

ROLE OF GREEN PROJECT MANAGEMENT PRACTICES ON ENVIRONMENTAL SUSTAINABILITY IN THE CONSTRUCTION INDUSTRY IN THE COUNTY GOVERNMENT OF NAKURU

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Abstract

Objective: To establish the role of green project management on environmental sustainability in the construction industry in Nakuru County government.

Design: exploratory research design

Setting: Construction firms within Nakuru County, Kenya

Subjects: One hundred respondents

Results: The study revealed construction firms in Nakuru County have laid down structures to ensure any reusable materials are maintained for future usage in their construction projects where 66% of these have aligned their processes with the conventional SMART waste model. Majority (67%) of the firms have put in

place mechanisms to ensure all the waste products are stored in safe places. However, only 33% of the firms utilize a wide array of green products to ensure minimal pollution of the environment. 76% of the construction firms in the County have the awareness of green project management initiatives available at their disposal. Findings however revealed that in 64% of the firms there is a general lack of effectiveness of the general regulatory standards and compliance to environmental sustainability in the firms studied.

Conclusion

There is a significant relationship between green project management practices and environmental sustainability. Proper waste management practices in the construction industry greatly contribute to environmental sustainability. A positive relationship was also found between the effectiveness of the existing policies and guidelines governing environmental sustainability. Recommendations were made that; there is need for the management of the construction firms to ensure that employees abide to the policies and guidelines provided as well that the government needs to do more towards ensuring environmental sustainability.

Introduction

Sustainable development has gained much attention in all nations. Sustainable building is also becoming increasingly relevant globally, especially in the real estate sector. Sustainable buildings are designed to reduce energy, materials, and resources on a life-cycle basis. The need to design buildings that enhance the environment instead of exploiting it becomes a reality. Driven by the increasing concerns about energy, greenhouse gas emissions and indoor air quality, an explosion in the interest of sustainable building is unmistakable (1). Sustainable buildings reduce consumption of materials, energy, water and improve indoor environmental health. The need to reduce the environmental footprint of buildings alongside the economic incentives to build green presents a substantial opportunity for the real estate and construction sectors (1).

The Earth's ecosystems today are at a critical point. Human activities currently lead to irreversible losses of important ecosystem functions. Buildings and construction works have the largest single share of global resource use and pollution emission. In OECD countries the built environment is responsible for around 25-40% of total energy use, 30% of raw material use, 30-40% of global greenhouse gas emissions and for 30 to 40% of solid waste generation (2).

The contribution by the Construction Industry to the robust national economic and urban growth in the country has been put under the microscope as its activities have constantly and lately failed to safeguard the fundamentals of society's resource base, which include the people, natural environment, industrial and production base of goods and services, and the expansive built environment. This has been through rising cases of fatalities as a result of collapsed buildings, depletion of the natural environment through development and encroachment of public land and water catchments areas and unprofessional practices in production, manufacturing and delivery of the final product in the real estate and construction industry. The intergenerational and interdependence aspect of sustainability demand that the built environment safeguards the needs and requirements of the society's resource base, which includes the people (3).

The world has changed over the past couple of decades with an ever-increasing recognition that we can no longer continue to use natural resources without facing environmental consequences. Business and the property industry have been slow to react to this changing view of the world, even though there has been awareness of the growing environmental consequences of our actions since the Industrial Revolution. While sustainability is usually interpreted today as the overarching goal or target of having a durable balance between the economy, environment, and society, sustainable development means an ongoing process directed towards achieving this goal. In this context, taking responsibility towards the environment can be seen as a precondition and measure for implementing the principles of sustainable development, The

urgency of undertaking action in order to achieve more sustainable development can be highlighted by referring, for example, to two recent publications: Millennium Ecosystem Assessment Report – a study involving the work of more than 1,360 experts worldwide – which revealed that —human activity is putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted (3).

The level of use of external and renewable sources of energy has been low and thus putting pressure on the available natural resources, a situation also attributed to increasing pollution. Other construction development regulation challenges today include environmental management in the context of rapid population growth and urbanization. As the urbanization trend continues, urban environments are deteriorating. One of the biggest policy challenges today is the inclusion of environmental policy into urban policy. There are a lot of cases of construction project without environmental impact assessment study or report as required by the law. Some of the projects have engaged professionals who are ignorant of the law requirements (4).

Sustainable development is unattainable without sustainable buildings. Interestingly, although many descriptions of what is a sustainable building have been offered, there has been no agreement on a single definition (5). As to sustainable construction, UNEP has defined it as the use and/or promotion of environmentally friendly materials, energy efficiency in buildings, and management of construction and demolition waste (6). Although many aspects of buildings can impact on sustainable development, those that are generally perceived as critical include: the consumption of resources, including energy, materials and water; waste and recycling; and indoor environmental (including air) quality (7).

