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MATERIAL MANAGEMENT AND SUSTAINABILITY OF COUNTY CONSTRUCTION PROJECTS IN GARISSA COUNTY, KENYA

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ABSTRACT

Purpose: The purpose of the study was to assess the effect of material management on the sustainability of construction projects in Garissa County.

Methodology: The study used a descriptive survey research design. The target population under study comprised of 200 construction projects in Garissa County. This study took 30% of the target population and thus 60 construction projects which was used for the study. Stratified random sampling technique was used to select the 60 construction projects. The study will consider 3 permanent staff from each construction project (Top Management, middle management and operational staff) as they provided informative details concerning the research. Therefore the total respondents were 180 (60*3).

Results: The study found out that procurement and purchasing processes and sustainability are positively and significantly related(r=0.288, p=0.000), Reduce, Reuse, and Recycle and sustainability are positively and significantly related (r=0.291, p=0.000). It was further established that material cost and sustainability are negatively and significantly related (r=-0.119, p=0.001).Similarly, results showed that energy saving practices and sustainability are positively and significantly related (r=0.083, p=0.000).

Unique contribution to theory, practice and policy: Based on the research findings, the study recommended for the projects construction management to order materials in the right quantities and material handling should be such as to minimize waste on site.

Key words: *Material management, sustainability, material cost*

1.0INTRODUCTION

1.1 Background of the Study

Materials management in the construction process is a method of controlling resources for a project. This includes the materials selection process, purchasing process, delivery process, and waste management process, which all constitute the materials management plan for the project. While many research projects suggest efforts to reduce overall project cost by managing materials more efficiently, few focus on materials management from a sustainability perspective (Medineckiene, Turskis & Zavadskas, 2010).

Sustainable materials management is a systemic approach to using and reusing materials more productively over their entire lifecycles. It represents a change in how our society thinks about the use of natural resources and environmental protection (Pearce & Ahn, 2013). By looking at a product's entire lifecycle we can find new opportunities to reduce environmental impacts, conserve resources, and reduce costs.

Construction and operation of buildings account for one-sixth of the world's fresh water withdrawals, one-quarter of world's wood harvest, and two-fifths of world's material and energy flows. The desire and need for more energy efficient products eventually affects construction. "Energy efficiency" in construction industry evolves into a broad field called "sustainable building". As defined by U.S. Environmental Protection Agency, "A green, or sustainable, building is the practice of creating and using healthier and more resource-efficient models of construction, renovation, operation, maintenance and demolition" (Collins, Gray & Bucher, 2008).

1.2 Statement of the problem

Construction industry consume substantial amount of raw materials in the process. The output is obviously the product and the waste material. Because of that, construction industries are well known as one of the worst environmental polluters (Khairulzan, *et.al.*, 2006).Construction projects have an environmental implications mainly because of the material used, nature of design, method of construction, location and layout, physical structure and the use to which building are put (Mustaffa, 2009). Regarding occurrence of imbalanced ecological environment, the movements of various construction resources, water and soil will cause changes to the natural environment. Furthermore, the wastes from such movements emit a general pollution to the environment as well. This can affect the surrounding region and quality of life to a large extent and even bring a significant loss of live hood (Groove, 2008).

1.3 General objective

The general objective of the study was to assess the effect of material management on the sustainability of County construction projects in Garissa County, Kenya.

1.3.1Specific objectives

i). To establish the effect of procurement and purchasing process of materials on the sustainability of County construction projects in Garissa County, Kenya.

ii). To establish the effect of reduce, reuse, recycle material management techniques on the sustainability of County construction projects in Garissa County, Kenya.
iii). To determine the effect of material cost on the sustainability of County construction projects in Garissa County, Kenya.
iv). To assess the effect of energy saving practice son the sustainability of County construction projects in Garissa County, Kenya.

2.0 LITERATURE REVIEW

2.1 Empirical Review

Darvik and Larsson (2010) argued that theories of information systems have widely applied in procurement systems to simplify and enhance the process of procurement as well as legal aspects of a business. Therefore, certain management strategies could be incorporated into procurement systems. This is a complementary and value added approach to the current developments in e-procurement systems. Generally, a procurement system is a managerial structure that is adopted by the client for the implementation, and at times eventual operation of a project. According to Darvik and Larsson (2010), the management of project procurement requires the contract management and change control to efficiently administer projects. Project-delivery methods are related to the contract strategies used for the acquisition of goods or services involving the employer and the contractor.

According to Berry& McCarthy, (2011), Procurement systems deal with risk allocation between the contractor and the employer. In a lump-sum contract, the risk allocation is regarded as fairer and more balanced in the perspective of employers because the employer has a better control in terms of the performance of the contractor and change management along the project. The roles and responsibilities are well defined and differentiated for the professionals who work in the project under this procurement system, particularly for the design–and-construction processes.

