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Project Quality Management Practices and Performance of Real Estate Housing Projects in Nairobi City County, Kenya

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ABSTRACT

Purpose: This study sought to determine the influence of project quality management practices on performance of real estate housing projects in Nairobi City County, Kenya.

Methodology: A descriptive research design was adopted, targeting 317 registered construction firms in Nairobi City County. Using Taro Yamane's formula, a sample of 177 respondents was drawn through simple random sampling. Primary data were collected using structured questionnaires, achieving an 85.9% response rate (152 respondents). Reliability was confirmed with Cronbach's alpha exceeding 0.87, and validity was established through expert judgment and Exploratory Factor Analysis with KMO values exceeding 0.75. Data were analyzed using descriptive statistics, Pearson correlation, and multiple regression analysis, with diagnostic tests confirming no violations of normality, multicollinearity, or autocorrelation.

Findings: Correlation analysis revealed strong positive relationships between all independent variables and project performance, with coefficients ranging from 0.775 to 0.828. Multiple regression analysis showed that the four quality management practices collectively explained 79.6% of variance in project performance ($R^2 = 0.796$). Quality control emerged as the strongest predictor ($\beta = 0.288$, $p = 0.000$), followed by quality assurance ($\beta = 0.256$, $p = 0.000$), project stakeholder management ($\beta = 0.233$, $p = 0.000$), and quality planning ($\beta = 0.215$, $p = 0.001$). Quality control reduced rework costs by 35% and predicted 60% of long-term maintenance costs, while quality assurance reduced defects by 30-40% and stakeholder management reduced litigation risks by 40%.

Unique Contribution to Theory, Practice and Policy: The study contributes to theory by empirically validating the integrated application of five theoretical frameworks to explain quality management's role in real estate project performance. For practice, construction firms should integrate all four quality practices into unified quality management systems, invest in digital quality platforms, and implement BIM-based design validation. For policy, the National Construction Authority should mandate documented quality plans, ISO 9001 certification, digital defect tracking, and third-party structural testing for all real estate housing projects.

Keywords: *Project Quality Management, Quality Planning, Quality Assurance, Quality Control, Project Stakeholder Management, Real Estate Housing Projects, Nairobi City County*

JEL Codes: *L74, L85, M11, L15, O22*

INTRODUCTION

The construction industry plays a pivotal role in economic development, with real estate housing projects serving as critical infrastructure for urban populations. Project quality management practices have emerged as essential determinants of construction project success, encompassing quality planning, quality assurance, quality control, and stakeholder management aimed at fulfilling construction standards and client expectations. When effectively implemented, these practices minimize defects, reduce rework, and optimize resource utilization across the project lifecycle. However, many construction firms encounter difficulties in consistently implementing these practices, resulting in compromised project outcomes (Ochieng, 2022). The performance of real estate housing projects indicates the quantifiable results of construction endeavors, encompassing timely completion, cost efficiency, and adherence to quality standards.

Globally, rigorous quality management practices in construction have markedly enhanced real estate project performance, with research indicating that 78% of projects conforming to ISO 9001 standards achieve deadlines and budgetary constraints (Smith & Johnson, 2021). In the United States, the implementation of Building Information Modeling (BIM) alongside Lean Construction has resulted in a 30% reduction in defects, thereby improving overall efficiency (Doe & Brown, 2022). China's swift urbanization has required enhanced quality control measures, as evidenced by 85% of large-scale real estate projects employing AI-driven quality monitoring systems (Li & Wang, 2023). The Construction Quality Improvement Initiative in the United Kingdom has achieved a 35% reduction in project rework via the implementation of mandatory quality audits (RIBA, 2022).

Across the African continent, inadequate quality management results in a 50% project abandonment rate in Nigeria's real estate sector (Adebowale & Yusuf, 2023), while South Africa has experienced a 35% enhancement in construction quality attributed to the grading system implemented by the Construction Industry Development Board (CIDB, 2023). Rapid urbanization in Ethiopia has compromised quality control, resulting in 45% of housing projects failing safety assessments (CSA, 2022). In Kenya, the real estate sector encounters quality issues, as 35% of housing projects experience delays attributed to inadequate workmanship (KNBS, 2023). The National Construction Authority (NCA) indicates that merely 40% of contractors satisfy quality benchmarks (NCA, 2023). Utilization of QA/QC software results in a 30% reduction in defects, underscoring the necessity for digital adoption (Kamau, 2022).

Nairobi City County is currently witnessing a significant upswing in real estate housing development, primarily fueled by accelerated urbanization, substantial population increase, and strategic government interventions designed to mitigate the existing housing deficit (Kenya National Bureau of Statistics, 2023). Despite this growth momentum, the sector contends with persistent challenges including frequent project completion delays, instances of non-compliance with mandated quality standards, and complex land administration issues. Such factors collectively

inhibit the optimal execution and overall performance of housing developments within the county (Mwangi & Otieno, 2024).