New trends in environmental accounting lean heavily towards life-cycle assessment that accounts not only for the use (energy consumption) phase of a building but also for the impacts of the pre-construction (design and siting) and construction phases. The increasingly common position that buildings, like other infrastructure modes, should be subjected to a cradle-to-grave analyses that address the impacts of their many uses is backed by emergent data that reveals the relative environmental, economic and social impacts of the various phases of the built environment (8).

The management of Construction processes to reduce, reuse, recycle and effectively dispose of wastes has a serious bearing on the final cost, quality, time and impact of the project on the environment. Kenya has a large housing deficit which is growing every year and is increasingly prevalent in urban areas including Nakuru, which is one of the fastest growing cosmopolitan towns in Kenya(9). According to the Ministry of Housing, the current annual housing deficit is estimated at 156,000 units per annum based on the population growth and urban migration currently taking place. The pace of construction is limited to only 50,000 units constructed and the deficit filled by growth in slum dwelling and poor quality traditional housing (10). The major concern is that almost none of the building adopts the green, sustainable design or technologies available in the market during their construction or occupational phases. Thus, there will be an increase in the consumption and demand of building materials, energy, water, and improve indoor environmental health which, in the long run, will not be sustainable (11).

According to Yuan and Shen (12), construction waste has caused serious environmental problems in many large cities. Enormous amounts of infrastructure and building work have been built, so numbers of demolished structures are also increasing in construction work. As increasing demands of dumping areas for never-ended demolished waste are thrown away, there is a shortage of landfills. Therefore, reducing waste generation becomes a pressing issue around the world. While serious pollution generated from construction activities, a comprehensive construction waste management is urgently needed on every construction site. It is of great importance to structure ways for minimizing waste generation is seen as the most favorable solution to waste problems of any kind. Indeed, it should be made compulsory that every construction

company should enact construction waste management plan tailored to its particular mode of business so that every personnel from the management to the operational level can head for the same goal of construction waste management (13).

Materials and Methods

The study was carried out at construction firms in Nakuru County which is one of the 47 counties of Kenya. The target population of the study included individuals working for the 60 construction firms that are registered in Nakuru. A sample of 109 staffs was selected from these firms through a stratified random sampling out of who 100 responded to the study. Questionnaires were the data collection tool used which were self-administered by the researcher. Data collected was analyzed through both descriptive statistics and inferential statistics. Regression analysis was conducted to show the regression model relating the dependent and independent variables in the study.

Results

Table 1 Demographic Characteristics of the Respondents

		Count	Column Total N %
Gender	Female	45	45.0%
	Male	55	55.0%
Age bracket	Below 21	2	2.0%
	21 - 29	48	48.0%
	30 -40	37	37.0%
	Above 40	13	13.0%
Education Level	Primary	0	0.0%
	Secondary	0	0.0%
	Tertiary/college	12	12.0%
Position	University	50	50.0%
	Post graduate	38	38.0%
	In charge of field environment	31	31.0%
How long have you worked	Field supervisor	69	69.0%
	1 - 3 years	10	10.0%
	3 - 5 years	35	35.0%
	5 - 8 years	42	42.0%
	9 years and above	13	13.0%

There were more (55%) male respondents as compared to the female (45%) respondents. most of the respondents (48%) were aged 21 – 29 years followed by 37% who were aged 30 – 40 years and 13% who were aged above 40 years whereas 2% were less than 21 years. On the respondents' level of education achieved, 12% had tertiary/college education, (50%) were the university undergraduates and 38% had a

university postgraduate degree. 69% of the respondents were field officers whereas 31% were officers in charge of field environment. 42% of the respondents had worked with their organizations for 5- 8 years, 35% had 3 – 5 years and 13% had worked for more than 8 years whereas 10% had worked for a period of 1 – 3 years.

Table 2 Recycling and Reusing

	N	Strongly agree	Agree	Fair	Disagree	Strongly disagree
The firm promotes usage of recyclable products within the construction process.	100	66	13	7	14	0
The firm has laid down structures to ensure any reusable materials are maintained for future use.	100	51	28	21	0	0
The firm uses benchmarking of the widely usable reusable products to project the requirements of the next construction activity.	100	62	19	5	14	0
The firm has aligned its processes with the conventional SMART waste model.	100	30	36	15	19	0
The firm has designed an elaborate waste management plan supported by wide re-usage of products where possible and waste reduction measures.	100	18	22	16	34	10
The firm utilizes energy conserving applications and methods.	100	41	25	15	19	0

The firms promotes usage of recyclable products within the construction process (79%). These also agreed indicating that the firms have laid down structures to ensure any reusable materials are maintained for future use. The firms use benchmarking of the widely usable reusable products to project the requirements of the next construction activity (81%). 66% agreed that construction firms have aligned processes with the conventional SMART waste model. However, most of the respondents disagreed that the firms had designed an elaborate waste management plan supported by wide re-usage of products where possible and waste reduction measures. 66% of the firms utilize energy conserving applications and methods.