Tam (2008), in his study, argued that the toxicity of trash is at an all-time high and the only way to stop this is by preventing waste from the very beginning of its life. The concept of reuse is applied by reinventing items after their initial life and avoiding additional waste by all means necessary. Though the concept of reuse is very important to the lifecycle of a material, there are times when a second life simply cannot be created for a certain item. However, when one does have to throw an item away; an important proactive strategy is to buy products that can be recycled or, at the very least, determine in advance the product is an alternative to a similar, less recyclable material. Recycling is the process of turning items considered to be waste into a valuable resource.

Rahman and Wright, (2014) argued that reducing the amount you buy is the most significant of all the options to manage waste. The key is to only purchase goods that we need and in the right amount. If we never generate products in the first place, we do not have to extract raw resources, manufacture goods from scratch, come up with shipping materials, utilize additional resources for shipping, and then devise ways to dispose of them.

Matthiessen and Morris (2007) argued that one of the most common methods used to establish the cost of green has been to compare the final construction costs for the project to the established budget. In other words, was the budget increased to accommodate the sustainable elements, or were those elements incorporated into the project within the original available funds. For many, this is the ultimate test of affordability; could green be acquired within the funds available. This measure is, however, challenging to use, since it is difficult to assess the reasonability of the original budget, or what other factors may have contributed to a project's budget performance. It is, therefore, the most subjective of the three measures.

According to Seah (2009), it is worth noting that the past three years have seen unprecedented construction cost escalation, with escalation running at over 10% per annum in many parts of the country. This has put tremendous pressure on all aspects of project design, including the sustainable features. Even with this pressure, many projects are still able to deliver successful green strategies, and achieve their sustainable goals. The most successful are those which had clear goals established from the start, and which integrated the sustainable elements into the project at an early stage. Projects that viewed the elements as added scope, tended to experience the greater budget difficulties.

According to Rosen (1995), a wide range of building design approaches and commercially available technologies can help effectively minimize a building's energy costs. An important concept in energy-efficient design is integrating the building's architectural and mechanical features to minimize energy use and reduce cost while maintaining comfort. This integration is best done during the very early stages, when the most cost-effective holistic system can be designed. Although some energy-efficiency strategies result in slightly higher first costs, the resulting annual cost savings result in lower lifecycle costs.

3.0 RESEARCH METHODOLOGY

The study used a descriptive survey research design. The target population under study comprised of 200 construction projects in Garissa County. This study took 30% of the target population and thus 60 construction projects which was used for the study. Stratified random sampling technique was used to select the 60 construction projects. The study will consider 3 permanent staff from each construction project (Top Management, middle management and operational staff) as they provided informative details concerning the research. Therefore the total respondents were 180 (60*3). The researcher used Cronbach Alpha Reliability coefficient to test reliability of instrument. Data for this study was collected using questionnaires. Data obtained from the study was coded and entered into the computer and analyzed using statistical package for humanities. The results of the analysis were presented using frequency tables and charts. Descriptive statistics such as, mean and frequencies and inferential statistics (regression and correlation analysis) were used to perform data analysis. A multiple linear regression analysis model was used to link the variables.

4.0 DATA ANALYSIS, RESULTS AND DISCUSSIONS

4.1 Demographic Characteristics

4.1.1 Gender of the respondents

The respondents were asked to indicate their gender. Majority of the respondents were male who represented 60% of the sample while 40% were female. This implies that majority of positions in county construction projects are male dominated.

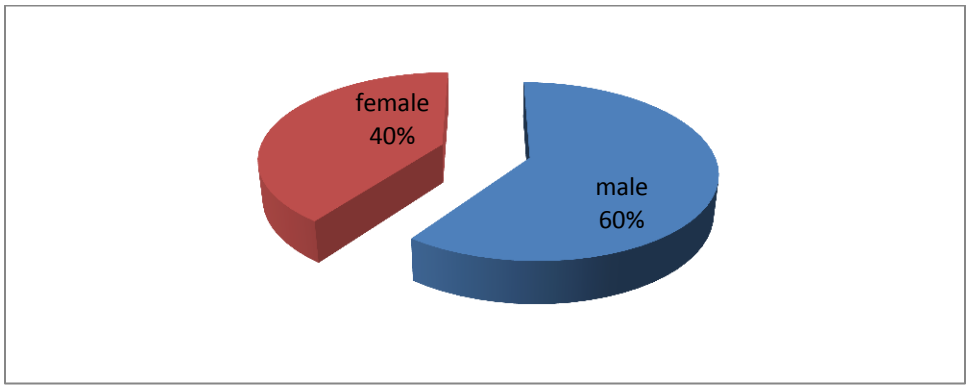

Figure 1: Gender of Respondents

4.1.2 Age of the respondents

Respondents were requested to indicate their age brackets. Majority of the respondents (35.8%) were on age bracket of 30-39 years. 28.5% were on age bracket of 40-49 years, 22.4% were above 49 years while 13.3% who were the least were between 20-29 years old. This implies that majority of the staff were older employees and these were expected to have a good background of the operations within the organization.

