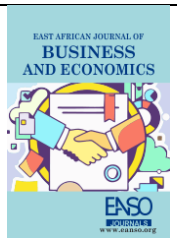

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Original Article

The Influence of Contractors' Selection Attributes. A Study of Public Construction Projects Performance in Kenya

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ABSTRACT

This paper evaluated the influence of contractors' selection attributes on public construction project performance in Kenya. This research contends that an investigation into contractors' selection attributes at the tender evaluation stage is important to enhance the likelihood of public construction project success performance. The study used a survey method and administered questionnaires to 263 respondents selected through stratified sampling. One hundred and eighty-nine (189) practitioners and professionals in state agencies returned filed questionnaires representing a 71.86% return rate. The literature review and interview reveal thirteen contractor selection variables and six project performance criteria. SPSS was used to analyse the data set obtained for reliability, normality, correlation, and logit regression test. Logit regression analysis reveals the omnibus test of model coefficients converged (Chi-square=26.116, df=13, p=0.016). The model summary reveals Nagelkerke R^2 of 0.246 indicating a relationship of 24.6% between the thirteen predictor variables and project performance indicators. It was found that contractors quoted tender price (Exp (B) = 1.866), innovation (Exp (B) = 2.808), and occupation health and safety (Exp (B) = 0.358) significantly influence the performance of public construction projects when all other contractor's selection variables are controlled. This indicates that the contractor's quoted tender price, innovation, and occupation health and safety explain well the success of the public construction project from thea six (performance by budget, time, procuring entity satisfaction, environmental sustainability, quality specifications, and fulfilling public need) project performance indicators.

APA CITATION

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INTRODUCTION

The construction sector is vital for the development of any nation and the development of projects such as roads, buildings, bridges, dams, sewerage, and water supply are the measure of their economic growth . In Kenya, the sector is one of the largest growing industries across the nation. The construction sector contributed 4.8 percent of Kenya's Gross Domestic Product (GDP), which rose to Kenya Shilling 5.36 trillion from 4.73 trillion in 2013 representing a nominal growth of 13.3 percent, according to the economic survey by the Kenya National Bureau of Statistics . The budget summary for the fiscal year 2022-2023, building onto Kenya's Vision 2030 stands for, the government allocated a colossal amount worth 212 billion for classified roads, 45.9 billion for water and sewerage infrastructure, and 27.4 billion Kenya Shilling for housing, urban development, and public works . The public procurement of construction projects consumes 10% of the National Budget, as indicated in the Printed Estimates . Its contribution is valued at over 50% in terms of demand, which is significant for a single client .

Despite its importance, the construction sector in developing countries has mostly underperformed .The public construction projects require competent contractors for effective and efficient implementation (Mushori *et al.*, 2020). Selecting a capable contractor is one of the most important tasks faced by clients who wish to achieve project success . Contractor selection involves tender evaluations which include many different parameters, such as quoted bid price, technical competence, management capability, earlier experience, environmental, quality management system, health and safety, innovation, and financial soundness . Indeed, it can be said that implementing a contractor selection and identifying the significant variables for competent contractors and their recognition is an essential step in making progress in the achievement of the Kenya Vision 2030 and aligns well with the Bottom-Up Economic Transformation Agenda (BETA) 2022-2027, and the 2030 Agenda for Sustainable Development Goals (SDGs). The 2030 SDGs, envisage the development of quality, reliable, sustainable, and resilient infrastructure, to support economic growth and human well-being with a focus on affordable and equitable access for all .

A construction project's success is highly dependent on a contractor (Yawei *et al.,* 2005). Rao *et al.* (2016) observed that adjusting success chances in construction projects and choosing an appropriate contractor are among the major assessments to be taken by clients. Contractor selection at the tender evaluation stage is a process of investigating and aggregating the results of the evaluation to identify the optimum choice (Holt,1998). A careful contractor selection considering the variables such as experiences, competencies, and altitude can lower cost as well as time overruns simultaneously improving the overall quality of work as well as environmental sustainability (Rao *et al.*,2016). Research

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observations indicate that the main challenge in public construction in Kenya is the failure of most of the contractors to deliver projects within the expected time frame, and expected cost and meet quality specifications upon completion (Ogwen *et al.*, 2016; World Bank, 2014). One main reason why performance in construction projects is compromised is due to rogue contractors (Mushori *et al.,* 2019). Many of the new entrants into the construction sector have little construction-related education and skills but these individuals are still allowed to set up construction companies . The contractor selection process comprises five common subsystems, for all types of procurement arrangements that include project packaging, invitation, prequalification, shortlisting, and tender evaluation (Hatush & Skitmore,1997). Tender evaluation is an attempt to select the best contractor is one of the major challenges that face public clients in selecting the best construction contractor. In Kenya for instance, the public procurement exercise adheres to the Public Procurement and Asset Disposal Act 2015(revised 2022) and involves different types of variables to evaluate the overall suitability of the contractor. In the current method of contractor selection, ad-hoc tender committee members choose bidders by the terms of reference (TOR) predetermined by the procuring public entity. However, the selection result is not always objective because the ad-hoc committee members have subjective preferences (Cheng *et al.*,2020).

