Assessment of The Impact of Sustainable Procurement Practices on The Cost of Road Construction Projects in Kenya. A Case Study of Kerra

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ABSTRACT: The main objective of this study was to evaluate the impact of sustainable procurement practices on the cost of road construction projects in Kenya. Specifically, the study sought to assess the extent to which green purchasing impacts the cost of road construction projects in Kenya and to determine the extent to which supplier partnering impacts the cost of road construction projects in Kenya. The research used a case study design. The study's target population comprised regional directors, supply chain officers and prequalified contractors from every county from all the 47 KeRRA regional offices. The total sample size was made up of 128 respondents. Data was collected using structured and semi-structured questionnaires. Data was analyzed with the aid of SPSS to display the descriptive statistics. Inferential statistics including Pearson Product Moment Correlation and regression were analyzed to describe the relationship between the study variables. The findings revealed that there was a positive and a significant association between green purchasing and cost of road construction. Results further revealed that there was a positive and a significant association between supplier partnering and cost of road construction. The study recommends contractors and other stakeholders in the road construction to consider use of green purchasing as well as ensuring supplier partnering as this will reduce cost of road constriction.

Key words: Green purchasing, Supplier partnering, Sustainable Procurement, Cost and Construction Projects

1.0 INTRODUCTION

Globally, organizations are continuously facing the pressure of delivering results in an uncertain world. The modern business climate demands companies to continuously improve their processes and their way of doing things to meet organizational objectives in a timely and cost-effective manner while maintaining the organization's profitability and market relevance. In this dynamic global marketplace, procurement must play a leading role in capturing the value at stake (Spiller, Reinecke, Ungerman, & Teixeira, 2018). With sustainability issues becoming vital in the developmental agenda of nations, it is time to shift the focus of developing countries' public procurement systems from mainly immediate economic advantages to sustainable public procurement systems, which will result in long term benefits (Nair & Chisoro, 2017). The concept of Sustainable Procurement (SP) is conceptualized by Borland (2016) to include global, environmental, financial and social /cultural considerations. It involves looking beyond the traditional economic parameters and making decisions based on life-cycle costs, associated environmental and social risks and benefits as well as broader social and environmental implications.

Public Procurement is the acquisition of goods, services as well as works by a procuring entity using funds obtained from public coffers. Sustainable procurement can therefore be defined as the application of sustainable development principles in the procurement function. Sustainable procurement is not simply about being "green". Sustainable procurement is about socially and ethically responsible purchasing, minimizing the environmental impact through the whole process of supply chain, delivering economically sound solutions as well as always ensuring good business practice (CIPS, 2018). Sustainable procurement is a branch of the broad concept of sustainable development although its focus is far wider than just the development as it also aims at meeting the varied needs of all people in the current as well as future communities, promoting personal wellbeing, social cohesion, inclusion, and creating equal opportunity (CIPS, 2018).

Kenya has experienced adoption of sustainable procurement in the recent past although the rate of adoption seems to be slow. This is happening despite the fact that the Kenyan government has passed laws to enhance adoption of green procurement in many sectors within the country. One such example is the Public Procurement and Asset Disposal Act PPADA of 2015 which clearly captures sustainable procurement issues. In as much as sustainable procurement is likely to have greater benefits for organizations, there are still

many entities in Kenya that are yet to appreciate the concept of sustainable procurement (Muraguri, Waweru & Musyimi, 2016). The responsibility is still on the public organizations to come up with measures that increase their efficiencies through sustainable procurement while saving on costs.

Sustainable procurement is the use of sustainable development concepts in the activities of procuring in an organization (CIPS, 2014). Sustainable procurement necessitates that all four elements of sustainability including environmental, social, economic and governance are incorporated in procurement policies (Kerzner, 2018). Sustainability in the construction industry encompasses embracing sustainable practices from project inception and planning, tendering and procurement, construction, project operation and maintenance to decommissioning which involves demolition and/ or disposal. Sustainable procurement is influenced by a number of factors such as economic factors, which include costs of product and services over the entire life cycle comprising acquisition, maintenance, operations and end-of-life management costs including waste disposal. Sustainable social and labour factors include recognizing equality and diversity, observing core labour standards, ensuring fair working conditions, increasing employment and skills, and developing local communities and their physical infrastructure. Sustainable environmental factors comprise natural resource use and water scarcity, emissions, climate change and biodiversity over the whole product life cycle (Hitt, Ireland, & Hoskisson, 2017).