Table 1: Age of the respondents

Age bracket	Frequency	Percent
20-29 years	22	13.3%
30-39 years	59	35.8%
40-49 years	47	28.5%
Over 49 years	37	22.4%
Total	**165**	**100**

4.1.3 Duration of being in the employment

On the question of the duration being in employment, majority of the respondents (53.3%) have been in the employment for 11-16 years, 21.8% have been in the employment for over 16 years, 15.8% have been in the employment for 5-10 years while 9.1% have been in employment for a period less than 5 year. This implies that majority of the respondents have been in the employment for a good period of time thus they were experienced.

Table 2: Duration of being in the employment

Years in employment	Frequency	Percent
Less than 5 years	15	9.1%
5-10 years	26	15.8%
11-16 years	88	53.3%
Over 16 years	36	21.8%
Total	**165**	**100%**

4.1.4 Highest Level of Education

The respondents were asked to indicate their highest level of education. Results in figure 4.2 show that 53% of the respondents had their highest level of education being masters and above qualifications, 38% had bachelors' qualifications while 9% had diploma qualification. In as far as the title of study is concerned, the results imply that, the respondents were expected to understand the questionnaire and give valid response since they had better understanding as guided by the their level of education which in this case majority having university as the highest level of education.

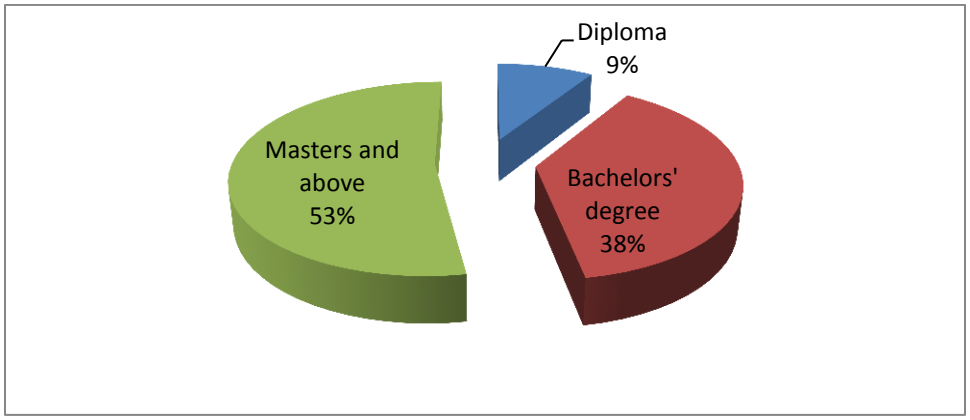

Figure 2: Highest Level of Education

4.2 Sustainability of Projects

Table 3: Sustainability of Projects

Statement	Totally disagree	Moderately disagree	Neutral	Moderately agree	Totally agree	Mean	Std Dev
Reduced adverse environmental and social impacts arising from procurement decisions	6.70%	4.20%	9.10%	40.00%	40.00%	4.02	1.13
Reduces waste to landfill	8.50%	10.90%	11.50%	33.30%	35.80%	3.77	1.28
Reduces air and water	4.20%	4.20%	8.50%	39.40%	43.60%	4.14	1.03

pollution							
Reduces consumption of both natural and processed resources	4.80%	4.20%	11.50%	57.60%	21.80%	3.87	0.96
Promotes health, safety and equality in the community	0.00%	11.50%	4.20%	48.50%	35.80%	4.08	0.93
Influences purchasing decisions to support issues such recognizing equality and diversity	4.20%	4.80%	8.50%	41.80%	40.60%	4.10	1.03
Increased employment and skills	10.90%	4.80%	13.30%	42.40%	28.50%	3.73	1.24
Developed local communities and physical infrastructure	4.20%	4.20%	10.90%	33.90%	46.70%	4.15	1.06
Average						**3.98**	**1.08**

Results show that majority of the respondents agreed that sustainability leads to reduced adverse environmental and social impacts arising from procurement decisions as indicated by a mean of 4.02, . Further results found that sustainability reduces waste to landfill as indicated by a mean of 3.77 who agreed with the statement, majority of the respondents agreed that sustainability educes air and water pollution as indicated by a mean of 4.14.

In addition, results show that sustainability reduces consumption of both natural and processed resources as indicated by a mean of 3.87, sustainability promotes health, safety and equality in the community (4.08).Majority of the respondents agreed that sustainability influences purchasing decisions to support issues such recognizing equality and diversity (4.10). Further, majority agreed that sustainability increases employment and skills (3.73). In addition, sustainability leads to developed local communities and physical infrastructure (4.15)

The average Likert scale of the responses is 3.98 indicates that majority of the respondents agreed to the statements. The standard deviation was 1.08 which indicates that the responses were varied.