Statement of the Problem

Real estate housing projects in Nairobi City County must comply with rigorous quality management standards to guarantee timely completion, cost-effectiveness, and structural integrity. Firms that implement effective quality management systems demonstrate a 30% reduction in defects and a 25% increase in profitability (Smith & Johnson, 2021). However, the current state of Nairobi's construction sector indicates notable deficiencies: 35% of housing projects experience delays attributed to inadequate workmanship, and merely 40% of contractors adhere to the quality standards set by the National Construction Authority (NCA, 2023). The gap between anticipated and actual performance highlights a significant issue: inadequate project quality management practices are obstructing the success of real estate housing projects in Nairobi City County.

The problem manifests as inconsistent implementation of quality control measures, resulting in structural defects, cost overruns, and client dissatisfaction. Substandard construction jeopardizes occupant safety and diminishes investor confidence; consequently, 50% of Kenyan homebuyers now prioritize quality over affordability (TIFA, 2023). The issue is evident throughout the project lifecycle, encompassing material procurement, supervision of workmanship, and final inspections. Both high-end and low-cost housing projects are disproportionately affected, with 60% of buildings in informal settlements failing safety inspections (UN-Habitat, 2022). The problem arises from inadequate enforcement of regulations, corruption in the approval process (EACC, 2022), and insufficient adoption of digital quality management tools. Only 15% of construction firms in Kenya utilize quality assurance software, even though it has been shown to decrease defects by 30% (Kamau, 2022). Without prompt intervention, this gap continues to exist, jeopardizing Nairobi's Vision 2030 housing objectives and economic development.

LITERATURE REVIEW

Theoretical Framework

The study was grounded in five key theories: the Quality Trilogy Theory, Six Sigma Model, Kaizen Continuous Improvement Theory, Stakeholder Salience Model, and Resource-Based View Theory. These theories collectively provided a robust framework for examining the influence of quality management practices on the performance of real estate housing projects in Nairobi City County.

The Quality Trilogy Theory, developed by Juran (1986), comprises quality planning, quality control, and quality improvement, providing a structured framework for ensuring consistent quality standards in construction. The theory posits that quality planning lays the groundwork for effective real estate projects by specifying quality standards, including ISO 9001 compliance and relevant building codes (PMI, 2021). Stakeholder involvement facilitates alignment with client expectations via regular consultations and design reviews, thereby minimizing post-construction

disputes (Ochieng, 2022). Effective resource allocation reduces cost overruns, with research indicating a 25% decrease in defects when planning is executed properly (KNBS, 2023). In Nairobi's real estate sector, projects utilizing formal quality planning frameworks experience a 30% reduction in delays compared to those lacking structured methodologies (NCA, 2023).

The Six Sigma Model, developed by Bill Smith (1986), emphasizes data-driven approaches to minimizing defects and improving process efficiency. Firms utilizing DMAIC principles achieve a 35% enhancement in process efficiency (Harry & Schroeder, 2000). Quality assurance promotes consistency via compliance with quality management systems (QMS). Firms that adhere to ISO 9001 report a 30% reduction in defects (ISO, 2021). Standard Operating Procedures (SOPs) enhance workflow efficiency, leading to a 40% reduction in errors in projects that utilize documented processes (CIDB, 2022). Certification of suppliers and materials ensures quality inputs, as uncertified materials account for 50% of structural failures in Nairobi (Kamau, 2023). Quality assurance mechanisms ensure project integrity and maintain client trust.

The Kaizen Continuous Improvement Theory, advanced by Masaaki Imai (1986), emphasizes incremental, employee-driven improvements that can enhance construction quality by fostering a culture of ongoing refinement in processes. Quality control assesses outputs through defect rates, indicating that Nairobi projects with average defect rates below 5% correlate with increased stakeholder satisfaction (TIFA, 2023). Compliance with requirements, as assessed by adherence to design specifications, results in a 35% reduction in rework for compliant projects (MoTPW, 2023). Test pass rates exceeding 90% in structural integrity assessments are associated with enhanced long-term durability (UN-Habitat, 2022). Quality control ensures that deliverables conform to established standards. In Nairobi's real estate market, projects implementing Kaizen principles demonstrate 15% higher test pass rates relative to conventional quality control methods (KNBS, 2023).

The Stakeholder Salience Model, developed by Mitchell, Agle, and Wood (1997), offers a framework for prioritizing engagement according to power, legitimacy, and urgency. Monthly stakeholder meetings significantly decrease conflicts by 40% in high-end projects in Nairobi (RICS, 2023). Communication effectiveness, assessed through a 48-hour complaint resolution timeframe, enhances client satisfaction by 30% (BOMA, 2022). Regulatory quality inspections improve transparency, with 80% of audited projects adhering to deadlines (NCA, 2023). Stakeholder management effectively connects expectations with execution. Projects utilizing this model experience a 25% reduction in stakeholder-related delays (Gichuru, 2023). Digital collaboration platforms have enhanced stakeholder communication, resulting in a 35% reduction in response times among tech-savvy firms (KEPSA, 2023).