In the construction industry, the aim of project control is to ensure that projects are completed on time, within cost and achieve the established project objectives. Unfortunately, cost fluctuations are a totally common phenomenon that are related to almost all projects within the construction enterprise (Kerzner, 2018). Similarly, cost fluctuation is a major problem in road project development that creates huge cost variances for the construction companies. According to Rahman (2019), cost fluctuation is a major problem in the construction industries in other countries such as Portugal and Nigeria where projects experience cost variances of around 40% of the contract cost.

The Kenya Vision 2030 aims to transform Kenya to a middle-income country by 2030, and the government recognizes that the attainment of Vision 2030 will depend heavily on the quality of the road infrastructure through the reduction of transport costs, improvement of accessibility and road safety. The centrality of the road infrastructure in the Vision 2030 and the heavy annual budgetary allocations to the sector underscores the need to investigate the time and cost drivers that contribute to cost variances of road projects. Despite the fact that road projects cost variances creates a significant financial risk to the government with a history of construction projects that were completed with significant cost variances, literature on the subject of road construction and cost variances in Kenya remains scanty (Adams, 2018).

1.1 Statement of the Problem

Organizations nowadays are under a lot of pressure to develop and incorporate sustainable measures in their systems in order to cut on cost, improve performance and ensure sustainability.

Many countries around the globe have invested in systems and programs with the sole purpose of improving the performance of their organizations. Although there are potential benefits to an organization that adopts sustainable procurement procedures, they are not generally used especially in Sub Saharan Africa, with the business sector being predicted to have very low adoption rate of these practices. Several impediments have been identified in the construction industry when trying to adopt various procurement innovations that apply to sustainable procurement such as the huge investments required incorporate sustainable procurement into their systems. As a result, there is a tension between the desire to pursue sustainability and the need to control costs and stay within budget. This can create challenges for project managers and decision-makers as they try to balance these competing priorities (Nair & Chisoro, 2017).

Wood and Richardson (2016) found that, while commercial executives within a single contracting firm responded positively, there were instances where, despite positive attitudes and even experiences, collaborating partnerships in construction remained cost-driven, even when there were perceived benefits in changing to a new approach. One cause for this could be the company's rigidity (Meehan & Bryde 2017). This is the result of an organization's routine becoming institutionalized. Processes become commonplace as businesses strive to keep a sense of trustworthiness. As a result, change is more difficult to accomplish because it requires a disruption in the present practice (Meehan & Bryde 2017). Also, the employees concerned believe that external constraints force them to make decisions incompatible with a long-term procurement strategy. This could signal a clash between employee pressures, with the stronger of these pushing them to stick with the more conventional methods (Krause et al., 2017). If costs rise, there may be little incentive for a construction company to embrace new techniques, such as shifting away from capital-cost-based approaches.

With increase in environmental concerns during the past decade, a consensus is growing that environmental pollution issues accompanying industrial development should be addressed together with sustainable procurement management (Sheu, Chou & Hu, 2015). Although there is a growing body of literature supporting the view that sustainable procurement pays through researches, the studies have demonstrated that there is necessity to carry out more studies to shed more light on the impact of sustainable procurement practices on the cost of road construction projects. There is therefore need for research in the roads sector as most of the previous studies have not focused on sustainable procurement practices and their effect on cost of road construction projects.

1.2 Theoretical review

The resource-based view holds that firms can earn sustainable super normal returns if they have superior resources which are protected by some form of isolating mechanism preventing their diffusion through industry (Barney, 2018). Resource-Based View (RBV) provides a good theoretical foundation to discuss the contribution of resources and capabilities to firm's performance. The theory gives an

insight on the relations among internal resources, capabilities and performance. The principal idea of the RBV is that for a firm to achieve superior advantages, then it all depends on its heterogeneous resources, which are inimitable, valuable and non- substitutable. It is perhaps one of the most influential frameworks for environmental management (Barney, 2018). On the other hand, the Institutional theory has been applied ever since 1930 (Bansal & Clelland, 2017) in understanding the response of the firm to increasing pressures for management of the environment. Due to increased public awareness of organizational failure and environmental demands, institutional theory recommends that companies can only gain legitimacy through reduction of their environmental impact and being socially responsible. Institutional pressure has led firms to adopt sustainable procurement practices. They can be conformance to environmental strategies that complies with regulations and adopting industry standards, or reducing the environmental impact of operations beyond regulatory requirements (Sharma & Erramilli, 2014).