Table 3 Proper Waste Management

	n	Strongly agree	Agree	Fair	Disagree	Strongly disagree
The firm has put in place mechanisms to ensure all the waste products are stored in safe places.	100	54	13	14	11	8
The firm has hired professional waste management firms to ensure proper disposal of waste products.	100	3	16	3	28	50
The firm utilizes a wide array of green products to ensure minimal pollution of the environment.	100	17	16	20	19	28
Proper waste management is undertaken both as a social responsibility of the firm and as part of the firms mission to keep a clean environment.	100	38	31	13	18	0
Efficient usage of resources is encouraged to avoid generation of waste within the firm.	100	38	44	18	0	0
The firm's personnel are well trained and capable of dealing and reducing the usage of environmentally deploring products.	100	18	12	38	32	0

Sixty seven percent of the firms have put in place mechanisms to ensure all the waste products are stored in safe places. However, only 19% of the firms had professional waste management service providers to ensure proper disposal of waste products. Only 33% of the firms utilize a wide array of green products to ensure minimal pollution of the environment. Among the firms, 69% ensures proper waste management which is undertaken both as a social responsibility of the firms and as part of the firm's mission to keep a clean environment. Findings also show that efficient usage of resources is encouraged to avoid generation of waste within the firm. Findings show that, only 30% of the firm trained the personnel giving them the ability to deal and reduce the usage of environmentally deploring products.

Table 4 Awareness of Green Project Management

	n	Strongly agree	Agree	Fair	Disagree	Strongly disagree
The firm is aware of the green project management initiatives available at its disposal.	100	50	26	11	10	3
The firm has laid out green project operations in the course of its construction business.	100	7	15	28	38	12
The entire firm personnel are conscious of the green project guidelines adopted by the firm.	100	6	17	28	20	29

Table 4 shows that 76% of the construction firms in Nakuru County are aware of the green project management initiatives available at their disposal. Only 25% of the respondents agreed that the firms had laid out green project operations in the course of their construction business. Thus, a number of the firms had not laid out such projects in their business. Similarly, only 23% of the respondents agreed that their entire firm personnel are conscious of the green project guidelines adopted by their firm.

Table 5 Effectiveness of Existing Policies and Guidelines

	n	Strongly agree	Agree	Fair	Disagree	Strongly disagree
There is a general lack of effectiveness of the general regulatory standards and compliance to environmental sustainability.	100	28	36	11	19	6
There is a general lack of coordination between government agents and county governments on monitoring and evaluating construction firm's activities.	100	37	25	8	19	11
The authorities in charge of environment management have high laxity and corruption bogging down their mandate implementation.	100	15	17	5	12	51
The government needs to do more to ensure environmental sustainability is promoted.	100	12	63	10	11	4

According to the results in table 5, majority of the respondents (64%) agreed that there is a general lack of effectiveness of the general regulatory standards and compliance to environmental sustainability in the firms studied. Findings also show that there is a general lack of coordination between government agents and county governments on monitoring and evaluating construction firm's activities. Majority of the respondents disagreed that the authorities in charge of environment management have high laxity and corruption bogging down their mandate implementation. 75% of the respondents expressed the concern that the government needs to do more to ensure environmental sustainability is promoted.

Table 6 Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.872 ^a	.849	.813	2.0241

a. Predictors: (Constant), Reuse and Recycling, Energy Utilization, Proper Waste Management

Table 6 illustrate that holding other factors constant, the predictor variables in this study (Reuse and Recycling, Energy Utilization and Proper Waste Management) explains 84.9% of the variation in the environmental sustainability.

Table 7 Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2373.422	10	237.34	8.12	.021 ^a
	Residual	2601.913	89	29.23		
	Total	4975.335	99			

a. Predictors: (Constant), Reuse and Recycling, Energy Utilization, Proper Waste Management

b. Dependent Variable: Environmental sustainability

Findings as shown in table 7 illustrate that the model developed relating the dependent and independent variables is statistically significant in predicting the environmental sustainability with the use of the variables selected. The F value was obtained as 8.12 which is greater than the F critical revealing the significant of the model in presenting the relationship between the variables.