Appropriate contractor selection processes remain a panacea in the mitigation of poor quality, time, and cost overruns on public construction projects (Eriksson,2007). The public construction projects in Kenya have suffered cost escalation, delayed completion, and site abandonment due to inadequate contractor selection processes. Contractor selection is often performed by professionals or any other public officers appointed by the appointing authority in an ad-hoc evaluation committee using their accumulated experience and judgment. There are variations in the amount of effort expended in the bid evaluation process, often without an understanding of how such variations influence the project outcome. Despite the efforts by the government of Kenya to improve the delivery of publicly funded construction projects through the Public Procurement and Asset Disposal Act 2015, their successful performance remains abeyance. The procurement law which is anchored in the Kenyan constitution is meant to improve the efficiency and effectiveness of the contractor evaluation process and to enhance the achievement of the project objectives and value for money, but this has not always been the case (Wahome *et al.,* 2013). The reports of the Office of Auditor General (OAG) in Kenya over the past have consistently revealed irregularities in contractor selection in public institutions . There is also evidence to suggest that, in Kenya, large numbers of construction projects have failed because of a lack of competence and ability of the contractors, which has hurt the development and growth of the nation (Nyika, 2012; Ondari & Gakera, 2013; Oguya & Muturi, 2016; Mushori, 2019). A study on risk management in Kenya's construction industry revealed that contractor incompetence is one of the risk management challenges in Kenya . Indeed, it can be said that implementing a contractor selection and identifying the significant attributes of competent contractors and their recognition is an essential step in making progress in the achievement of the BETA 2022-2027, Kenya Vision 2030 and aligns well with the 2030 Agenda for Sustainable Development Goals (SDGs).

LITERATURE REVIEW

Contractor Selection

The evolution of contractor selection started in the early age of the construction industry, and by the end of the 18th century builders and architects had established the traditional procurement process. The contractor selection process involves the use of different procurement and evaluation methods . The selection of suitable contractors is directly related to construction project success and achievement of specified objectives; therefore, contractor selection constitutes a critical decision for any public entity (Watt *et al.*,2010). According to Watt *et al.,* (2010), the selection of contractors

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occurs at the early stages of the project life cycle. Several selection procedures occur at this stage such as open tendering, restricted tendering, prequalification, or negotiation which are based on countries' jurisdiction laws and regulations are currently practised for contractor selection. In an open tendering process, every contractor can apply and after a bid evaluation process, the optimal bid is awarded the contract . Traditionally and by default, one of the most frequent procedures used for selecting contractors is open tendering (competitive) where the lowest bidder is awarded the contract .

Kenya, a developing country is a member of the Organisation for Economic Cooperation and Development (OECD) and World Trade Organisation (WTO) has adopted the United Nations Commission on International Trade Law (UNCITRAL) model law and introduced modifications involving defined procedures, for bid evaluation to this "lowest bidder" criterion (Arrowsmith,2010). As a result, we created a construction contractor generation at the cheer of procurement officers that is mindful of nothing other than being the lowest bidder . The variation in these procedures, however, still serves the common objective of selecting a qualified contractor on a competitive basis in the public sector. The procedures in Kenya broadly follow the concept outlined in the Public Procurement and Assets Disposal Act 2015(revised 2022). The evaluation and comparison are done using the procedures and variables set out in the tender documents. On the other hand, the evaluation of contractors considers specific variables that can measure the suitability of the contractor for the proposed project (Holt,1998). Contractor evaluation is different from contractor selection. Contractor selection refers to the process of aggregating the results of the evaluation to identify the optimum choice, while contractor evaluation is the process of investigating or measuring project variables (Holt,1998). The two processes are always grouped to represent a single procedure. The purpose of the tendering procedure is to select an appropriate contractor, at a time appropriate to the circumstances, and to obtain from him at the proper time an acceptable tender or offer upon which a contract can be let . The contractor's bid evaluation processes of assessing weights and scores of contractor's attributes have been criticized as arbitrary and subjective and the lack of a standard methodology increases the scope of misuse . Hence, the results associated with the selection of contractors are found to be unrealistic assessment leading to incompetent contractor selection. The following list includes most of the key variables that should be assessed when conducting contractor selection: financial soundness, reputation, technical ability, management capability, quality management, health and safety record, innovation ability, quoted tender price, environmental sustainability, experience (Mushori,2019; Ayettey & Danso,2018; Alzhrani *et al.,* 2013) and social sustainability . Munano (2012) acknowledges that many projects that are from the public sector have underperformed. For instance, the rate of completing public projects in Kenya from 2007/2008 -2011/2012 financial years was 37.97%, 47.53%, 33.14%, and 21.88%, average percentage completion rate of 35.13% (Munano,2012). Research observation on determining factors influencing the successful completion of construction projects in Kenya indicated that the contractor's capacity significantly influenced the project performance . Further study by Kithinji and Kamara in Meru County in Kenya revealed innovation and financial soundness influence road construction project completion. In the search for empirical evidence Mushori *et al.,* (2020) examined the influence of the contractor's capacity using correlation design and revealed that contractors' attributes had a statistically significant influence on project performance and recommended a robust evaluation method of contractor attributes.