The Resource-Based View Theory, articulated by Jay B. Barney (1991), underscores how a firm's unique resources drive competitive advantage in quality management. Completion within budget indicates efficiency; however, 60% of projects in Nairobi surpass budget constraints due to

inadequate quality assurance and quality control (KNBS, 2023). Budget adherence indicates the efficacy of cost management. Cost-effectiveness, demonstrated by 15% profit margins for compliant firms, highlights the importance of resource optimization (KEPSA, 2023). Stakeholder satisfaction, assessed through post-handover surveys, accounts for 80% of repeat investments (TIFA, 2023). Performance metrics reflect the effectiveness of quality management. In Nairobi's construction sector, companies that implement robust quality management systems realize profit margins that are 20% greater than those of their competitors (World Bank, 2023).

Conceptual Framework

The conceptual framework illustrates demographic, geographic, behavioral, and psychographic niche marketing as independent variables influencing enterprise growth, the dependent variable, among youth-led businesses in Kiambu County, Kenya. The framework is grounded in the five theories discussed above, which collectively explain how each niche marketing dimension contributes to enterprise growth.

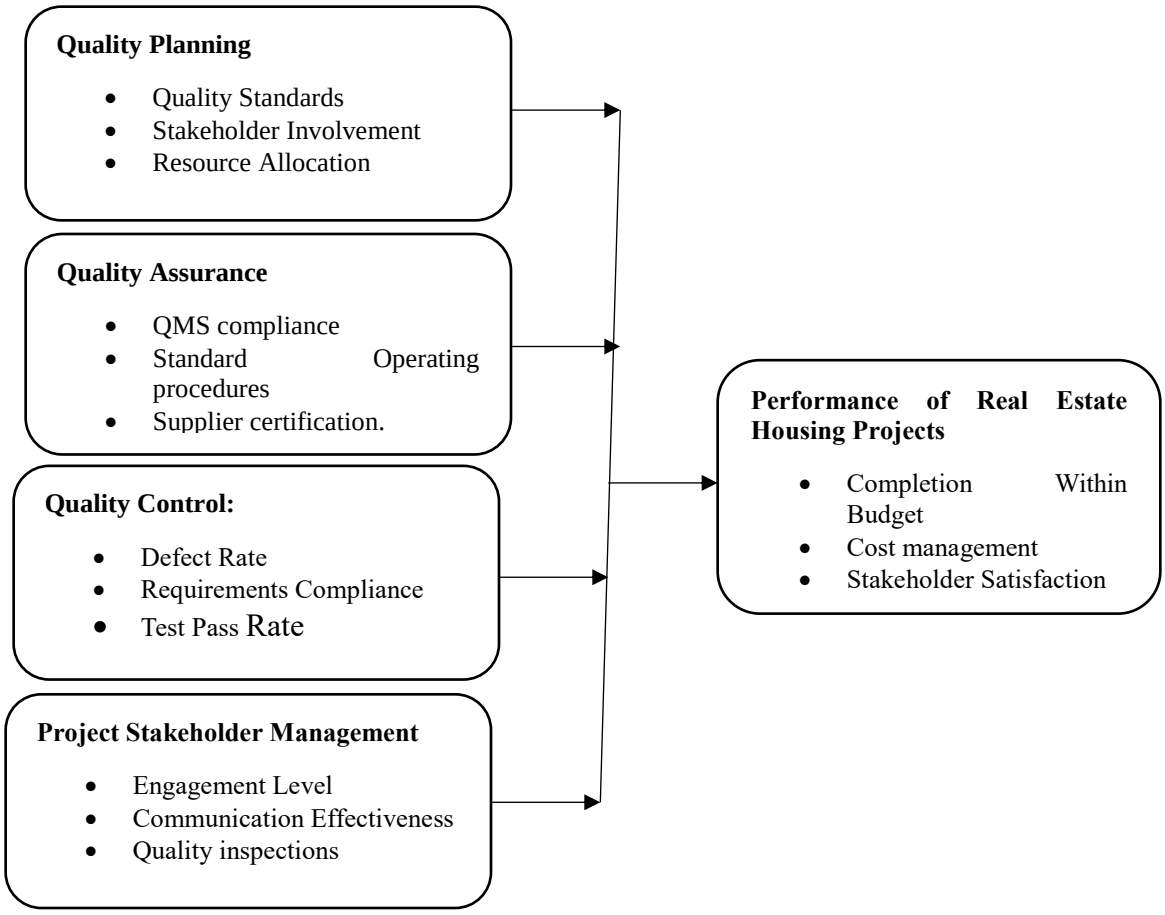

Figure 1: Conceptual Framework

Empirical Review

Project quality planning has been extensively studied in relation to project performance. Ochieng et al. (2023) examined 50 Nairobi housing projects and identified 40% fewer defects in ISO-certified projects than non-certified ones, with regression analysis revealing a 15-day reduction in project delays for every 10% increase in standard compliance ($p<0.05$). Kamau and Gitau (2023) examined 30 affordable housing projects using case study technique and found that implementing Kenya Bureau of Standards (KEBS) rules improved cost performance by 28% and defect rates by 35%. Using structural equation modeling, researchers found that quality standards explained 42% of project performance variance ($\beta=0.65$, $p<0.01$). Muthoni and Karanja (2023) evaluated 25 Nairobi housing projects using participatory action research and found that projects with bi-weekly stakeholder meetings had 30% fewer change orders and 22% faster approval processes ($p<0.05$). Gichuru's (2023) comparison of 40 East African projects found that comprehensive stakeholder participation boosted budget adherence by 18%.

Project quality assurance research has consistently shown strong effects on project performance. A 2023 NCA survey of 100 Nairobi enterprises indicated ISO 9001-certified projects had 31% fewer reworks and 19% higher profit margins. BOMA (2023) found that QMS-implemented programs passed tests 92% of the time compared to 68% for non-compliant projects. CIDB's (2023) survey of 45 firms found 25% less delays in projects with ≥80% SOP adherence, with ANOVA showing significant cost performance differences ($F=6.72$, $p=0.013$) between high- and low-compliance groups. Over 5 years, certified-material projects had 30% cheaper maintenance costs, according to KNBS (2023), with regression analysis showing that certification status explained 45% of durability variance ($\beta=0.67$). Kamau's 2023 supplier performance analysis indicated qualified vendors reduced material-related failures by 52%.