4.3 Influence of Procurement and Purchasing on Sustainability

4.2.1Descriptive Statistics

The respondents were asked to indicate on how they rate the procurement and purchasing processes in Garissa County with regards to sustainability. The results are presented in table 4.4.

Table 4: Sustainability of procurement and purchasing

Sustainability	Frequency	Percent
very sustainable	40	24.2
Moderately sustainable	103	62.4
Not sustainable	22	13.3

Total	**165**	**100**

Results in Table 4 revealed that 62.4% of the respondents indicated that the procurement and purchasing processes are moderately sustainable, 24.2% indicated very sustainable while only 13.3% indicated not sustainable.

The respondents were asked to respond on the statements on evident in the construction of project in Garissa County. The responses were rated on a five likert scale as presented in Table 4.

Table 5: Evident in the construction of project in Garissa County

Statement	**Totally disagree**	**Moderately disagree**	**Neutral**	**Moderately agree**	**Totally agree**	**Mean**	**Std. Dev**
Centralization of purchases	4.20%	10.90%	13.90%	35.80%	35.20%	3.87	1.14
Cost cutting	10.90%	4.80%	17.60%	38.20%	28.50%	3.68	1.24
Electronic procurement systems	6.70%	8.50%	4.80%	57.00%	23.00%	3.81	1.09
Average						3.79	1.16

Majority of 71.0%(35.8%+35.2%) of the respondents agreed that there exist centralisation of purchases, , 66.7% agreed with the existence of cost cutting, 80% of the respondents agreed that there exist Electronic procurement systems. On a five point scale, the average mean of the responses was 3.79 which mean that majority of the respondents were agreeing with most of the statements; however the answers were varied as shown by a standard deviation of 1.16.

The respondents were further requested to show on what extent the purchaser (Garissa County) enjoys the following benefits in the construction industry projects. The responses were rated on a five likert scale as presented in Table 4.7.

Table 5: Benefits in the construction industry projects

Statement	**Totally disagree**	**Moderately disagree**	**Neutral**	**Moderately agree**	**Totally agree**	**Mean**	**Std. Dev**
Securing best value for money	17.60%	4.20%	8.50%	11.50%	58.20%	3.88	1.556
Achieving more efficient use of public resources	4.20%	15.20%	9.10%	40.00%	31.50%	3.79	1.166
Achieving positive publicity	4.20%	4.20%	11.50%	40.60%	39.40%	4.07	1.031
Providing government leadership to the	4.20%	4.80%	8.50%	41.80%	40.60%	4.1	1.031

community in demonstrating social and environmental responsibility through the purchase of sustainable products and services		
Average	**3.99**	**1.08**

Majority of 69.7%(11.5%+ 58.2%) of the respondents agreed that the purchase enjoys securing best value for money , 71.5% agreed that the purchase enjoys achieving more efficient use of public resources, 80% of the respondents agreed that the purchase achieve positive publicity while 82.4% agreed that the purchase enjoy the benefit of Providing government leadership to the community in demonstrating social and environmental responsibility through the purchase of sustainable products and services. On a five point scale, the average mean of the responses was 3.99 which mean that majority of the respondents were agreeing with most of the statements; however the answers were varied as shown by a standard deviation of 1.08.

4.2.2 Regression Analysis

The results presented in table 6 present the fitness of model used of the regression model in explaining the study phenomena.

Table 6: Model Fitness

Indicator	Coefficient
R	0.516
R Square	0.226
Adjusted R Square	0.261
Std. Error of the Estimate	0.275404

Procurement and purchasing was found to be satisfactory variable in explaining sustainability of the construction projects. This is supported by coefficient of determination also known as the R square of 22.6%. This means procurement and purchasing explained 22.6% of the variations in the dependent variable which is sustainability.

In statistics significance testing the p-value indicates the level of relation of the independent variable to the dependent variable. If the significance number found is less than the critical value also known as the probability value (p) which is statistically set at 0.05, then the conclusion would be that the model is significant in explaining the relationship; else the model would be regarded as non-significant.

Table 7: Analysis of Variance

	Sum of Squares	df	Mean Square	F	Sig.
Regression	4.477	1	4.477	59.031	.000

Residual	12.363	163	0.076
Total	16.841	164	

Table 7 provides the results on the analysis of the variance (ANOVA). The results indicate that the overall model was statistically significant. Further, the results imply that the independent variable is a good predictors of sustainability. This was supported by an F statistic of 59.031 and the reported p value (0.000) which was less than the conventional probability of 0.05 significance level.