A valuable resource is that which can influence an entity in coming up with strategies that takes advantage of opportunities to be able to beat stiff competition. These resources can be the financial ability, location, human resource, technology along capabilities such as engaging in practices that are sustainable. Firms can create good relationships with regulators by participating in government-sponsored voluntary program which develops a voluntary agreement between government agencies and firms hence encouraging technological innovation and reduction in pollution. Meyer and Rowan (2018) argue that the institutional environment strongly influences the development of formal structures in an organization more than market pressures. These theories are relevant in explaining why road construction firms in Kenya may consider adopting sustainable procurement practices. Being firms that are construction oriented, adoption of the practices of managing procurement which are sustainable is one of the strategies that can assist them to control their costs and cost variances. Secondly, the firms being institutions that are influenced by occurrences in the external environment, are forced to bow to pressures from environmental networkers to adopt sustainable procurement practices.

1.3 Empirical Review

Globally, Raj, Agrahari and Srivastava (2020) conducted a study on people and internal pressures on sustainability and how it impacts adoption of sustainability, which enhances efficiency using public procurement practitioners from 102 countries. Systematic literature review was the methodology adopted. Findings revealed that institutional pressures affect sustainability adoption. Dahl and Clement (2020) did a study on the review of green and sustainable public procurement on Swedish municipalities and established that sustainable procurement influences cost, flexibility and timeliness. The study employed systematic literature review.

Omojola and Olugboyega (2015) conducted a study on the influence of construction materials supply chain network structures and sustainability strategies on project delivery in Nigeria. The findings revealed that the phone and personal interaction were the network systems employed by small contractors to relate with material suppliers. The findings also revealed that suppliers and small contractors were not employing information technology (ICT) in their supply chain network, and that strategies employed by contractors to select suppliers had a positive influence on cost, quality and schedule of projects.

Regionally, Warinda, Nyariki, Wambua, Muasya and Hanjra (2020) carried out a study on Sustainable development in East Africa using a panel data from 1,160 smallholder households in East Africa. From more than 90 implemented projects over 15-year period, 23 projects regionally were sampled. It was established that sustainable procurement led to increased benefits like reduced lead time and cycle time, enhanced flexibility and better quality of agricultural products.

Locally, Wanja and Achuora (2020) majored on performance of procurement and sustainable procurement practices in Kenyan food and beverages manufacturing sector. It was established that sustainable procurement influenced performance with green purchasing having a large influence. Reverse logistics, green description, ecological procurement and green stock management, which are indicators of sustainable procurement, were found to have a larger impact on procurement performance and specifically flexibility, service delivery and Timeliness.

Oduor (2019) conducted a study on performance and sustainable procurement of supermarkets in Nairobi noted that engaging stakeholders, ecological sourcing, ecological production and backward logistics were embraced to a medium and large extent by supermarkets in Nairobi. The outcome also revealed that by using sustainable procurement practices, medium and large supermarkets in Nairobi were able to increase their speed, create higher-quality products, and save on cost.

On cost and sustainable procurement of food and beverage manufacturing entities, Wanja and Odoyo (2020) in their study on sustainable procurement practices and performance of procurement in food and beverages manufacturing firms in Kenya found that electronic procurement (ICT), eco-specification, eco purchasing, and reverse logistics all influenced the cost through cost reduction, clean environment and improved products quality. Descriptive cross-sectional survey method was used. Magembe (2020) focused on environmental performance and sustainable procurement of EPZs in Kenya using a descriptive design method. The researcher concluded that sustainable procurement influences environmental performance and that sustainable procurement was adopted to a large extent. Green packaging, eco-design and labelling and green procurement were found to influence performance of EPZs in Kenya.

The diagrammatic presentation of the conceptual framework of the study is presented in Figure. 1 below.