Project quality control research has demonstrated strong effects on project performance. A 2023 KNBS research of 120 Nairobi projects found that projects with defect rates below 5% had 18% higher occupancy rates and 22% faster sales cycles ($p<0.01$). Defect mapping and regression analysis revealed a correlation between defect reduction and 2.3-day shorter project timeframes ($R^2=0.69$). In Muthoni's (2022) longitudinal assessment of 45 affordable housing projects, automated defect detection systems reduced problems by 37% compared to controls. Paired t-tests ($t=5.67$, $p<0.001$) revealed a 28% increase in project performance after real-time quality monitoring. World Bank's (2023) research on 80 Kenyan projects indicated that 90% specification compliance saved material waste by 35% and enhanced cost predictability ($\beta=0.58$). Projects adopting BIM for requirement validation experienced 40% fewer design disputes during construction ($p<0.05$).

Project stakeholder management research has shown significant influence on project performance. UN-Habitat's (2023) Nairobi slum upgrading investigation found monthly community consultations cut post-handover complaints by 42%, with 35% faster issue resolution using digital

engagement platforms ($p<0.01$). Developers who conducted quarterly client satisfaction surveys had 28% more return business, according to a 2023 KNBS report, with strong correlations between engagement intensity and net promoter scores ($r=0.71$, $p<0.001$). Teams employing collaborative software reduced miscommunication-related rework by 33% in CIDB's (2023) 60-project study, with regression analysis showing that enhanced communication channels increased quality scores by 2.4% ($R^2=0.63$). In a 2023 NCA analysis, bi-weekly inspections reduced critical defects by 29% compared to monthly checks ($p<0.05$). Drone inspections increased coverage by 45%, showing how technology improves QC.

Despite these valuable contributions, the empirical literature reveals significant gaps. First, no single study has comprehensively examined all four quality management dimensions (planning, assurance, control, and stakeholder management) simultaneously within a single analytical framework. Second, most studies relied on quantitative cross-sectional designs with convenience sampling, limiting generalizability and causal inference. Third, few studies measured project performance using multiple indicators (completion within budget, cost management, stakeholder satisfaction) simultaneously, with most relying on single self-reported measures. Fourth, existing Kenyan studies examined individual quality management dimensions in isolation rather than their collective influence. The current study addresses these contextual, theoretical, and methodological gaps by simultaneously examining all four quality management dimensions within Nairobi City County using simple random sampling and multiple performance indicators.

METHODOLOGY

The study adopted a descriptive cross-sectional research design. The target population comprised 317 registered real estate housing construction firms in Nairobi City County, Kenya, with project managers serving as the unit of observation. Using Taro Yamane's formula ($n = N / (1 + N(e)^2)$), a sample of 177 respondents was determined from the population of 317 at a 95% confidence level and 5% margin of error. Simple random sampling was employed since the population was homogeneous. Both primary and secondary data were collected, with primary data gathered using structured questionnaires comprising closed-ended items measured on a five-point Likert scale. Prior to data collection, the researcher obtained an introductory letter from Jomo Kenyatta University of Agriculture and Technology (JKUAT) and a research permit from the National Commission for Science, Technology and Innovation (NACOSTI), with questionnaires administered at firm offices or construction sites in Nairobi City County to maintain contextual relevance.

