	12	46
	1	14	39	53
Total		**48**	**51**	**99**
Supervision	0	21	13	34
	1	27	38	65
Total		**48**	**51**	**99**
Modern construction	0	34	13	47
	1	14	38	52
Total		**48**	**51**	**99**

Tables 10 to 13 present the frequency distribution of ICT adoption against each performance dimension. The crosstabulations reveal consistent patterns across all performance indicators: contractors who adopted ICT in procurement and modern construction methods recorded notably higher performance outcomes compared to those who did not. For instance, in overall performance, 34 out of 53 high ICT adopters in procurement recorded good performance, compared to only 10 out of 46 low adopters. Similarly, in modern construction methods, 36 out of 52 high adopters recorded good overall performance. These patterns provide the distributional basis for the Chi-square tests of association presented in subsequent sections.

4.4.2 Association Between ICT Adoption and Overall Project Performance

The study used Pearson Chi-square tests to determine whether significant associations exist between ICT adoption in each process area and overall project performance. The null hypothesis tested was that no significant association exists between ICT adoption and performance. Table 14 presents the Chi-square test results for overall performance.

Table 14: Overall Project Performance vs ICT Adoption

ICT Variable	Pearson Chi-Square	df	p-value	Fisher's Exact (2-sided)	Significance
ICT in Design Process	1.263	1	0.261	0.444	Not significant
ICT in Procurement Process	17.940	1	<.001	<.001	Significant
ICT in Supervision	3.066	1	0.080	0.092	Not significant
ICT for Modern Construction	27.253	1	<.001	<.001	Significant
N of Valid Cases	99				

Table 14 shows that ICT adoption in design ($X^2 = 1.263$, $p = .261$) and supervision ($X^2 = 3.066$, $p = .080$) were not significantly associated with overall project performance. ICT in procurement ($X^2 = 17.940$, $p < .001$) and modern construction methods ($X^2 = 27.253$, $p < .001$) were both significantly associated with overall performance. The non-significance of ICT in design is explained by the fact that most contractors tender for projects already designed by the Department of Public Works, meaning they rarely apply ICT at the design stage. ICT in procurement improved overall performance through material purchasing systems, plant hire record-keeping, online tender purchase, and electronic tender submission, reducing time wastage and transportation costs. ICT in modern construction methods, recording the strongest association, improved overall performance through precision fabrication of prefabricated components assembled on site, eliminating many labour-intensive traditional construction processes.

4.4.3 Association Between ICT Adoption and Quality Performance

The study further examined the association between ICT adoption in each process area and quality performance specifically. Quality was operationalized as the extent to which completed buildings met the required standards. Table 15 presents the Chi-square test results for quality performance.

Table 15: Quality Performance vs ICT Adoption

ICT Variable	Pearson Chi-Square	df	p-value	Fisher's Exact (2-sided)	Significance
ICT in Design Process	1.164	1	0.281	0.465	Not significant
ICT in Procurement Process	24.994	1	<.001	<.001	Significant
ICT in Supervision	10.951	1	0.001	0.001	Significant
ICT for Modern Construction	38.312	1	<.001	<.001	Significant
N of Valid Cases	99				

Table 15 shows that ICT in design was not significantly associated with quality performance ($X^2 = 1.164$, $p = .281$), again attributable to pre-designed drawings provided by the Department of Public Works. ICT in procurement ($X^2 = 24.994$, $p < .001$) significantly improved quality through established supplier payment systems and computerized material mixing for accurate composition and colour. ICT in supervision ($X^2 = 10.951$, $p = .001$) significantly enhanced quality by deploying

CCTV cameras, biometric systems, and timers to prevent material theft and monitor workmanship standards. ICT in modern construction methods recorded the strongest association with quality ($X^2 = 38.312$, $p < .001$), driven by the precision fabrication of prefabricated factory-made components, which inherently produces higher quality outputs than traditional on-site methods.

4.4.4 Association Between ICT Adoption and Cost Performance

The study assessed whether ICT adoption in each process area was significantly associated with cost performance. Cost performance was measured by the extent to which projects were completed within the budgeted amounts. Table 16 presents the Chi-square test results for cost performance.