Regression of coefficient was presented in table 7

Table 8: Regression of Coefficients

Variable	B	Std. Error	t	sig
(Constant)	2.257	0.226	10.004	0.000
Procurement and Purchasing	0.444	0.058	7.683	**0.000**

Regression of coefficients results in table 8 shows that procurement and purchasing processes and sustainability are positively and significantly related (r=0.444, p=0.000). Gelderman &Van Weele (2005) argue that purchases affects all business areas in a company and it is therefore important that all business areas can influence the purchases, so the outcome becomes optimal for the whole company. To reach the best effects of a centralized purchasing organization the company needs a way of working that supports feedback between the construction site, the purchasing department and the suppliers.

4.3 Influence of Reduce, Reuse, Recycle on Sustainability

The second objective of the study was to establish the effect of Reduce, Reuse, Recycle on the sustainability of County construction projects in Garissa County.

4.3.1 Descriptive Statistics

The respondents were asked to indicate on their agreement on the following statements regarding the process of Reduce, Reuse, and Recycle in Garissa County and results presented in table 4.9.

Table 9: Process of Reduce, Reuse, and Recycle

Statement	no	yes
There is less toxicity from construction projects	21.80%	78.20%
There are processes for reinventing waste	13.30%	86.70%
There is reducing of purchases to manage waste	15.20%	84.80%
Contractors observe Reduce, Reuse, Recycle in their operations	15.20%	84.80%

From table 9, 78.2% of the respondents indicated that there is less toxicity from construction projects, 86.7% indicated that there are processes for reinventing waste, 84.8% agreed that there is reducing of purchases to manage waste very sustainable while another 84.4% responded that contractors observe Reduce, Reuse, Recycle in their operations.

4.3.2 Regression Analysis

The results presented in table 9 present the fitness of model used of the regression model in explaining the study phenomena.

Table 9: Model Fitness

Indicator	Coefficient
R	0.378
R Square	0.143
Adjusted R Square	0.138
Std. Error of the Estimate	0.297544

Results in table 9 shows that Reduce, Reuse, and Recycle explained 14.3% of the variations in the dependent variable which is sustainability.

In statistics significance testing the p-value indicates the level of relation of the independent variable to the dependent variable. If the significance number found is less than the critical value also known as the probability value (p) which is statistically set at 0.05, then the conclusion would be that the model is significant in explaining the relationship; else the model would be regarded as non-significant.

Table 9: Analysis of Variance

	Sum of Squares	df	Mean Square	F	Sig.
Regression	2.41	1	2.41	27.219	**0.000**
Residual	14.431	163	0.089		
Total	16.841	164			

Table 9 provides the results on the analysis of the variance (ANOVA). The results indicate that the overall model was statistically significant. Further, the results imply that the independent variable is a good predictors of sustainability. This was supported by an F statistic of 27.219 and the reported p value (0.000) which was less than the conventional probability of 0.05 significance level.

Regression of coefficient was presented in table 4.14

Table 10: Regression of Coefficients

Variable	B	Std. Error	t	Sig.
(Constant)	3.301	0.133	24.901	0.000
Reduce, Reuse, and Recycle	0.38	0.073	5.217	**0.000**

Regression of coefficients results in table 4.14 shows that Reduce, Reuse, and Recycle and sustainability are positively and significantly related (r=0.38, p=0.000). Rahman and Wright, (2014) argued that reducing the amount you buy is the most significant of all the options to manage waste. The key is to only purchase goods that we need and in the right amount. If we

never generate products in the first place, we do not have to extract raw resources, manufacture goods from scratch, come up with shipping materials, utilize additional resources for shipping, and then devise ways to dispose of them.

4.4 Influence of Material cost on Sustainability

4.4.1 Descriptive Statistics

The respondents were asked to indicate if the cost of green materials impacts the processes of sustainability of construction projects in Garissa County.

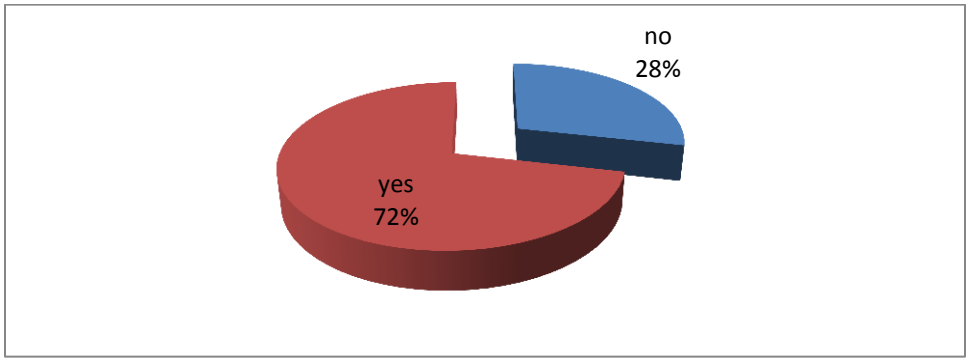

Figure 2: Cost of green materials

72% indicated that the cost of green materials impact the processes of sustainability of construction projects while 28% did not agree.