Green purchasing
- Recyclable materials
- Energy Conserving Products

Supplier Partnering
- Long-term Associations
- Joint Planning

Cost of Road Projects
- Cost Efficiency
- Delivery Timelines

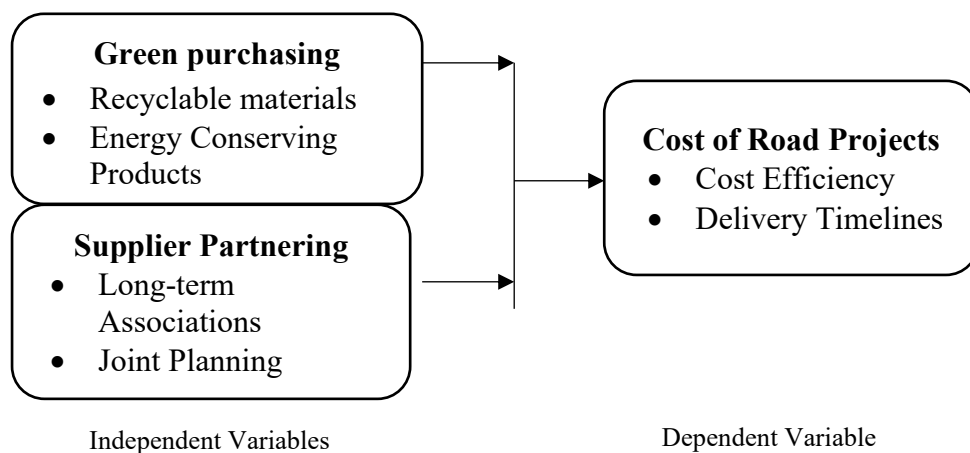Independent Variables

Dependent Variable

Figure 1: Conceptual Framework

2.0 Methodology

The researcher adopted a case study design to conducts the study. The study's target population comprised of regional directors, supply chain officers and prequalified contractors from every county from all the 47 KeRRA regional offices. KeRRA's operations are devolved to the County level. Regional directors, supply chain officers and 2 prequalified contractors from every county from all the 47 KeRRA regional offices served as the sampling frame for this study. An appropriate sampling frame is necessary for the identification of sampling units (Sim & Waterfield, 2019).

The Slovins formula as proposed by Almeda, Capistrano, & Sarte (2010) was used to calculate the sample size of the study. This formula is ideal as it allows the researcher to sample the population with the desired degree of accuracy (Almeda, Capistrano, & Sarte, 2010). A 95% confidence level and P = 0.5 are assumed for the Equation below.

$$N = \frac{N}{1 + N(e)^2}$$

$$= \frac{188}{1+188\,(0.05)^2} = 128$$

Where;

n = Size of the sample,

N = Size of the population given as 188,

e = Acceptable error given as 0.05

Sample =128

The study used a simple random sampling method to choose the people who would participate in the study or respondents. The sampling method was appropriate to cut down on bureaucracy that might make it hard to reach the people they want to talk to because they are experienced and deal with strategic issues for the organization (Cooper & Schindler, 2017).

The study relied on primary data which was collected using structured and semi-structured questionnaires sent to procurement practitioners and afterward collected by the researchers. The questionnaire's reliability and validity was tested with at least 10% of respondents in pilot research. According to the general rule, the pilot test should make up 10% of the sample (Sim & Waterfield, 2019

The questionnaires were processed to check for completeness and consistency. The information gathered was examined using quantitative methods. The study used the statistical program for sciences (version 22) for analysis. To facilitate analysis, the data was first coded. The information obtained from the questionnaire was used to satisfy the objectives of the study, which are to evaluate the sustainability of procurement practices within the Kenya Rural Roads Authority. For simplicity of interpretation, outcome of the analysis was presented in tables and charts.

Descriptive statistics, according to Kothari (2019), enables description of research data, by analyzing the central tendency and dispersion characteristics of the data. Inferential data analysis was done using regression and correlation analysis. The regression analysis was used to establish the relations between the independent and dependent variables.

3.0 Results and Discussions

A pilot study was conducted to analyze and detect the weaknesses of the data collection instrument. The pilot test involved 13 respondents from Taita Taveta County. Reliability was tested using the Cronbach Alpha, which has cut-off points for reliability at 0.7 as recommended by Ritter (2010). Items with Cronbach alphas of less than 0.7 were dropped. Results of the test indicated that all the variables of the study realized alpha scores of above 0.7 as indicated in Table. 1 below and therefore no items were dropped in the study. The data collection instrument was consequently considered reliable for data collection in the study.

Table 1: Chronbach Alpha

Variable	Number of Items	Chronbach Alpha
Green Purchasing	12	0.874
Supplier Partnering	12	0.943
Cost	12	0.914

3.1 Response Rate

A total of 128 questionnaires were distributed to the respondents to fill and give feedback. Out of the 128 questionnaires distributed, 108 were filled and returned, and out of which only 105 questionnaires were responsive. The study therefore achieved a response rate of 82%. This was considered sufficient for the study analysis in line with the recommendation by Creswell and Plano (2011), who asserted that a response rate above 60% in a research study is sufficient to certify data analysis. Figure 2 below indicates the study's response rate.