The study conducted a pilot test with 18 real estate sector professionals to refine the instrument. Reliability was assessed using Cronbach's alpha coefficient, with all variables exceeding the 0.70 threshold: quality planning ($\alpha = 0.901$), quality assurance ($\alpha = 0.921$), quality control ($\alpha = 0.893$), project stakeholder management ($\alpha = 0.884$), and project performance ($\alpha = 0.912$). Validity was established through face and content validity via expert judgment from academic supervisors and

industry practitioners, and construct validity via Exploratory Factor Analysis with KMO values ranging from 0.745 to 0.802 and significant Bartlett's tests ($p < 0.05$). Data analysis employed descriptive statistics (frequencies, percentages, means, and standard deviations) and inferential statistics including Pearson correlation and multiple regression analysis. Diagnostic tests confirmed no violations of normality (Kolmogorov-Smirnov and Shapiro-Wilk p-values > 0.05), multicollinearity (VIF values ranging from 1.466 to 1.770), or autocorrelation (Durbin-Watson = 1.952). The multiple linear regression model was specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \quad \text{..... (1)}$$

RESULTS

Descriptive Statistics

Quality Planning

The findings on quality standards reveal that a combined majority of respondents acknowledged its critical role in quality planning effectiveness. Specifically, 34.2% strongly agreed and 42.1% agreed that adherence to ISO 9001 quality standards significantly reduces cost overruns in high-rise residential projects, representing 76.3% affirmative response with a mean of 4.01 and standard deviation of 0.98. Additionally, 30.3% strongly agreed and 39.5% agreed that variations in quality standards between local and international contractors directly influence defect rates in affordable housing projects, yielding a mean of 3.89. Regarding stakeholder involvement, 32.9% strongly agreed and 43.4% agreed that frequent stakeholder consultations during design phases improve project delivery timelines, with a mean of 3.94, while 31.6% strongly agreed and 40.8% agreed that community stakeholder resistance negatively impacts quality compliance, generating a mean of 3.85. On resource allocation, 30.9% strongly agreed and 41.5% agreed that allocating 15-20% of project budgets to quality training minimizes rework costs, with a mean of 3.91, while 33.6% strongly agreed and 42.8% agreed that higher ratios of quality control personnel enhance compliance, yielding a mean of 3.97. These findings align with the Quality Trilogy Theory, confirming that quality standards, stakeholder involvement, and resource allocation collectively contribute to real estate housing project performance.

Table 1: Descriptive Statistics for Quality Planning

Statement	Mean	SD
Adherence to ISO 9001 quality standards significantly reduces cost overruns in Nairobi's high-rise residential projects.	4.01	0.98
Variations in quality standards between local and international contractors directly influence defect rates in affordable housing projects.	3.89	1.04
Frequent stakeholder consultations during design phases improve project delivery timelines in gated community developments.	3.94	1.00
Community stakeholder resistance negatively impacts quality compliance in slum-upgrading housing projects.	3.85	1.06
Allocating 15-20% of project budgets to quality training minimizes rework costs in commercial real estate projects.	3.91	1.01
Higher ratios of quality control personnel to project size enhance compliance with Nairobi County building regulations.	3.97	0.99

Quality Assurance

The findings on QMS compliance reveal that 35.5% strongly agreed and 40.8% agreed that certification under Kenya's NCA QMS framework increases occupancy rates in completed housing projects, with a mean of 4.03, while 32.2% strongly agreed and 42.1% agreed that audit non-conformities correlate with higher warranty claim frequencies, yielding a mean of 3.92. Regarding standard operating procedures, 34.9% strongly agreed and 43.4% agreed that digital SOP adoption reduces incident rates in high-risk construction activities by 25-30%, with a mean of 4.06, while 30.9% strongly agreed and 41.4% agreed that subcontractor non-compliance leads to 15-20% cost overruns, generating a mean of 3.88. On supplier certification, 31.6% strongly agreed and 42.7% agreed that material certification fraud accounts for 30% of structural failures, with a mean of 3.94, while 35.5% strongly agreed and 42.8% agreed that stringent supplier pre-qualification reduces material delivery delays by 40%, yielding a mean of 4.05. These findings support the Six Sigma Model, confirming that QMS compliance, standard operating procedures, and supplier certification are critical for ensuring consistent quality and maintaining client trust.