The respondents were also asked to indicate on the extent in which are costs an impending factor for stakeholders in Garissa County to look at sustainability of projects. Results were presented in Table 4.15.

Table 11: Extent in which are costs an impending factor for stakeholders

	Frequency	Percent
Minimal extent	21	12.7
Moderate extent	47	28.5
Great extent	52	31.5
Very great extent	37	22.4
Total	**165**	**100**

31.5% indicated to a great extent, 28.5% to a moderate extent, 22.4% to a very great extent while 12.7% indicated to a minimal extent.

Further, the respondents were asked to indicate if a sustainable budget impact in achieving a sustainable project. Results were presented in Figure 3

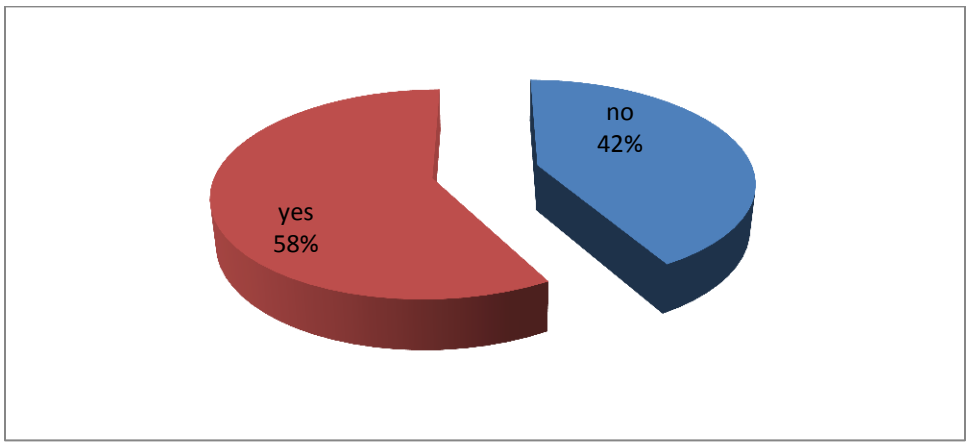

Figure 3 Sustainable budget

58% of the respondents indicated that sustainable budget impact in achieving a sustainable project while 42% indicated that it does not. Results were presented in Figure 4.4

Lastly, the respondents were asked to indicate if previous road construction projects been able to deliver successful green strategies.

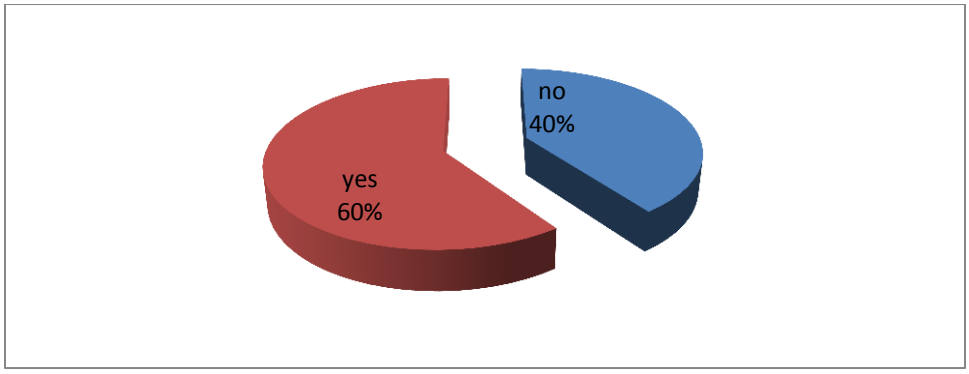

Figure 4: Road construction projects

60% of the respondents indicated that road construction projects been able to deliver successful green strategies while 40% indicated that it did not.

4.4.2 Regression Analysis

The results presented in table 11 present the fitness of model used of the regression model in explaining the study phenomena.

Table 11: Model Fitness

Indicator	Coefficient
R	0.233

R Square	0.054
Adjusted R Square	0.049
Std. Error of the Estimate	0.312565

Results in Table 4.12 shows that Cost material explained 5.4% of the variations in the dependent variable which is sustainability.

In statistics significance testing the p-value indicates the level of relation of the independent variable to the dependent variable. If the significance number found is less than the critical value also known as the probability value (p) which is statistically set at 0.05, then the conclusion would be that the model is significant in explaining the relationship; else the model would be regarded as non-significant.

Table 12: Analysis of Variance

	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.916	1	0.916	9.375	**.003**
Residual	15.925	163	0.098		
Total	16.841	164			

Table 12 provides the results on the analysis of the variance (ANOVA). The results indicate that the overall model was statistically significant. Further, the results imply that the independent variable is a good predictors of sustainability. This was supported by an F statistic of 9.375 and the reported p value (0.000) which was less than the conventional probability of 0.05 significance level.