THEORETICAL FRAMEWORK

Public Value Theory

Moore, (1995) formulated the Public Value theory (PVT) to provide public sector managers with a greater understanding of the constraints and opportunities within which work, and the

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challenge to create publicly valuable outcomes . Public value is combining safeguarding and enriching the 'public sphere' with the delivery of 'what is the public values' . Public value theory centres on three facets namely, the government's role as a producer of value, public officers' role as caretakers of public assets who have to maximize them for public value, and the systems essential to these officers to guarantee service reliability and consistency . The theory posits that the works of public officers depend on what matters for the public good of citizens without shrinking the value of economic measures (Benington, 2011). Moore (1995), posits that the public entities must ensure that the services they offer to the public must be of the highest quality and acceptable.

The relationships among government agencies and contractors constitute an arena of public provision that not only constitutes public values but also where responsibility and transparency are problematic . The public value theory envisages a manager's purpose as going beyond implementation policy and adherence to institutional norms. The theory is important in explaining how the implementation of public procurement policies is envisaged to create value for money. However, the achievement of the public value for money objective demands attention throughout the entire public procurement process . After the contract award phase, timely deliveries by contractors within the budget and in line with the needs and specifications of the entities are required. The theory applied to this study, the selection of contractors for public construction projects must ensure that only the most appropriate and qualified contractors are selected to provide the best public value. Public construction projects play an important role in social economic development in Kenya, and because the state entities have an important role in implementing the public construction projects, the decisions that the state entities make in procuring must first and foremost ensure that the public gets the value for money. Additionally, the procurement decisions that are made and the contractors awarded the contracts must meet all the variables and hence most appropriate to implement the contract.

Construction Management Theory

The use of theories in construction management (CM) research is unique and different from other fields of research . Radosavljevic and Bennet (2012) attempt to provide a foundation by proposing a theory of construction management that identifies the actions that help construction projects and companies to be efficient . Construction management is a set of functions where different techniques are employed. Some of the functions are based on or can be explained by various scientific theories . In light of the multidisciplinary nature of the CM problem, theories from different disciplines are relied upon as explanatory and predictive frameworks in CM. In contrast to many fields of research, there is no universal and explicit theory of construction management .

Koskela (2002) in his theoretical foundation explains the novel features of construction management for instance, the transformation flow-value (TVF) theory conceptualized construction as a production activity that consists of the transformation of production factors into finished products following specific processes to deliver value to the end used. Further Koskela (2000), from his typology, asserted that theories in the field of construction management research provide several additional functions that include: tools to analyse design, tendering, production, and operation, the framework of communication, and transferring innovative practices in other settings . Construction management theory is based on a "tool kit of concepts and relationships" that will improve the efficiency and quality of "construction products". The theory is useful in studying the contractor's project success variables which form the functions of a contractor.

Theories Explaining Project and Project Management Success and Failure

The concept of project success is difficult to define. But what can be said of project success? There is no consensus as to what constitutes

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"project success" or "project failure" . Several authors simply presume that everyone knows what is meant by "project success" and" project failure". The only thing that is certain in project management is that success is an ambiguous, inclusive, and multidimensional concept whose definition is bound to a specific context (Ika,2009). Project success has long been considered to fall within time, cost, and quality constraints. The "time/cost/quality triangle", which some professionals call the "holy Trinity" or the "triangle of virtue" sufficed as a definition of project success and . Westerveld (2003) defines project success as: "*The satisfaction of all stakeholders*". Westerveld, (2003) argues that it is impossible to generate a universal checklist of project success criteria for all projects. Success criteria will differ from project to project depending on several issues, for example, size, uniqueness, and complexity . To develop a model for projects that links success criteria and success factors a more flexible approach seems appropriate (Westerveld, 2003). According to Lim and Mohamed, (1999), doubts often arise about what and who determines project success. Criteria are assets of principles or standards by which judgment is made; whereas factors are the set of circumstances, facts, or influences that contribute to the results . This study focuses on the variables that contribute to or influence project success which form the attributes of the contractor bidding for the contract as well as the dependent variables which are the indicators. In this case, the factors that contribute to project success form the predictor variables for the study.

One of the most important findings from the literature review was that the factors so far expounded could not explain the reason(s) why the same project could be considered 'successful' by one party, and be considered a 'failure' by another Lim and Muhammed (1999) assert. Measuring project success should encompass project outcome success as well as project management success. Project outcome success refers to the strategic success of deliverables, which means meeting initial project objectives and other benefits gained for all stakeholders over time. The success of a project is dependent on having: a realistic goal, competition; client satisfaction; a definite goal; profitability; market availability; the implementation process, and; the perceived value of the project . However, the project management literature review indicates that project management has three major objectives: a project must be managed on time, within budget, and to quality specifications. Morris and Hugh (1986) declare that a project may still be successful despite the failings of project management because it meets the higher and long-term objectives. In conclusion, most of the factors affecting project management success form part of contractors' attributes or variables such as technical capacity, financial soundness, health and safety, innovation capability, and management capacity among others that indeed form the variables in this study. Contractors must give due importance to enablers of project success which are the predictor variables of the study, by so doing build firms' internal capacity for a competitive market environment.

From the conceptual framework for this study, the independent, and dependent variables are depicted in *Figure 1*. It is conceptualized that: the independent variable is the contractor selection variables that include: reputation, technical capability, financial soundness, management capability, health & safety, innovation ability, experience, quality management, tender price, environmental, social sustainability, corporate governance, and statutory requirements. The project success criteria that were used to determine success (1) or failure (0) dichotomy formed the dependent variables: budget, time, procuring entity satisfaction, environmental sustainability, quality specifications, and public needs.