Response rate

18%

82%
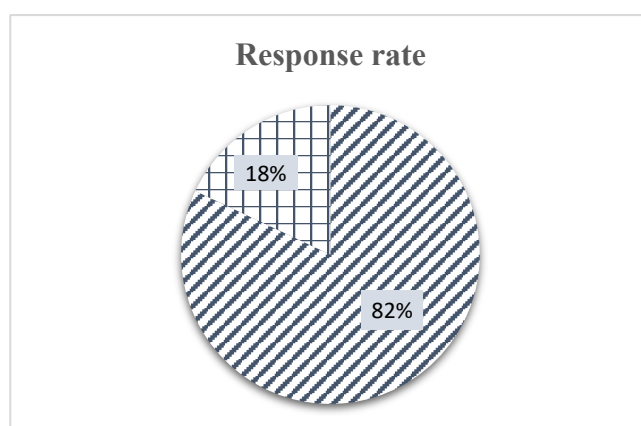
3.2 Descriptive Statistics

The study requested respondents to indicate their views on the following statements relating to green purchasing and their views were presented in Table 2 below.

Table 2: Descriptive Statistics for Green Purchasing

GREEN PURCHASING	SA%	A%	N%	D%	SD%	Mean	SD
The entity purchases products that are recyclable in nature with little effect on the environment.	32.38%	39.05%	17.14%	7.62%	3.81%	4.12	1.341
The entity procures and uses materials that are energy conserving.	25.71%	40.00%	14.29%	14.29%	5.71%	3.92	1.480
Our e-procurement process has little effect on the environment since we use energy conserving products and materials.	19.05%	45.71%	19.05%	11.43%	4.76%	3.88	1.391
We have procurement policies and contract clauses that promote the purchase and use of recyclable materials.	16.19%	39.05%	19.05%	18.10%	7.61%	3.41	1.071
The entity procures from ISO-14000 Certified vendors and contractors who focus on selling recyclable material and energy conserving products.	13.34%	41.90%	20.00%	19.05%	5.71%	3.57	1.210

The study sought to access the extent to which green purchasing impacts the cost of road construction projects in Kenya. To better understand the extent and nature, respondents were asked to respond to various questions relating to green purchasing and the cost of road construction projects in Kenya. As to whether the entity purchases products that are recyclable in nature with little effect on the environment, findings indicated that majority of the respondents 71.43% (mean=4.12, SD=1.341) were in agreement with the statement, 17.14% of the respondents were neutral to the statement, whereas 11.43% of the respondents were not in agreement with the statement.

The analysis revealed that most of the entities procures and uses materials that are energy conserving, as most of the respondents with 65.71% (mean=3.92, SD=1.480) were in agreement with the statement. However, 14.29% of the respondents were neutral to the statement and 20% of the respondents were not in agreement with the statement.

The study sought to investigate whether e-procurement process had little effect on the environment since we use energy conserving products and materials. Findings revealed that majority of the respondents with 64.76% (mean=3.88, SD=1.391) were in agreement with the statement, 19.05% of the respondents were neutral to the statement, whereas 16.19% of the respondents were not in agreement with the statements.

The study also sought to investigate whether there were procurement policies and contract clauses that promote the purchase and use of recyclable materials. Findings indicated that majority of the respondents with 55.24% (mean=3.41, SD=1.071) were in agreement with the statement, 19.05% were neutral to the statement, whereas 25.71% of the respondents were not in agreement with the statement.

Finally, the study sought to investigate whether entities procure from ISO-14000 Certified vendors and contractors who focus on selling recyclable material and energy conserving products. Majority of the respondents with

55.24% (mean=3.57, SD=1.210) were in agreement with the statement, 20% of the respondents were neutral to the statement, whereas 24.76% of the respondents were not in agreement with the statement.

These findings were in agreement with those of Holt and Kockelbergh (2017) who reiterated that organizations that practice green purchasing benefit economically by the reduction of wastes generated from suppliers, and reduced expenses in handling and waste disposing risks, and that organizations improve their public image through adoption of green procurement. Use of green suppliers may help a company grow its reputation among employees, investors and users.

The findings are also in agreement with those of (Griffith & Harvey, 2015) who were of the opinion that the principal objective in acquiring information on green purchasing of road construction materials is to identify geotechnical materials that are capable of meeting the engineering, economic and environmental requirements of the project. This is done to ensure that all the required material needs for the contract are covered in the project materials plan.

The analysis revealed high scores of mean and standard deviations of 4.12, 1.341; 3.92, 1.480; 3.88, 1.391; 3.41, 1.071; 3.57, 1.210 respectively on positions that the entities purchase products that are recyclable in nature with little effect on the environment, the entity procures and uses materials that are energy conserving, their e-procurement process has little effect on the environment since they use energy conserving products and materials, they have procurement policies and contract clauses that promote the purchase and use of recyclable materials, and that the entities procure from ISO-14000 Certified vendors and contractors who focus on selling recyclable material and energy conserving products. These provide concrete evidence that adoption of green purchasing impacts the cost of road construction projects in Kenya.