Regression of coefficient was presented in 12

Table 12: Regression of Coefficients

Variable	B	Std. Error	t	Sig
(Constant)	4.25	0.091	46.938	0.000
Material Cost	-0.142	0.046	-3.062	0.003

Regression of coefficients results in table 12 shows that material cost and sustainability are negatively and significantly related (r=-0.142, p=0.003). Gohand Yang (2010) also found that the population data is statistically highly skewed; that is to say that the distribution is not evenly spread about the average, but instead is highly weighted towards the lower end premiums with a long tail containing a few high premium projects. This, coupled with the fact that very few projects, if any, will report coming in under budget due to sustainable features, means that the average reported cost (mean) is typically higher than the reported cost for the average project (median), which is in turn, likely to be higher than the premium for the typical project (due to the absence of any reported negative premiums).

4.4 Influence of Energy Saving Practices on Sustainability

4.4.1 Descriptive Statistics

The respondents were asked to indicate the extent to which they agreed with the following statements regarding the achievement of energy saving practices in construction projects in Garissa County. Results were presented in Table 4.19.

Table 13: Energy Saving Practices

Statement	Totally disagree	Moderately disagree	Neutral	Moderately agree	Totally agree	Mean	Std. Dev
Careful selection and specification of materials has led to energy saving practices in the projects	6.70%	8.50%	17.00%	25.50%	42.40%	3.88	1.24
Building's architectural and mechanical features impact on the energy saving practices of projects	11.50%	4.20%	9.10%	32.70%	42.40%	3.90	1.31
Average						**3.89**	**1.27**

67.9% agreed that careful selection and specification of materials has led to energy saving practices in the projects while 75.1% agreed that building's architectural and mechanical features impact on the energy saving practices of projects. On a five point scale, the average mean of the responses was 3.89 which mean that majority of the respondents were agreeing with most of the statements; however the answers were varied as shown by a standard deviation of 1.27.

4.4.2 Regression Analysis

The results presented in table 14 present the fitness of model used of the regression model in explaining the study phenomena.

Table 14: Model Fitness

Indicator	Coefficient
R	0.375
R Square	0.141
Adjusted R Square	0.135
Std. Error of the Estimate	0.297988

Energy saving practices explained 14.1% of the variations in the dependent variable which is sustainability.

In statistics significance testing the p-value indicates the level of relation of the independent variable to the dependent variable. If the significance number found is less than the critical value

also known as the probability value (p) which is statistically set at 0.05, then the conclusion would be that the model is significant in explaining the relationship; else the model would be regarded as non-significant.

Table 15: Analysis of Variance

	Sum of Squares	df	Mean Square	F	Sig.
Regression	2.367	1	2.367	26.652	**.000**
Residual	14.474	163	0.089		
Total	16.841	164			

Table 15 provides the results on the analysis of the variance (ANOVA). The results indicate that the overall model was statistically significant. Further, the results imply that the independent variable is a good predictors of sustainability. This was supported by an F statistic of 26.652 and the reported p value (0.000) which was less than the conventional probability of 0.05 significance level.

Regression of coefficient was presented in table 4.22

Table 15: Regression of Coefficients

Variable	B	Std. Error	t	sig
(Constant)	3.576	0.082	43.561	0.000
Energy saving practices	0.111	0.022	5.163	**0.000**

Regression of coefficients results in table 16 shows that Energy saving practices and sustainability are positively and significantly related (r=0.111, p=0.000). Seah, (2009) argued that careful selection and specification of materials can make a major contribution to reduction of waste, improved energy efficiency of construction, and lower costs. Energy efficiency looks at reducing the energy consumption in on-mode and standby-mode. The eco-design activities are linked the existing product quality activities in R&D process and are unclosed with Product Eco Declaration to stakeholders.

4.5 Correlation Analysis

Correlation analysis were conducted between the dependent and the independent variables and results presented in Table 4.23.

Table 16: Correlation Matrix

		Sustainability	Procurement and purchasing	Reuse, Use and Recycle	Material Cost	Energy saving practices
Sustainability	Pearson Correlation	1.000				
	Sig. (2-tailed)					

Procurement and purchasing process	Pearson Correlation	.516**	1.000			
	Sig. (2-tailed)	0.000				
Reuse, Use and Recycle	Pearson Correlation	.378**	.274**	1.000		
	Sig. (2-tailed)	0.000	0.000			
Material Cost	Pearson Correlation	-.233**	-0.140	0.042	1.000	
	Sig. (2-tailed)	0.003	0.073	0.591		
Energy saving practices	Pearson Correlation	.375**	.264**	0.018	-0.008	1.000
	Sig. (2-tailed)	0.000	0.001	0.821	0.916	

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

Table 16 presents the results of the correlation analysis. The results revealed that procurement and purchasing processes and sustainability are positively and significantly associated(r=0.516, p=0.000).The table further indicated that Reduce, Reuse, and Recycle and sustainability are positively and significantly associated (r=0.378, p=0.000). It was further established that material cost and sustainability are negatively and significantly associated (r=-0.233, p=0.003).Similarly, results showed that energy saving practices and sustainability are positively and significantly associated (r=0.375, p=0.000). This implies that an increase in any unit of the variables leads to an improvement in sustainability

4.6 Multivariate Regression Model

The results presented in table 16 present the fitness of model used of the regression model in explaining the study phenomena.