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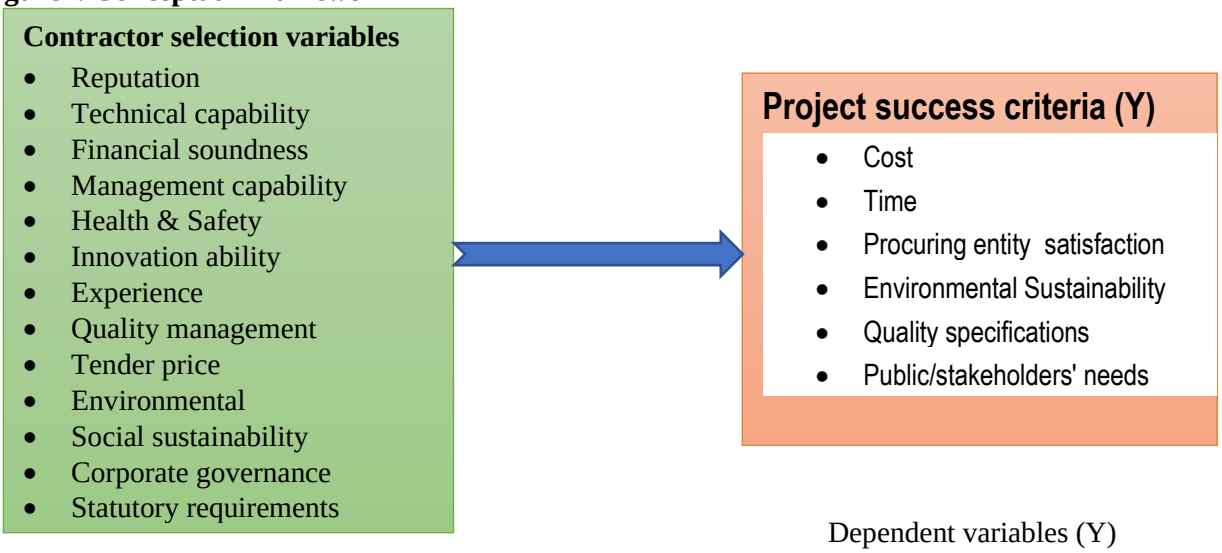
Figure1: Conceptual Framework



Independent variables (Xi)

Dependent variables (Y)

METHODOLOGY

In total, there are 261 Kenyan state corporations as per the Inspectorate of State Corporations (ISC, 2013) spread out all over the country. The Taskforce on Parastatals Reforms, (as per Executive Order No.1 2013) recommended the dissolution, transfer, and merging of some of the agencies, and from the elimination, the actual number of state corporations is 187. From the summary list of projects and medium-term projections of the national government for the financial year 2007/2008-2020/2021, the researcher obtained 841 projects. The study used a survey questionnaire and structured interview methods. The target population for the study was 841 construction projects and a sample size of 263 was drawn from the same. The population of the study was construction projects (buildings, roads, bridges, dams, sewerage, and water supply) whose timeliness had expired from 2007-2021 in Kenya State entities. At the same time, the projects studied were only those on execution, completed, and stalled undertaken by the contractor registered with the National Construction Authority (NCA1 to NCA5). The state entities are the agents of the government in implementing the construction projects under the procurement legal framework. This study used mixed strategy both quantitative and qualitative to complement each other. Different names have been assigned to this strategy; such as multi-strategy , mixed methods , mixed methodology multi-methods . This study adopts a cross-sectional survey research design coupled with the mixed strategy . A stratified random sampling technique was used to sample 263 projects from 841 identified construction projects administered to professionals: engineers, architects, quantity surveyors, project managers, and procurement officers *(Table 1)* who were involved in the evaluation of tenders. The structured interview schedule to capture answers to questions that were qualitative was administered to twenty-seven respondents. A purposive sampling technique was used to determine the twenty-seven experienced respondents on matters of tender evaluation who were willing to be interviewed. Creswell's (2014) recommendation ranges between 5-25 interviewees for a phenomenological study and 20-30 for a grounded theory study. Subsequently, SPSS version 16 was used to run several tests: descriptive and inferential. The sample size was calculated using Fisher's (1935) formula suggested by as shown:

$$nf = \frac{Z^2 pq}{e^2}$$

Where: nf= population

Z= table value from the normal table

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P= probability of success

q= (p-1) probability of failure

e= allowed error

$$nf= \frac{(1.96)^2\,(0.5)\,(0.5)}{(0.05)^2} = 384$$

According to the Fisher formula, when the population size is less than 10,000, the sample size (nf) can be calculated as follows;

$$nf = \frac{nf}{1+\frac{nf-1}{N}}$$

Where: nf = desired sample size (when the population is less than 10,000

N= the estimate of the population size

Using proportional allocation, the proportion of the size for each stratum added together will give the total sample size.

Where: N = 841 is the population of construction projects (unit of analysis) in each stratum.

N is the total population of construction projects in all corporations.

S (nf) is the sample size calculated from the formulae.

$$\{nf = \frac{\mathbf{384}}{\mathbf{1}+\frac{\mathbf{384}-\mathbf{1}}{z}}\}.$$

nf the sample size 263 construction projects.