Table 8 Regression Coefficients

Model	Unstandardized Coefficients		Standardized	t	Sig.
	B	Std. Error	Coefficients Beta		
(Constant)	1.284	1.394		1.004	.000
Reuse and Recycling	2.452	1.406	1.054	.246	.010
Energy Utilization	2.839	.479	1.916	1.073	.024
Proper Waste Management	1.016	.025	.228	1.639	.001

a. Dependent Variable: Environmental sustainability

The coefficients in table 8 leads to the model relating the dependent and independent variables which becomes: ***Environmental Sustainability = 1.284 + 2.452 X1 + 2.839 X2 + 2.016 X3***. From the model, holding the predictor variables constant, environmental sustainability would be 1.284. All the independent variables indicated a positive coefficient showing that increase in one of the variables would result to increase in environmental sustainability.

Discussion

The study results illustrated that majority the construction firms in Nakuru County have laid down structures to ensure any reusable materials are maintained for future usage in their construction projects. These firms also use benchmarking of the widely usable reusable products to project the requirements of the next construction activity. 66% of the firms were found to have aligned their processes with the conventional SMART waste model. However, only 30% of the firms had designed an elaborate waste management plan supported by wide re-usage of products where possible and waste reduction measures. Sixty six percent of these firms as well utilize energy conserving applications and methods. These results are in line with the findings of another study (14) which illustrated that recycling strategies of collecting used oil during oil change operations for later use, use of biomass energy, use of high energy efficient lighting through the property, use of energy saving bulbs, use of solar energy and use of sensors or timers to save electricity in intermittent areas significantly lead to reduced production of environment externalities in the course of a firm's operations.

With regard to the proper waste management practices adopted by the firms, the study findings illustrated that 67% of the firms have put in place mechanisms to ensure all the waste products are stored in safe

places. However, only 19% of the firms had hired professional waste management firms to ensure proper disposal of waste products. Findings further revealed that, only 33% of the firms utilize a wide array of green products to ensure minimal pollution of the environment. Proper waste management is undertaken both as a social responsibility of 69% of the firms and as part of the firms mission to keep a clean environment. 82% of the firms also were more concerned and encouraged efficiency in material use to avoid generation of waste within the firm. Findings as well indicated that, only 30% of the firms' personnel were found to have been well trained and capable of dealing and reducing the usage of environmentally deploring products. Coventry and Guthrie, (14) in their study illustrated that there are two fundamental reasons for reducing, reusing and recycling waste: the economic advantages, and the environmental advantages. The environmental advantages include the minimization of the risk of immediate and future environmental pollution and harm to human health while the economic advantages include lower project costs, increased business patronage, lower risk of litigation regarding wastes amongst others.

Findings on the awareness of green project management revealed that, 76% of the construction firms that were studied were aware of the green project management initiatives available at their disposal. Findings also showed that only 25% of the firms had laid out green project operations in the course of their construction business. As well, only 23% of the firms had their personnel who were conscious of the green project guidelines adopted by their firm. The findings support the argument of a similar study (11) that the increasing awareness of environmental impacts from construction wastes has led to the development of waste management as an important function of construction project management.

The study further established that in 64% of the firms studied, there is a general lack of effectiveness of the general regulatory standards and compliance to environmental sustainability in the firms studied. Findings also indicated that there is a general lack of coordination between government agents and county governments on monitoring and evaluating construction firm's activities. According to the results, authorities in charge of environment management have high laxity and corruption bogging down their mandate implementation. Findings thus showed that the government needs to do more to ensure environmental sustainability is promoted. In line with these, a similar study (15) concluded that one of the challenges that Kenyan cities face is the lack of a framework to address urban-environmental sustainability problems, which include landfills, a lack of clean drinking water, poor sanitation, inadequate energy, and lack of solid waste management.

Conclusion

There is a significant relationship between green project management practices and environmental sustainability. However, most of the construction firms in Nakuru County have not adopted these practices in their business operations. The recycling and reuse measures play a great role in contributing top environmental sustainability through creating a safe environment for business development as well as safety for human health. Proper waste management practices in the construction industry greatly contribute to environmental sustainability. Keeping safety policies towards environment sustainability in a firm contributes to improved environment conducive for further business investment. Awareness on the green project to the management of the construction firms facilitates the practicing of these practices. The more awareness the organizations have, the better will be the environment since more will be practiced towards environment sustainability. A positive relationship as well exists between the effectiveness of the existing policies and guidelines governing environmental sustainability. The authorities in charge of environment management however are faced with high laxity and corruption bogging down their mandate implementation.

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