Table 17: Model Fitness

Indicator	Coefficient
R	0.658
R Square	0.443
Adjusted R Square	0.419
Std. Error of the Estimate	0.244306

Procurement and purchasing Reuse, Use and Recycle, Material Cost and Energy saving practices were found to be satisfactory variables in explaining sustainability of construction projects. This is supported by coefficient of determination also known as the R square of 44.3%. This means Procurement and purchasing, Reuse, Use and Recycle, Material Cost and Energy saving practices explain 44.3% of the variations in the dependent variable which is sustainability of construction projects. This results further means that the model applied to link the relationship of the variables was satisfactory.

In statistics significance testing the p-value indicates the level of relation of the independent variable to the dependent variable. If the significance number found is less than the critical value also known as the probability value (p) which is statistically set at 0.05, then the conclusion would be that the model is significant in explaining the relationship; else the model would be regarded as non-significant.

Table 18: Analysis of Variance

	Sum of Squares	df	Mean Square	F	Sig.
Regression	7.291	4	1.823	30.539	**.000**
Residual	9.55	160	0.06		
Total	16.841	164			

Table 18 provides the results on the analysis of the variance (ANOVA). The results indicate that the overall model was statistically significant. Further, the results imply that the independent variables are good predictors of performance. This was supported by an F statistic of 30.539 and the reported p value (0.000) which was less than the conventional probability of 0.05 significance level.

Regression of coefficient was presented in table 4.26

Table 19: Regression of Coefficients

Variable	B	Std. Error	t	sig
(Constant)	2.261	0.228	9.937	0.000
Procurement and purchasing process	0.288	0.056	5.141	**0.000**
Reuse, Use and Recycle	0.291	0.063	4.654	**0.000**
Material Cost	-0.119	0.037	-3.25	**0.001**
Energy saving practices	0.083	0.018	4.523	**0.000**

Regression of coefficients results in table 4.26 shows that procurement and purchasing processes and sustainability are positively and significantly related(r=0.288, p=0.000).The table further indicated that Reduce, Reuse, and Recycle and sustainability are positively and significantly related (r=0.291, p=0.000). It was further established that material cost and sustainability are negatively and significantly related (r=-0.119, p=0.001).Similarly, results showed that energy saving practices and sustainability are positively and significantly related (r=0.083, p=0.000).

This implies that an increase in any unit of the variables leads to an improvement in sustainability.

In the study of Matthiessen and Morris (2007), they found that the majority of projects did achieve their sustainable goals within their original budget. Subsequent analysis supports this finding. It is likely that, in some of these cases, budgets were set with sustainability in mind, making the finding for those projects less meaningful, but in general, we find that projects with budgets set without reference to sustainable goals are still achieving certification with little or no adjustment to their b

Therefore, the optimal model is as shown below:

$Y= 2.261+ 0.288X_1+ 0.291X_2 -0.119X_3+ 0.083X_4$

Where

Y =Sustainability of construction of projects

X_1= Procurement and purchasing;

X_2 = Reduce, Reuse, Recycle

X_3 = Material Cost and

X_4 = Energy Saving Practices

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the findings above the study concluded that Procurement and purchasing Reuse, Use and Recycle, and Energy saving practices has a positive and significant effect on sustainability while material cost has a negative and significant effect on sustainability.

The study also concluded that purchases affects all business areas in a company and it is therefore important that all business areas can influence the purchases, so the outcome becomes optimal for the whole company.

In addition, the study concluded that a wide range of building design approaches and commercially available technologies can help effectively minimize a building's energy costs.

5.2 Recommendations

Based on the research findings, the study recommended for the projects construction management to order materials in the right quantities and material handling should be such as to minimize waste on site. Material control procedures must be put in place and closely managed. It is essential to reduce the use of non-renewable materials and where possible they should be substituted with secondary resources such as materials reclaimed after construction or demolition activities. Emissions into the atmosphere resulting from construction and demolition activities should be reduced to tolerable levels.

The study also recommended for alternative sources which could serve as substitute to materials involve the use of non-primary materials Recycling in construction will involve sorting of material wastes produced on sites into their constituents and processing of the base constituents using appropriate recycling equipment.

For the best effects of a centralized purchasing organization the company needs a way of working that supports feedback between the construction site, the purchasing department and the suppliers.

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