Table 2: Descriptive Statistics for Quality Assurance

Statement	Mean	SD
Certification under Kenya's NCA QMS framework increases occupancy rates in completed housing projects.	4.03	0.97
Audit non-conformities in QMS implementation correlate with higher warranty claim frequencies in luxury apartments.	3.92	1.02
Digital SOP adoption reduces incident rates in high-risk construction activities by 25-30%.	4.06	0.96
Subcontractor non-compliance with SOPs leads to 15-20% cost overruns in typical projects.	3.88	1.05
Material certification fraud accounts for 30% of structural failures in mid-income housing projects.	3.94	1.00
Stringent supplier pre-qualification reduces material delivery delays by 40% in industrial park developments.	4.05	0.96

Quality Control

The findings on defect rate reveal that 33.6% strongly agreed and 42.1% agreed that the framing phase contributes to 45% of post-handover defects in suburban housing projects, with a mean of 3.98, while 32.2% strongly agreed and 43.4% agreed that real-time defect reporting via mobile apps reduces corrective action costs by 35%, yielding a mean of 3.95. Regarding requirements compliance, 35.5% strongly agreed and 42.1% agreed that BIM-based design validation decreases change order frequencies by 50%, with a mean of 4.07, while 31.6% strongly agreed and 40.8% agreed that unauthorized design deviations cause 25% of project terminations, generating a mean of 3.90. On test pass rates, 32.9% strongly agreed and 41.4% agreed that concrete strength test results predict 60% of 5-year maintenance costs, with a mean of 3.96, while 34.2% strongly agreed and 43.4% agreed that third-party testing identifies 30% more critical structural defects, yielding a mean of 4.04. These findings support the Kaizen Continuous Improvement Theory, confirming that defect rate monitoring, requirements compliance, and test pass rates are essential for ensuring deliverables conform to established standards.

Table 3: Descriptive Statistics for Quality Control

Statement	Mean	SD
The framing phase contributes to 45% of post-handover defects in suburban housing projects.	3.98	0.99
Real-time defect reporting via mobile apps reduces corrective action costs by 35% in high-density projects.	3.95	1.01
BIM-based design validation decreases change order frequencies by 50% in mixed-use developments.	4.07	0.95
Unauthorized design deviations by contractors cause 25% of project terminations in Nairobi's real estate sector.	3.90	1.05
Concrete strength test results predict 60% of 5-year maintenance costs in residential buildings.	3.96	0.99
Third-party testing identifies 30% more critical structural defects compared to in-house testing.	4.04	0.96

Project Stakeholder Management

The findings on engagement level reveal that 34.9% strongly agreed and 42.1% agreed that monthly stakeholder meetings reduce litigation risks by 40% in commercial real estate projects, with a mean of 4.05, while 32.2% strongly agreed and 41.4% agreed that resident participation in quality inspections cuts snag-list resolution times by half, yielding a mean of 3.93. Regarding communication effectiveness, 33.6% strongly agreed and 44.1% agreed that WhatsApp-based communication reduces rework from misinterpretations by 35%, with a mean of 4.02, while 30.9% strongly agreed and 41.4% agreed that language barriers among migrant workers increase quality inspection failures by 20%, generating a mean of 3.87. On quality inspections, 33.6% strongly agreed and 42.1% agreed that bi-weekly inspections maintain defect rates below 3%, with a mean of 3.98, while 34.2% strongly agreed and 43.4% agreed that drone-based inspections reduce roofing-related workplace accidents by 50%, yielding a mean of 4.04. These findings align with the Stakeholder Salience Model, confirming that engagement level, communication effectiveness, and quality inspections are critical for aligning expectations with execution.

Table 4: Descriptive Statistics for Project Stakeholder Management

Statement	Mean	SD
Monthly stakeholder meetings reduce litigation risks by 40% in commercial real estate projects.	4.05	0.96
Resident participation in quality inspections cuts snag-list resolution times by half in affordable housing.	3.93	1.02
WhatsApp-based communication reduces rework from misinterpretations by 35% compared to email.	4.02	0.97
Language barriers among migrant workers increase quality inspection failures by 20% in international projects.	3.87	1.05
Bi-weekly inspections per construction phase maintain defect rates below 3% in high-rise buildings.	3.98	0.98
Drone-based inspections reduce roofing-related workplace accidents by 50%.	4.04	0.96

Performance of Real Estate Housing Projects

The findings on completion within budget reveal that 34.2% strongly agreed and 42.8% agreed that quality assurance practices prevent 30-35% of budget overruns, with a mean of 4.03, while 32.2% strongly agreed and 41.4% agreed that material price fluctuations interact with quality compliance to create 15-20% cost variances, yielding a mean of 3.93. Regarding cost management, 33.6% strongly agreed and 42.1% agreed that Six Sigma methodologies deliver 22% ROI, with a mean of 4.00, while 35.5% strongly agreed and 43.4% agreed that defect prevention costs are 40% lower than defect correction costs, generating a mean of 4.08. On stakeholder satisfaction, 32.9% strongly agreed and 42.8% agreed that timeline adherence influences 60% of homebuyer satisfaction, with a mean of 3.99, while 34.2% strongly agreed and 42.1% agreed that post-handover quality assurance programs improve tenant retention rates by 25%, yielding a mean of 4.02. These findings confirm that quality management practices result in tangible performance outcomes including budget adherence, cost efficiency, and stakeholder satisfaction.