Based on Fisher's (1935) formula, suggested by Mugenda and Mugenda (2003) the sample size for the construction projects was 263 hence 263 questionnaires were distributed. Using stratified random sampling the questionnaires were distributed as follows: purely commercial state agencies 1, State corporations with strategic function 8, State Agencies-Executive Agencies 174, State Agencies- Independent Regulatory Agencies 17, State Agencies-Research institutions, public Universities, and Tertiary Education Training institutions 63. The study recorded an overall questionnaire response of 71.86% which is quite good. The researcher sought the help of three (3) experienced supervisors in validating the test items using a 5-point Likert scale. The rating scale used was demarcated into five non-overlapping spaces as 1.0-1.80 for "Strongly Disagree", 1.81-2.60 for "Disagree" 2.61-3.40 for "Neutral", 3.41-4.20 "Agree" and 4.21-5.00"Strongly agree", hence the cut-off point for success is 3.4 . Given the hypothesis, the dichotomy (0 and 1) was measured based on a criterion with zero(failure) taking values ranging from 1 to 3.4 and 1 (success performance) taking the range 3.4 to 5. SPSS version 17 was used to run several tests: cross-tabulation, reliability test using Cronbach's Alpha, test of normality, and logistic regression analysis.

Reliability

Using a 5-point Likert scale for measuring contractor selection variables and the same result over time, the internal consistency method was used to measure the questionnaire construct coefficient of reliability or consistency. The basic formula for finding the internal consistency reliability is called coefficient alpha . In this study, using SPSS Cronbach's Alpha coefficient (or Guttman's λ_3 was used to measure the questionnaires' construct coefficient of reliability (or consistency) by solving :

$$\alpha = \frac{K}{K-1}\,(1- \frac{\sum_{i=1}^{k}\sigma_i^2}{\sigma_x^2})$$

Where K is the number of items in a scale σ_i^2 is the variation of ith item and σ_x^2 is the variance of the scale (total) scores.

The test shows the Cronbach's alpha for the thirteen contractor parameters to be 0.724 indicating a good internal consistency reliability (alpha should be greater than 0.7).

Table 1: Reliability Test Results

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.724	.843	13

Source: (Author, 2022)

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Test of Normality

Table 2 shows the variables that were subjected to Shapiro-Wilk's tests of normality. Shapiro-Wilk test is the most powerful normality test, followed by the Anderson-Darling test, Lilliefors test, and Kolmogorov-Smirnov test . The Kolgomorov – Smirnov test is a non-parametric test that can be used to test the underlying distribution of a given random variable. Shapiro-Wilk statistic of the variables had a p-value of 0.000 which is less than 0.05 with 95% confidence, the study concluded the variable followed a normal distribution.

Table 2: Test of Normality

Variables	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	f	Sig
Reputation	.242	148	.000	.850	48	.000
Financial soundness	.429	148	.000	.582	48	.000
Management capability	.443	148	.000	.186	48	.000
Quality management	.325	148	.000	.712	48	.000
Quoted tender price	.399	148	.000	.617	48	.000
Occupation health and safety	.237	148	.000	.839	48	.000
Innovation ability	.214	148	.000	.891	48	.000
Technical capability	.487	148	.000	.486	48	.000
Experience	.399	148	.000	.665	48	.000
Environmental sustainability	.240	148	.000	.855	48	.000
Social sustainability	.232	148	.000	.881	48	.000
Corporate governance	,231	148	.000	.887	48	.000
Government statutory requirement	.395	148	.000	.633	48	.000

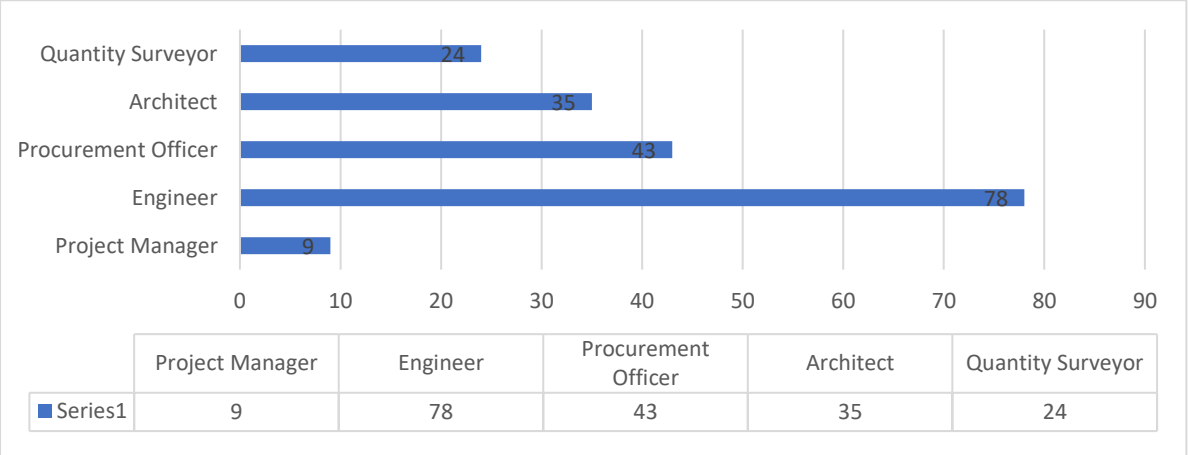
Source: (Author,2022)

RESULTS

Professional Background

Figure 2, indicates that the majority of the respondents were professionals employed by public entities and they had the necessary academic qualification in tandem with their professional background.