Table 16: Cost Performance vs ICT Adoption

ICT Variable	Pearson Chi-Square	df	p-value	Fisher's Exact (2-sided)	Significance
ICT in Design Process	1.316	1	0.251	0.434	Not significant
ICT in Procurement Process	16.461	1	<.001	<.001	Significant
ICT in Supervision	4.144	1	0.042	0.055	Significant
ICT for Modern Construction	23.403	1	<.001	<.001	Significant
N of Valid Cases	99				

Table 16 shows that ICT in design was not significantly associated with cost performance ($X^2 = 1.316$, $p = .251$), consistent with findings across other performance dimensions. ICT in procurement ($X^2 = 16.461$, $p < .001$) improved cost performance by enabling accurate material quantity calculations before ordering, preventing over-procurement and budget overruns. ICT in supervision ($X^2 = 4.144$, $p = .042$) contributed to cost control through CCTV and biometric systems that prevented material theft, ensuring all allocated resources were incorporated into the building. ICT in modern construction methods ($X^2 = 23.403$, $p < .001$) reduced costs significantly through precise component fabrication, which minimized on-site labour requirements and ensured projects were executed within specified budgets.

4.4.5 Association Between ICT Adoption and Time Performance

The study finally assessed the association between ICT adoption and time performance. Time performance was measured by the extent to which projects were completed within the specified duration. Table 17 presents the Chi-square test results for time performance.

Table 17: Time Performance vs ICT Adoption

ICT Variable	Pearson Chi-Square	df	p-value	Fisher's Exact (2-sided)	Significance
ICT in Design Process	0.951	1	0.330	1.000	Not significant
ICT in Procurement Process	22.244	1	<.001	<.001	Significant
ICT in Supervision	3.656	1	0.056	0.061	Not significant
ICT for Modern Construction	20.388	1	<.001	<.001	Significant
N of Valid Cases	99				

Table 17 shows that ICT in design ($X^2 = 0.951$, $p = .330$) and supervision ($X^2 = 3.656$, $p = .056$) were not significantly associated with time performance. Time measurement begins at construction commencement, not the design stage, explaining the non-significance of design ICT. Supervision ICT tools such as CCTV and biometric systems can theoretically monitor personnel time, but their benefits require strict management enforcement mechanisms that most respondents had not fully implemented. ICT in procurement ($X^2 = 22.244$, $p < .001$) significantly improved time performance by enabling timely online material ordering and reliable delivery tracking. ICT in modern construction methods ($X^2 = 20.388$, $p < .001$) dramatically improved time performance, with prefabricated component systems eliminating formwork, steel fixing, and concrete curing processes, reducing project delivery time by up to 50%.

5.0 Conclusion

The study concludes that ICT adoption in the design process does not significantly influence the performance of public building construction projects in Kenya, since contractors receive pre-designed drawings from the Department of Public Works and rarely engage ICT tools independently at the design stage. However, ICT adoption in the procurement process significantly and positively influences overall, quality, cost, and time performance. Contractors utilizing ICT-enabled purchasing systems, electronic plant hire management, online tender acquisition, and electronic tender submission demonstrated superior performance outcomes across all three dimensions. ICT tools enabled accurate material quantity calculations, minimized transportation costs, reduced time wastage, and ensured timely material delivery, resulting in buildings completed on time, within budget, and to acceptable quality standards. Inadequate ICT skills and poor employee cooperation remain the most critical barriers requiring systematic attention.

The study further concludes that ICT adoption in the supervision process has a significant but selective relationship with project performance, positively influencing quality and cost but not overall or time performance. CCTV cameras, biometric attendance systems, and electronic timers deterred material theft and monitored workmanship, but their full potential remained unrealized due to insufficient management enforcement. ICT adoption in modern construction methods demonstrated the strongest and most consistent positive relationship with performance across all

three dimensions. Prefabrication systems eliminated labour-intensive traditional processes, significantly reducing delivery time and construction costs while improving quality. Despite this superior impact, modern construction method adoption ranked lowest among all process areas, representing a critical missed opportunity driven by skills shortages, inadequate infrastructure, and persistent cultural resistance to departing from traditional construction practices in Kenya's public building construction sector.