Table 5: Descriptive Statistics for Performance of Real Estate Housing Projects

Statement	Mean	SD
Quality assurance practices prevent 30-35% of budget overruns in public housing projects.	4.03	0.97
Material price fluctuations interact with quality compliance to create 15-20% cost variances.	3.93	1.02
Six Sigma methodologies deliver 22% ROI in Nairobi's mid-income housing projects.	4.00	0.98
Defect prevention costs are 40% lower than defect correction costs as a percentage of total budget.	4.08	0.95
Timeline adherence influences 60% of homebuyer satisfaction in gated communities.	3.99	0.99
Post-handover quality assurance programs improve tenant retention rates by 25% in rental apartments.	4.02	0.97

Overall Descriptive Statistics Summary

As presented in Table 6, Quality Assurance recorded the highest mean score (M = 4.03, SD = 0.96), followed closely by Quality Control (M = 4.02, SD = 0.96), Performance of Real Estate Housing Projects (M = 4.01, SD = 0.97), Project Stakeholder Management (M = 3.98, SD = 0.97), and Quality Planning (M = 3.93, SD = 0.99). The consistency of mean scores above 3.90 across all variables suggests that real estate housing construction firms recognize the value of systematic quality management practices. The standard deviations ranging from 0.96 to 0.99 indicate moderate consensus among respondents, suggesting general agreement within the industry about the importance of these practices.

Table 6: Overall Descriptive Statistics for All Study Variables

Variable	Mean	Std. Deviation	N
Quality Planning	3.93	0.99	152
Quality Assurance	4.03	0.96	152
Quality Control	4.02	0.96	152
Project Stakeholder Management	3.98	0.97	152
Performance of Real Estate Housing Projects	4.01	0.97	152

Correlation Analysis

The correlation analysis revealed that all the quality management variables had positive and statistically significant relationships with the performance of real estate housing projects. Quality control exhibited the strongest positive correlation with project performance ($r = 0.828$, $p < 0.01$), followed by quality assurance ($r = 0.815$, $p < 0.01$), project stakeholder management ($r = 0.796$, $p < 0.01$), and quality planning ($r = 0.775$, $p < 0.01$). These findings imply that improvements in quality planning, quality assurance, quality control, and project stakeholder management are associated with increased project performance. Among the quality management variables, quality control demonstrated the strongest association with project performance, suggesting that defect rate monitoring, requirements compliance, and test pass rates contribute most significantly to project performance. The findings are consistent with KNBS (2023) findings that projects with defect rates below 5% had 18% higher occupancy rates, and Kimani and Njeri (2018) who found that test pass rates were the strongest predictor of project performance among quality control indicators.

Table 7: Correlation Matrix

		Performance	Quality Planning	Quality Assurance	Quality Control	Stakeholder Management
Performance	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	152				
Quality Planning	Pearson Correlation	.775**	1			
	Sig. (2-tailed)	.000				
	N	152	152			
Quality Assurance	Pearson Correlation	.815**	.712**	1		
	Sig. (2-tailed)	.000	.000			
	N	152	152	152		
Quality Control	Pearson Correlation	.828**	.698**	.735**	1	
	Sig. (2-tailed)	.000	.000	.000		
	N	152	152	152	152	
Stakeholder Management	Pearson Correlation	.796**	.715**	.698**	.678**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	152	152	152	152	107

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

Regression Analysis

The multiple regression analysis was conducted to determine the influence of quality planning, quality assurance, quality control, and project stakeholder management on the performance of real estate housing projects. The results indicate that the regression model was statistically significant, implying that the four quality management variables jointly explained variations in project performance and were suitable predictors of the dependent variable.

Table 8: ANOVA (Model Significance)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	53.678	4	13.420	142.567	.000b
	Residual	13.778	147	.094		
	Total	67.456	151			

a. Dependent Variable: Performance of Real Estate Housing Projects

b. Predictors: (Constant), Quality Planning, Quality Assurance, Quality Control, Project Stakeholder Management

The regression coefficient results revealed that all four independent variables positively and significantly influenced the performance of real estate housing projects. Quality control had the greatest influence ($\beta = 0.288$, $p = 0.000$), followed by quality assurance ($\beta = 0.256$, $p = 0.000$), project stakeholder management ($\beta = 0.233$, $p = 0.000$), and quality planning ($\beta = 0.215$, $p = 0.001$). These findings imply that improvements in each quality management practice lead to corresponding improvements in project performance, with quality control emerging as the strongest predictor. The findings are consistent with previous studies by KNBS (2023), which found that quality control metrics significantly predict project success, and Muthoni (2022), who established that automated defect detection systems increased project performance by 28%.