Figure 2: Professional background



Source: (Author,2022)

Category of Construction Project

Figure 3 depicts the different categories of construction projects that were undertaken and ongoing in state entities in Kenya. The figure shows that almost 40% (80) of close to half of public construction projects were building projects, followed by 38%(76) for road projects, and 6.5% (13) dams. This reveals that the majority

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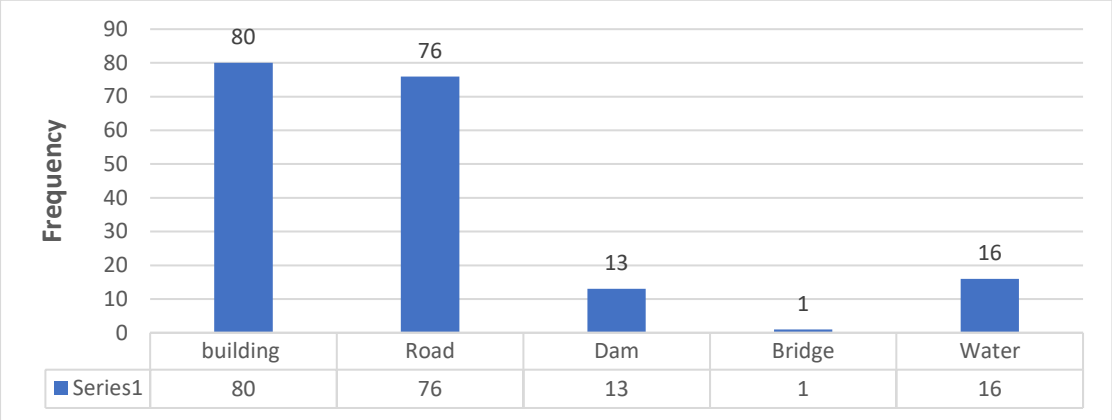
of the projects undertaken by state entities are buildings and road construction projects in Kenya.

Figure 3: Category of construction project



Source: (Author,2022)

Respondents' Experience and Level of Challenges Cross-tabulation

Table 3 shows the cross-tabulation of respondent's experience against the level of challenge measured on a Likert scale of 1-5. Experienced members of the tender committee faced a challenge at a level of 8.1% and an extreme of 2%. They faced no challenge at a level of 31.3% with the least at 27.3%. Highly experienced tender committee at 25.8% while 16.10% faced challenges and 4.8% extreme change. Less experienced committee members experience a 50% level of challenges. This was necessary for validation of the data received reflecting the experience and the level of challenges in the contractor selection of construction projects. This confirms that the respondents who were members of tender committees for selecting contractors were well experienced and had fewer challenges in matters of evaluation of tenders. This is an indication that the data sources can be relied on for analysis.

Table 3: Experience *Rate of the level of challenges cross-tabulation

		Rate the level of challenges					
		NC	**LC**	**MC**	**C**	**EC**	**Total**
No experience	Count	3	0	1	1	1	6
	% within Experience	50%	0%	16.70%	16.70%	16.70%	100%
Less experience	Count	1	0	0	1	0	2
	% within Experience	50%	0%	0%	50.00%	0%	100%
Neutral	Count	4	6	5	0	0	15
	% within Experience	26.70%	40%	33.30%	0%	0%	100%
Experience	Count	31	27	31	8	2	99
	% within Experience	31.30%	27.30%	31.30%	8.10%	2.00%	100%
Highly experienced	Count	16	17	16	10	3	62
	% within Experience	25.80%	27.40%	25.80%	16.10%	4.80%	100%
Total	Count	55	50	53	20	6	184
	% within Experience	29.90%	27.20%	28.80%	10.90%	3.30%	100%

Rate the level of challenges

Key NC= No challenge LC=Least challenge MC=Moderately challenging C=Challenging EC=Extremely challenging Total

Source: (Author,2022)

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Evaluation of Contractor Selection.

A logistic regression model was built to predict the project's success (Logit (Y)). In the Likert scale, from strongly disagree (1) to strongly agree (5) the respondents used the following six criteria (budget, time, entity satisfaction, quality specification, environmental, public need) to determine successful and failed projects. An example: "Please evaluate performance satisfaction which indicates the project performance success to the contractor's attributes on the project". Given the hypothesis,

Logit (y) = In $(\frac{p}{1-p})$ = α + β_x+…….+ $\beta_k X_k$,

The dichotomy (0 and 1) was measured based on a 5-point Likert scale demarcated into four non-overlapping spaces criterion with zero(failure) taking values 1 to 3.4 and 1 (success) taking the range 3.41 to 5. Logistic regression analysis was used to model the significance of contractor's variables on construction project success and estimate the probability of its success. The thirteen (13) predictor variables and the six (6) dependent variables were then included in the model, which was analysed to fit the model. *Omnibus Test of Model Coefficients:* The results in *Table 4* show the model chi-square and the significance levels for the test of the null hypothesis that all coefficients are equal to p=0.016. The model chi-square value which is the difference between the null model and the current (chi-square values =26.116), the null hypothesis is rejected since the p-value is less than 0.05 (significance level).