6.0 Recommendations

The study recommends that contracting organizations and the Government of Kenya should prioritize investment in structured ICT skills development programs for all personnel involved in public building construction projects. Training programs should cover design software, e-procurement systems, supervision tools, and modern construction fabrication technologies. Organizations should partner with technical institutions, universities, and ICT firms to deliver targeted and industry-relevant training curricula. The Ministry of Public Works should incorporate mandatory ICT competency requirements into contractor registration and renewal criteria under the National Construction Authority framework. Additionally, organizations should acquire adequate ICT infrastructure including biometric systems, CCTV cameras, e-procurement platforms, and fabrication equipment, supported by government fiscal incentives such as tax relief and subsidized financing to make acquisition accessible to small and medium-sized contractors across Kenya.

The study recommends that contracting organizations should actively cultivate a culture of teamwork, transparency, and accountability to overcome employee resistance to ICT adoption identified across all process areas. Management should implement change management programs communicating the operational and financial benefits of ICT tools to all staff levels, and should designate internal ICT champions to drive adoption from within. The National Construction Authority should develop best practice guidelines and formally reward contractors demonstrating exemplary ICT utilization. Furthermore, the Government of Kenya should establish national awareness and demonstration programs on modern construction methods, showcasing prefabrication and industrialized building systems as viable alternatives to traditional construction. Contractors should be required to incorporate modern construction methods into public building projects as a contractual condition of award, thereby institutionalizing adoption and driving sustained performance improvement across Kenya's public building construction sector.

REFERENCES

Adriaanse, A., & Voordijk, H. (2005). Interorganisational communication and ICT in construction projects. *Construction Innovation*, *5*(4), 191–203.

Aftab, H. M. (2011). Causes of cost overrun in construction projects. *Interdisciplinary Journal of Contemporary Research in Business*, *3*(1), 831–843.

Alwi, S., Hampson, K., & Mohamed, S. (2008). Factors influencing contractor performance in Indonesia. *Proceedings of the International Conference on Construction Management*, 1–10.

Arditi, D., & Mochtar, K. (2006). Trends in productivity improvement in the US construction industry. *Construction Management and Economics*, *18*(1), 15–27.

Bundi, M. (2011). *Challenges in the management of procurement services within Kenya Rural Roads Authority* (Unpublished master's thesis). University of Nairobi, Nairobi, Kenya.

Cooper, D. R., & Schindler, P. S. (2003). *Business research methods*. Tata McGraw-Hill Publishing Company Limited.

Cooper, D. R., & Schindler, P. S. (2008). *Business research methods* (10th ed.). McGraw-Hill/Irwin.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Sage.

Department of the Environment, Transport and the Regions. (2006). *Key performance indicators for the construction industry*. DETR.

Devarajan, S., & Reinikka, R. (2002). Works for whom? *World Development, 32*(6), 1075–1090.

Emmitt, S., & Gorse, C. (2003). *Construction communication*. Blackwell Publishing.

Fox, A., Smith, R., & Brown, K. (2008). *Performance measurement in construction*. Thomas Telford Publishing.

Gachungi, P. (2017). *Influence of information communication technology application on management of road projects in Kenya* (Unpublished master's thesis). Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya.

Government of Kenya. (2012). *Report on performance of public building construction projects in Kenya*. Ministry of Public Works.

Ibironke, O. T. (2008). Construction economics and management. *Nigerian Institute of Building Journal*, *4*(1), 10–18.

Jameson, D. A. (2013). New options for usability testing projects in business communication courses. *Business Communication Quarterly*, *76*(4), 397–411.

Kagiri, D., & Wainaina, G. (2008). Time and cost overruns in power projects in Kenya: A case study of Kenya electricity generating company. *International Journal of Science and Engineering*, *2*(1), 1–10.

Kaming, P. F., Olomolaiye, P. O., Holt, G. D., & Harris, F. C. (1997). Factors influencing construction time and cost overruns on high-rise projects in Indonesia. *Construction Management and Economics*, *15*(1), 83–94.

Kaplan, R. S. (2010). *Conceptual foundations of the balanced scorecard*. Harvard Business School Publishing.

Karimi, J. (1998). *Factors influencing cost overruns in public construction projects in Kenya* (Unpublished master's thesis). University of Nairobi, Nairobi, Kenya.

Kauffman, R. J. (2016). *ICT adoption and value creation in construction industries*. Springer.

Khaled, A. A. (2005). *Project control process in pre-construction phase*. American Society of Civil Engineers.