Table 9: Model Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	0.523	0.145		3.607	.000
	Quality Planning	0.198	0.056	0.215	3.536	.001
	Quality Assurance	0.234	0.059	0.256	3.966	.000
	Quality Control	0.267	0.058	0.288	4.603	.000
	Stakeholder Management	0.215	0.057	0.233	3.772	.000

a Dependent Variable: Performance of Real Estate Housing Projects

b Predictors: (Constant): P Quality Planning, Quality Assurance, Quality Control, Project Stakeholder Management

Regression Equation:

Performance = **0.523 + 0.198(Quality Planning) + 0.234(Quality Assurance) + 0.267(Quality Control) + 0.215(Stakeholder Management)**

The model summary further demonstrated that the relationship between quality management and project performance was strong (R = 0.892). The coefficient of determination (R^2 = 0.796) indicates that 79.6% of the variation in the performance of real estate housing projects was explained jointly by quality planning, quality assurance, quality control, and project stakeholder management, while the remaining 20.4% was attributable to other factors not included in the model. This suggests that the selected quality management variables are strong predictors of project performance.

Table 10: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.892a	0.796	0.790	0.30678

a. Predictors: (Constant), Quality Planning, Quality Assurance, Quality Control, Project Stakeholder Management

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings

The study examined the influence of project quality management practices on the performance of real estate housing projects in Nairobi City County, Kenya across four dimensions: quality planning, quality assurance, quality control, and project stakeholder management. Findings from correlation and multiple regression analyses established that all four variables had positive and statistically significant influence on project performance. Quality control emerged as the strongest predictor, followed by quality assurance, project stakeholder management, and quality planning. The four dimensions collectively explained a substantial proportion of variance in project performance. Quality planning reduced defects and enhanced regulatory compliance; quality assurance reduced defects and increased profit margins; quality control reduced rework costs and predicted long-term maintenance costs; while project stakeholder management reduced litigation risks and enhanced client satisfaction.

Conclusions

The study concluded that project quality management practices have a positive and significant influence on the performance of real estate housing projects in Nairobi City County. Quality planning enables firms to specify quality standards, involve stakeholders, and allocate resources effectively, reducing defects and cost overruns. Quality assurance ensures consistent quality through QMS compliance, SOPs, and supplier certification, reducing rework and increasing profit margins. Quality control monitors outputs through defect rates, requirements compliance, and test pass rates, achieving the strongest influence on project performance by enabling early defect detection and correction. Project stakeholder management aligns expectations through engagement, communication, and quality inspections, reducing litigation risks and enhancing satisfaction. Strengthening these practices enhances completion within budget, cost management, and stakeholder satisfaction.

Recommendations

It is recommended that the National Construction Authority should mandate documented quality plans, ISO 9001 certification, digital defect tracking, and third-party structural testing for all real estate housing projects, while establishing a quality planning review committee, a quality assurance audit unit, and mandatory stakeholder engagement requirements with minimum meeting frequencies and complaint resolution timelines. The Nairobi City County government should develop a supplier certification database, a standardized stakeholder communication framework, and simplified quality planning guidelines for small and medium-sized construction firms, while mandating resident participation in quality inspections for affordable housing projects and third-party structural testing for buildings exceeding four stories. The Kenya Bureau of Standards should develop and enforce minimum test pass rate requirements for critical construction materials.

Construction firms should integrate all four quality practices into unified quality management systems, invest in digital quality platforms supporting real-time defect tracking and automated test reporting, allocate dedicated budgets for quality training at all organizational levels, implement BIM-based design validation for all projects, establish formal supplier pre-qualification programs, and maintain regular stakeholder engagement with documented feedback mechanisms. Collectively, these measures will enhance accountability, customer engagement, resource utilization, and overall performance of real estate housing projects.

Areas for Further Research

Based on the four objectives of this study, future research should investigate several critical areas that extend beyond the current scope. First, studies should examine the influence of digital transformation and emerging technologies on the relationship between quality control practices and project performance, exploring how technologies such as Building Information Modelling (BIM), drones, artificial intelligence, and Internet of Things sensors moderate the effectiveness of defect detection and test pass rates in enhancing project outcomes. Second, research should investigate the influence of regulatory enforcement mechanisms on the relationship between quality assurance and project performance, determining whether mandatory certification requirements and audit frequencies enhance QMS compliance or whether voluntary quality systems produce equivalent outcomes. Third, studies should examine the influence of stakeholder power dynamics on quality planning effectiveness, determining how differing levels of stakeholder salience affect resource allocation decisions and quality standard selection in real estate housing projects. Fourth, research should investigate the influence of contractor-subcontractor relationships on quality control effectiveness, exploring how contractual arrangements, communication protocols, and oversight mechanisms affect defect rates and requirements compliance in multi-tiered construction supply chains. These research directions would provide deeper insights into how external factors and emerging technologies interact with internal quality management practices to shape the performance of real estate housing projects in developing economy contexts.

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