Table 4: Omnibus Test of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	26.116	13	.016
	Block	26.116	13	.016
	Model	26.116	13	.016

Source: (Author,2022)

Model Summary: The model summary has values shown in *Table 4* revealing how well the model fits the data. The -2 log likelihood (goodness of fit test) value for the current model is 127.050. The Cox& Snell R Square which is an attempt to provide a logistic regression equivalent to the coefficient of determination in multiple regression, the value was 0.153. The Nagelkerke R Square which adjusts the Cox & Snell R-square so that it ranges from '0' to '1' was 0.246. *Table 6* depicts a model summary indicating Nagelkerke R^2 of 0.246 indicated a relationship between aggregated dependent variables (construction project performance =Y) and the thirteen predictor variables. The classification *Table 5* reveals the overall prediction success of 80.9 % (*Table 5*). In the model for construction project performance (Y), at least 30 projects failed and 127 projects were successful.

Table 5: Classification Table

Observed			Predicted		
			Performance (Comb)		Percentage Correct
			Fail	Succeed	
Step 0	Performance (Comb)	Fail	0	30	0
		Succeed	0	127	100.0
		Overall			80.9

Source: (Author,2022)

The results of Omnibus tests of model coefficients converged (Chi-square = 26.116, df=13, p=0.016). The model summary in *Table 5* shows a Cox & Snell R^2 of 0.153 the predictors in the model explained 15.3% of the variation in construction project performance (Y). *Table 6*

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depicts a Nagelkerke R^2 of 0.246 indicating a relationship between aggregated dependent variables (Y), and the thirteen predictor variables. However, 74.7% of the variation could not be counted for by the study variables. The fitted model is:

Table 6: Model Summary

Step	-2Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	127.050[a]	.153	.246

Source: (Author,2022)

Table 7 indicates the study results of how projects performed based on the six project performance criteria. The projects performed well in fulfilling public needs at 90.7%, meeting quality specifications, and procuring entity satisfaction at 85.8% all above 80% successful performance. Meeting budget and environmental sustainability were all above 70%. However, project performance on time frame was the poorest where only 49.7% of projects were delivered on time. This representation therefore depicts the respondent's overall views on project performance on road, building, dam, water supply, and bridge construction projects they worked on respectively.

Table 7: Percent of Failed and Succeeded Projects

Project performance criteria	Failed Per cent	Succeeded Per cent	Total
Performance by budget	29.2	70.8	100.0
Performance by time	50.3	49.7	100.0
Performance by procuring entity satisfaction	14.2	85.8	100.0
Performance by Environmental Sustainability	26.8	73.2	100.0
Performance by Quality specifications	9.3	90.7	100.0
Fulfilled public needs	9.3	90.7	100.0
Performance (Comb)	20.1	79.9	100.0

Source: (Author,2022)

The dichotomous dependent variable in a 5-point Likert scale was determined based on the criterion with 0 (failure) taking values 1 to 3.4 and 1 (success) taking the range 3.41-5 where the successful projects and failed projects were determined. *Table 8*, reveals the research findings of aggregated (mean) performance based on the overall six performance criteria (see *Table 7*) which indicate 127 projects reported as successful and 30 projects as failed projects.

Table 8: Classification of Projects

Observed			Predicted		
			Performance (Comb)		
			Fail	Succeed	Percentage correct
Step 0	Performance (Comb)	Fail	0	30	.0
		Succeed	0	127	100.0
		Overall Percentage			80.9

Source: (Author,2022)

Table 9 depicts the variables in the model.

Logit (Y) = $Log_e(\frac{p}{1-p})$ = -3.721 + 1.028X_5 + 1.033X_6 + 0.624X_9

On observing the role of each independent variable the fitted model, the Null hypothesis.

H_0 : $\beta_i = 0$ was tested and for i = X_1 , X_2 X_3, X_4, X_7 , X_8 , X_{10} , X_{11}, X_{12} , X_{13} .

The exponentiated values of the regression coefficient "B" and Abraham Wald Chi-square test are shown in *Table 7*. The null hypothesis was retained. This implies that the following variables have no significant predictive role in this model

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based on the study: 1. contractor's reputation, 2. technical capability, 3. financial soundness, 4. management ability, 7. experience, 8. quality management, 10. environmental sustainability, 11. social sustainability safeguards, 12. corporate governance, and 13. government statutory requirements. When controlling the effect of the aforementioned predictors the significant predictors were:

X_5 (B= 1.028, Wald =4.604, p=0.032, Exp(B) = 0. 358)

X_6 (B= 1.033, Wald = 7.287, p = 0.007, Exp (B) = 2.808)

X_9 (B= 0.624, Wald =4.033, p = 0.045, Exp (B) = 1.866**)**

Exp (B) = 1.866 implies that increasing X_9 (contractor's quoted tender price) by one unit, placing the contractor at 1.866 times more likely to succeed than fail. Exp (B) = 2.808 suggests that increasing X_6 (contractor Innovation ability) by one unit placing the contractor at 2.808 times more likely to succeed than fail. Exp(B) = 0.358 indicates that increasing X_5 (contractor occupation health and safety) by one unit placing the contractor at 0.358 times more likely to succeed than fail. *Table 7* depicts the variables in the Equation in the model of the significant predictor variables which are: Occupation health and safety, Contractor's innovation ability, and contractor's quoted tender price are significant predictors. The study revealed that the independent variables in the logit regression model are useful in determining the most suitable contractor for public construction projects while controlling the effect of the other variables.