The study further requested respondents to indicate their views on the following statements relating to supplier partnering and their views were presented in Table 3 below.

Table 3: Descriptive Statistics for Supplier Partnering

SUPPLIER PARTNERING	SA%	A%	N%	D%	SD%	Mean	SD
The entity has strategic alliances and long-term associations with venders and contractors.	27.62%	42.86%	12.38%	11.43%	5.71%	3.97	1.013
The entity considers advance funding of vendors and contractors as part of its joint planning in certain projects	14.29%	33.33%	25.71%	17.14%	9.52%	2.87	1.617
The entity engages consultants as part of its joint planning in the development and design processes.	14.29%	42.86%	20.95%	15.24%	6.67%	3.07	1.819
The entity maintains a database of its long-term associations such as prequalified suppliers and contractors.	22.86%	43.81%	14.29%	13.33%	5.71%	3.54	1.114
As part of its joint planning, the entity invites suppliers and other stakeholders for trainings and seminars to educate them on the need to supply green products	15.24%	44.76%	15.24%	19.05%	5.71%	4.08	1.213

The study sought to determine the extent to which supplier partnering impacts the cost of road construction projects in Kenya. To better determine the extent and nature, respondents were asked to respond to various questions relating to supplier partnering and the cost of road construction projects in Kenya. As to whether the entity has strategic alliances and long-term associations with venders and contractors, findings revealed that most of the entities have strategic alliances and long-term associations with vendors and contractors as supported by 70.48% (mean=3.97, SD=1.013) of the respondents. However, 13% of the respondents were neutral to the statement and 17.14% of the respondents were not in agreement with the statement.

The study sought to determine whether entities consider advance funding of vendors and contractors as part of its joint planning in certain projects. Majority of the respondents with 47.62% (mean=2.87, SD=1.617) were in agreement with the statement, 25.71% of the respondents were neutral to the statement, and 26.66% of the respondents were not in agreement with the statement.

As to whether the entity engages consultants as part of its joint planning in the development and design processes, the study established that most entities engage consultants as part of their joint planning in the development and design processes as supported by 57.15% (mean=3.07, SD=1.819) of the respondents. However, 20.95% of the respondents were neutral to the statement, and a further 21.91% of the respondents were not in agreement with the statement.

The study sought to determine whether entities maintain a database of their long-term associations such as prequalified suppliers and contractors. Findings revealed that most entities maintain a database of their long-term associations such as prequalified suppliers and contractors as supported by majority of the respondents with 66.67% (mean=3.54,

SD=1.114). 14.29% of the respondents were neutral to the statement, whereas 19.04% of the respondents were not in agreement with the statement.

The study also sought to determine whether as part of their joint planning, entities invite suppliers and other stakeholders for trainings and seminars to educate them on the need to supply green products. Majority of the respondents were in

support of the statement with 60% (mean=4.08, SD=1.213), 26.67% of the respondents were neutral to the statement, whereas 24.76% of the respondents were not in agreement with the statement.

These findings were in agreement with those of Griffith and Harvey (2015) who emphasized that increased interaction in an individual project may lead to advantages if the cooperation begins at an early stage. If the supplier and sub-contractors are involved already at the drawing and planning stage, many of the problems and costs, which are currently resolved during production, could be avoided. Increased interaction between projects managed by the same company generates potential for improvements. By having more or less fixed constellations of sub-contractors, it is possible to ensure that the same company and individuals meet in several projects to cut down on costs.

The findings also agree with those of Flynn (2016) who affirmed that companies make mutual adjustments to improve the use of common resources and interests between them and their suppliers. It is very hard to change deeply rooted traditions and work methods since it involves re-examination of principles that have been applied for a long time. The transition to a focused partnering will be very demanding, both in terms of time and resources. Consensus and courage of all parties involved is a requirement for the mutual benefit of all parties.

The analysis reveals high scores of mean and standard deviations of 3.97, 1.013; 3.07, 1.819; 3.54, 1.114; 4.08, 1.213 respectively on positions that entities have strategic alliances and long-term associations with venders and contractors, entities engage consultants as part of their joint planning in the development and design processes, entities maintain a database of their long-term associations such as prequalified suppliers and contractors, and that as part of their joint planning, the entity invites suppliers and other stakeholders for trainings and seminars to educate them on the need to supply green products. This provides evidence that adoption of Supplier Partnering impacts the cost of road construction projects in Kenya.