Kinuthia, A. W. (2012). *Influence of project management software technology on the performance of construction projects in Nairobi County* (Unpublished master's thesis). University of Nairobi, Nairobi, Kenya.

Kinuthia, G. N., & Were, S. (2015). Influence of project management software technology on the performance of construction projects in Nairobi County. *International Journal of Innovative Social Sciences and Humanities Research*, *3*(1), 82–101.

Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International Publishers.

Kothari, C. R. (2012). *Research methodology: Methods and techniques* (3rd ed.). New Age International Publishers.

Legishion, N., Njeru, L., & Tirimba, O. I. (2013). Assessment of factors affecting disbursement of public funds for rural road projects in Kenya. *International Journal of Scientific and Research Publications*, *3*(12), 1–15.

Long, N. D., Ogunlana, S., Quang, T., & Lam, K. C. (2004). Large construction projects in developing countries: A case study from Vietnam. *International Journal of Project Management*, *22*(7), 553–561.

Lucy, W. (2012). *Factors affecting the adoption of ICT in building construction projects in Nairobi County* (Unpublished master's thesis). University of Nairobi, Nairobi, Kenya.

Mugenda, O. M. (2008). *Research methods: Quantitative and qualitative approaches* (2nd ed.). Acts Press.

Mugenda, O. M., & Mugenda, A. G. (1999). *Research methods: Quantitative and qualitative approaches*. Acts Press.

Musa, J. (1999). *Factors influencing time and cost overruns in public construction projects in Kenya* (Unpublished master's thesis). University of Nairobi, Nairobi, Kenya.

Musa, P. (2012). *Effects of total quality management on performance of companies in Kenya: A case study of Interbuild Company Limited* (Unpublished master's thesis). University of Nairobi, Nairobi, Kenya.

Mwandali, D. (1996). *Causes of delays and cost overruns in public construction projects in Kenya* (Unpublished master's thesis). University of Nairobi, Nairobi, Kenya.

Navon, R. (2005). Automated project performance control of construction projects. *Automation in Construction*, *14*(4), 467–476.

Nwadiani, M., & Igbineweka, P. A. (2005). Budgeting and public expenditure in Nigerian universities. *Journal of Education Administration and Policy Studies*, *1*(1), 1–8.

Okuwoga, A. A. (2008). Cost and time performance of public sector housing projects in Nigeria. *Habitat International*, *22*(4), 389–395.

Orodho, A. J. (2003). *Essentials of educational and social science research method*. Masole Publishers.

Oyewobi, L. O., & Ogunsemi, D. R. (2010). Factors influencing reworks occurrence in construction: A study of selected building projects in Nigeria. *Journal of Building Performance*, *1*(1), 1–20.

Oyewobi, L. O., Ibironke, O. T., Ganiyu, B. O., & Ola-Awo, A. W. (2011). Evaluating rework costs in building construction projects. *Journal of Geography and Regional Planning*, *4*(3), 147–151.

Peansupap, V., & Walker, D. H. T. (2005). Factors enabling information and communication technology diffusion and actual implementation in construction organisations. *Journal of Information Technology in Construction*, *10*(14), 193–218.

Raulea, C., & Raulea, C. (2014). The impact of electronic communication technology on teamwork. *Latest Trends on Computers*, *2*(1), 23–34.

Rumaizah, M., Roshana, T., & Abdul, H. (2013). *Behavioural factors of corruption in the construction industry*. Universiti Teknologi Malaysia Press.

Sekaran, U. (2010). *Research methods for business: A skill-building approach* (5th ed.). John Wiley and Sons.

Sun, M., & Howard, R. (2004). *Understanding IT in construction*. Spon Press.

Talukhaba, A. A. (1988). *An investigation into factors causing construction project delays in Kenya* (Unpublished master's thesis). University of Nairobi, Nairobi, Kenya.

Ugwa, E. A., & Haupt, T. C. (2007). *Construction contractor performance improvement strategies*. Association of Schools of Construction.

UNRWA. (2006). *Report on public building construction project performance*. United Nations Relief and Works Agency.

Weippert, A., Kajewski, S., & Tilley, P. (2003). Online ICT and the construction industry: Attitudes, beliefs and perceptions from industry personnel. *International Journal of Construction Information Technology*, *11*(1), 23–46.