The results of the structured interviews with the respondents were consistent with quantitative data on construction contractor selection: "*The quoted tender price reflects the market rates, and how the rates compare with the market and therefore it's a significant variable to consider while selecting a construction contractor"* Department of Public Works Quantity Surveyors' opinion 2021. The results of the interview with an Engineer acknowledged that *"variables such as contractors' innovation ability or technology ensure that the most appropriate contractor is selected for the public project success in future"*. Senior Road Construction Engineers' opinion, 2021. Finally, on how to improve the contractor selection process: "*Include a clause in Public Procurement and Asset Disposal Act 2015(revised,2022), a formula to evaluate either too-high or too-low bids to the market or engineers' estimation, and regular review of the contractor selection process by benching marking with best practice such as multinational lenders World Bank and Africa Development Bank on contractor selection process method".* Senior Supply Chain Management Officers' opinion, 2021.

Table 9: Variables in the Equation

		B	S.E	Wald	df	Sig	Exp (B)
Step 1[a]	X1	.321	.409	.616	1	.433	1.379
	X2	.828	.538	2.367	1	.124	2.289
	X3	.801	.479	2.795	1	.095	.449
	X4	.110	.439	.063	1	.802	1.117
	X5	1.028	.479	4.604	1	.032	.358
	X6	1.033	.383	7.287	1	.007	2.808
	X7	-.233	.376	.384	1	.536	.792
	X8	-.277	.381	.529	1	.467	.758
	X9	.624	.311	4.033	1	.045	1.866
	X10	.698	.435	2.569	1	.109	2.010
	X11	-.236	.443	.283	1	.595	.790
	X12	.005	.303	.000	1	.986	1.005
	X13	,271	.276	.962	1	.327	1.311

Source: (Author,2022)

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The results (*Table 9*) further indicate that the contractor's occupational health and safety measures p=0,032<0.05, innovation ability p=0.007<0.05 and finally, the quoted tender price of the contractor p=0.045<0.05 all had a statistically significant influence on the performance of construction projects. Based on these results, reject the null hypothesis that the contractor's occupation health and safety is equal to zero (β_i = 0), the contractor's innovation ability is equal to zero (β_i = 0), and the contractor's quoted tender price is equal to zero (β_i = 0). Hence, it was concluded that occupation health and safety, the contractor's innovation ability, and the contractor's quoted tender price had a significant influence on the performance of road, building, dam, bridge, and water supply projects. Further, the coefficients associated with the occupational health and safety ability of the contractor, the innovation ability of the contractor, and the contractor's quoted tender price are positive, indicating a direct relationship. The findings of the objective were consistent with study showed that the most critical attribute which positively influences project performance is the quoted tender price. This study also resonates well with Alzahrani and Emsley (2013) study in their logistic analysis that revealed health and safety as the first among the nine underlying clusters. Similarly, Ng and Skitmore (1998) in their study found that health and safety is a key criterion among a set of criteria agreed upon between the public and private client groups .

DISCUSSION

The logistic regression analysis was conducted to estimate the probability of construction project success and establish the significant contractor variables that influence construction project success performance. Further, the analysis was done to identify the contractor attributes that demonstrated a strong relationship to the success of the construction project that can be used to select a contractor. This study finding is consistent with a study in the UK on contractor performance prediction models for UK construction contractors using logistic regression . Similarly, Lee (2016) in his study investigated contractor selection by Malaysian housing developers. According to Lee's (2016) findings of his research, developers especially the larger firms rely less on relationship criteria, but the study demonstrated that contractor selection is based on multi-criteria beyond those traditionally used such as time, quality, and cost also known as "iron triangle". Lee (2016), proposed future studies to include criteria such as health and safety on site and environmental sustainability. The study also concurs with Mushori's (2019) findings in Kenya on how contractor's safety records influence the performance of infrastructural construction projects. On the other hand, the study is consistent with Kithinji & Kamara (2017) in a study on factors influencing the completion of government road infrastructure projects in Kenya, which concluded that technological innovation largely influenced construction project completion. This research has added occupation health and safety, environmental sustainability, public entity satisfaction, and public needs in an attempt to contribute to the body of knowledge. The models demonstrated a high prediction capability of 80.9%. The objective of logit regression was to evaluate the relationship between the contractor's selection variables and criteria that affect the construction project's success.

CONCLUSION AND RECOMMENDATIONS

The study evaluated the contractor selection in Kenya on publicly funded projects. Based on the findings of the study, the following is the summary:

- The findings showed that new emerging criteria such as innovation, health and safety, are now becoming increasingly significant factors in the success of the project and therefore need to be considered in the contractor selection.
- The health and safety on site is a key attribute among the thirteen that contribute to the

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contractor's ability to achieve project success performance measures.

- Respondents indicated that modern construction is increasingly becoming challenging with innovative designs and construction technology, and therefore the need for contractors with innovation capability.

The logistic regression model created a simple decision-making approach based on three contractor selection variables against six project performance criteria while all other ten contractor selection variables are controlled. This is an alternative supportive practical solution for Kenyan state entities to enhance and improve the contractor selection process which can be adopted by state entities and construction industry practitioners. Based on the study variables only account for 15.3% of the variation in the success performance of construction projects. Further study on other variables needs to be researched to determine the underperformance of public construction projects in Kenya. From the aforementioned findings, the research therefore recommends: The use of the emerging contractor selection variables such as contractors' innovation ability, and occupation health and safety records in tender evaluation.

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