3.3 Correlation Analysis

Correlation analysis is the statistical tool used to determine the level of association between two variables (Cooper & Schindler, 2012). A correlation of ± 1.0 means there is a perfect positive or negative relationship (Hair *et al*., 2010). The values are interpreted between 0 (no relationship) and 1 (perfect relationship). The relationship is considered small when $r = \pm 0.1$ to ± 0.29, while the relationship is considered medium when $r = \pm 0.30$ to ± 0.49, and when r is ± 0.50 and above, the relationship can be considered strong. Results of the correlation are presented in Table 4 below.

Table 4: Correlation Matrix

		Cost of road construction	Green purchasing	Supplier Partnering
Cost of road construction	Pearson Correlation	1		
	Sig. (2-tailed)			
Green Purchasing	Pearson Correlation	0.436*	1	
	Sig. (2-tailed)	0.031		
Supplier Partnering	Pearson Correlation	0.315**	0.017	1
	Sig. (2-tailed)	0.005	0.358	
* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).				

The results above indicated that there was a positive and a significant association between green purchasing and cost of road construction (r=0.436, p=0.031). Results further revealed that there was a positive and a significant association between supplier partnering and cost of road construction (r=0.315, p=0.005).

3.4 Regression Analysis

Regression analysis was conducted to test the significance of the study variables on the cost of road construction projects in Kenya, a case study of KERRA. Regression analysis is used in social sciences to predict the values of the dependent variable from known values of the independent variables (Mishra, 2010).

3.4.1 Green Purchasing and Cost of Road Construction Projects

Descriptive statistical analysis conducted indicated that there was a significant relationship between green purchasing and cost of road construction projects. This permits a regression analysis to be conducted to explain the relationship. A regression on the influence of green purchasing on the cost of road construction projects was therefore conducted and findings indicted in Table 5 below.

Table 5: Regression for Green Purchasing and Cost

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.560	.382		11.934	.000
	GP	.440	.137	.432	-3.214	.002

a. Dependent Variable: Cost

A regression on the influence of green purchasing on cost of road construction projects was carried out using the following model: $Y = \beta_0 + \beta_1 X_1 + \varepsilon$ where Y is performance, β_0 is the intercept, β_1 is the change in cost occasioned by the change in X_1. Findings revealed that the p-value was 0.002, which was less than 0.05 at 95% level of confidence. This meant that green purchasing had a significant influence on the cost of road construction projects. The standardized regression coefficients for green purchasing was 0.432, meaning that a unit increase in green purchasing would result in 43.2% increase in cost of road construction projects. The study therefore concluded that there was a significant positive relationship between green purchasing and cost of road construction projects.

This outcome was in concurrence with that of Dahl and Clement (2020) whose study on the review of green and sustainable public procurement on Swedish municipalities established that green and sustainable procurement influences cost, flexibility and timeliness. Acquisition of materials is very important in road construction projects since the materials are incorporated into the works to form the structure of the road. The indicators of acquisition of materials are establishment of material types required, establishment of quantities of materials required, testing for quality of materials, procurement of materials and inventory control. Procurement of materials in a timely manner is necessary to avoid unnecessary delays to the project (Holt & Kockelbergh, 2019). To do this efficiently, investing in green procurement to reduce cost and ensure adequate availability of the products is necessary.

3.4.2 Supplier Partnering and Cost of Road Construction Projects

Descriptive analysis conducted indicated the presence of significant relationship between supplier partnering and cost of road construction projects. This necessitated conducting regression analysis to test the relationship. A regression analysis on supplier partnering and cost of road construction projects was conducted and findings presented in Table 6 below.

Table 6: Regression Analysis on Supplier Partnering and Cost

Coefficientsᵃ

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.443	.348		7.024	.000
	SP	.665	.203	.409	3.266	.001

a. Dependent Variable: Cost

A regression on the influence of supplier partnering on cost of road construction projects was carried out using the following model: $Y = \beta_0 + \beta_2 X_2 + \varepsilon$ where Y is performance, β_0 is the intercept, β_2 is the change in cost occasioned by the change in X_2. Findings revealed that the p-value was 0.001, which was less than 0.05 at 95% level of confidence. This meant that supplier partnering had a significant influence on the cost of road construction projects. The standardized regression coefficients for supplier partnering was 0.409, meaning that a unit increase in supplier partnering would result in 40.9% increase in cost of road construction projects. The study therefore concluded that there was a significant positive relationship between supplier partnering and cost of road construction projects.

These findings were in agreement with those of Omojola and Olugboyega (2015) whose study on the influence of construction materials supply chain network structures and sustainability strategies on project delivery in Nigeria revealed that phone and personal interaction were the network systems employed by small contractors to relate with material suppliers. The findings were also in agreement with those of Chogo and Kitheka (2019) study on firm's performance and sustainable procurement in the house construction industry whose findings revealed that sourcing locally, partnering with suppliers, backward logistics and implementation of ICT had a positive substantial impact on timeliness and flexibility.

3.4.3 Regression for Overall Model

Multiple regression analysis was further carried out to empirically determine the relationship between sustainable procurement practices and cost of road construction projects. This was done using the model summary, analysis of variance (ANOVA), and multiple regression. Model summary presents the coefficients of correlation (R) that shows the nature of the relationship between the study variables, and the coefficient of determination (R2) that symbolizes the magnitude to which the independent variables forecasts the changes in the dependent variable. The model summary for the study is presented in Table 7 below.

Table 7: Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.913[a]	.833	.827	.009

a. Predictors: (Constant), GP, SP, ICT, EP

Table 7 above indicates that the R^2 for the regression model between sustainable procurement practices and cost of road construction projects was 0.833, meaning that the independent variables of the study explain 83.3% of the variations in the dependent variables. This means that the goodness of fit for the regression model testing the relationship was satisfactory. The independent variables were good predictors of cost of road construction projects. Analysis of variance (ANOVA) was used to test if two population means are identical and tests the results of the study for significance. ANOVA results for the study are presented in Table 8 below.

whole contribute to the variance of the dependent variable was significant at 95% confidence level.

Multiple regression analysis was used to bring out the existing mathematical relationships between the predictor and outcome variables through beta coefficients, and the statistical significance of the relationships through p-values. The regression coefficients for this analysis are presented in Table 9 below.

Table 8: ANOVA

ANOVAᵃ

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.458	2	5.364	122.551	.000[b]
	Residual	4.290	98	.044		
	Total	25.748	102			

a. Dependent Variable: Cost

b. Predictors: (Constant), GP, SP

Findings indicated that the regression model was significant and a good predictor of the relationship between the variables of study since the p-value was less than 0.05. The F value, which shows whether the set of independent variables as a

Table 9: Multiple Regression Coefficients

Coefficientsª

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.226	.118		1.915	.047
	GP	.394	.176	.514	2.233	.028
	SP	.235	.040	.626	5.853	.000

a. Dependent Variable: Cost

Table 9 presents the regression weights as well as the beta values associated with each of the independent variables. The model constant was 0.226 and the standard error was 0.118. The model that represented the relationship was therefore obtained from the above coefficients and assisted in determining the relationship between sustainable procurement practices and the cost of road construction projects. The regression model applied was $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2$ where X_1 and X_2 were sustainable procurement practices and β_1 to β_4 were regression weights associated with each of the independent variable. From the data presented in the regression coefficients in the table above, the regression equation established was as follows;

$Y = 0.226 + 0.394 X_1 + 0.235 X_2$

The regression model indicates that the cost of road construction projects under KeRRA would be 0.226 when holding all the other variables constant. A unit increase in green purchasing or supplier partnering would lead to an increase in the cost by factors of 0.394 and 0.235 respectively.

4.0 CONCLUSION

The study concluded that there is a direct relationship between sustainable procurement and cost of road construction projects. The study further concluded that green purchasing and supplier partnering were key determinant of cost reduction in road contraction projects in Kenya.

Based on research findings from the regression analysis, green purchasing had a positive and significant coefficient estimate of 0.394. This indicated that unit increase in green purchasing resulted to a corresponding increase in cost, while holding all the other variables constant. Consequently, there was sufficient evidence to reject the null hypothesis, and therefore the hypothesis was rejected since green purchasing had a positive and significant influence on cost.

In light of the research findings from the regression, supplier partnering had a positive and significant coefficient estimate of 0.235. This indicated that a unit increase in supplier partnering by 0.235 resulted to a corresponding increase in cost while holding all the other 17

variables constant. The hypothesis was therefore rejected since green purchasing had a positive and significant influence on cost.

5.0 RECOMMENDATIONS

Based on the findings the study recommends that both the regulatory authority and various stakeholder in the construction industry to consider sustainable procurement as they would aid in cost reduction. The study recommend use of green purchasing and supplier partnering as they were found to explain a high percentage in addressing the challenges of cost in road construction projects.

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