

# Factors Influencing Maintenance Of Coastline Structures In The Kenyan Coastline

Hillary James Nyaanga

Dr. Severina Peter Nkirina

Dr. Kaibui Mwikamba

Jomo Kenyatta University of Agriculture & Technology

*Abstract: Coastline structures are important in ensuring movement and protection of lives along the coastlines. The desire to promote economic activities and save lives has hence made various stakeholders to initiate projects to facilitate the maintenance of coastline structures on a regular basis. This study sought to establish the factors influencing coastline maintenance levels in the Kenyan coastline. The study focused on the project implementers who are currently engaged in the coastline maintenance project along the Kenyan coastline line. The target population was 90 employees. A total of 51 questionnaires were filled and returned and this paper is based on these findings. The research used descriptive research design and collected data using a structured questionnaire. A 5 point likert scale was used to measure the perceived influence of different factors on coastline maintenance levels. Data was analysed using SPSS version 23. Descriptive statistics and measures of central tendency were used to summarize and describe findings. The study found out that finance and budget was the most important factor influencing coastline structures maintenance and government support. The other factors were of moderate influence. The study concludes that in coastline structures maintenance projects, there is need to consider strongly the extent of government support as well as financial resources and budgetary allocations.*

*Keywords: Coastline structures, maintenance, influence, coastlines, finance, budget, technology, government support, management training and qualifications*

## I. INTRODUCTION

Coastlines have received a lot of attention from researchers and environmental groups due to their inherent value in sustaining livelihoods. For example (Mwanje, 1997; Gilbert and Velinga, 1990), propose measures to protect the coastlines as involving; retreat, accommodation; and protection. The dangers arising from un protected coastlines would be as a result of rising sea water and sea movements leading to destructive floods among other challenges. Human activity has been blamed for the erosion and the destruction of the coastline in many instances (Mwanje, 1997).

## A. THE CASE OF KENYAN COASTLINE

The Kenyan coastline stretches from Vanga at the border of Kenya and Tanzania in the south coast to the border with Somali in the north coast. The Kenyan coastal and marine ecosystems constitute a rich and diverse national asset that supports the livelihood of 2.7 Million coastal communities and contributes to the national economic development especially from its contribution through tourism sector which is a major player in the economy.

A long the Kenyan coastline, there are a number of structures and activities engaged in by the coastal populations. The structures safeguard human life as well as facilitate passage and sea movement to make coastal activities more robust. They are used as a strategy to protect the coastline

from erosion especially the sea walls (Mwanje, 1997; and Kairu, 1997).

#### B. COASTLINE STRUCTURES AND THE NEED FOR MAINTENANCE

Coastline structures comprise of jetties, seawalls, pontoons and access staircases among others (IPCC, 2014). These are also the ones likely to be found along the Kenyan coastline (Mwandotto, 1997; Kuria, 1997 and Mwanje, 1997).

The coastline structures require regular maintenance and upgrading in order to continue protecting the coastlines as well safe guard human lives reliably (Anyona and Rop, 2016; and Awour et al., 2008). This kind of maintenance may embrace renovation to restore a structure, service and equipment by a major overhaul to the original design and specification, or to improve on the original design. Renovation may include rehabilitation or modernization or adaptation also due to improved technology and product specifications in the construction industry (Amobi, 2006).

A sustainable maintenance is therefore a functional system dedicated to help maintain a healthier, more productive environment, which is better for users of these structures, and the wider community of coastal area residents. Newer technologies, designs and processes make it possible to maintain effectively, efficiently and with less impact on structures as well as the environment hence addressing concern of environmentalists and cost conscious stakeholders in the long run (Atakilte, 2002 and Linham and Nicholi, 2010).

Furthermore, the coastline structures are constructed of coral stone and mortar; sometimes interspersed with reinforced concrete. These are not very strong materials and may require monitoring to do repairs on cracks and other weak points to ensure stability and durability in the long run.

Environmental researchers point to the need of governments of developing countries to consider maintenance of coastline structures while formulating national economic plans and measures that affect coastline activities. This is important because coastal users all over the world are frequently faced with serious erosion of their sandy coasts among other challenges (Anyona and Rop, 2016; IPCC, 2014, Kairu, 1997 and Nyandwi, 1997). Continuous maintenance and improvement of the coastlines, together with monitoring and studies of coastal processes have yielded considerable experience on various coastal protection measures all over the world (Awour, 2008; Gilbert and Vellinga, 1990; New York City Government, 2013).

#### C. STATEMENT OF THE PROBLEM

Research evidence alludes that coastlines will be exposed to increasing risks, including coastal erosion, over the coming decades due to climate change and sea-level rise mostly brought about by effects of global warming among other factors (Awour, 2008; Anyona and Rop, 2016; and IPCC, 2014). Adaptation for the coasts of developing countries will be more challenging than for coastlines of developed countries, due to constraints on adaptive capacity.

Sea-level rise has substantial inertia and will continue beyond the 21<sup>st</sup> Century.

Coastal erosion is a serious environmental problem affecting several coastal and island countries in the West Indian ocean region, including Kenya, Tanzania and Mozambique, to name only a few. Proper maintenance of coastline structures will hence enhance the design life of the facilities and reduce rehabilitation of deteriorated structures in addition to ensuring protection of lives which may arise from accidents caused by sudden failures of structures.

The current study therefore sought to find out to what extent various factors are perceived to influence the maintenance levels of coastline structures along the Kenyan coastline.

#### D. RESEARCH QUESTIONS

The study was guided by the following questions.

- ✓ What are the factors influencing maintenance of coastline structures in the Kenyan coastline?
- ✓ What extent does budget and finance factors affect maintenance of coastline structures?
- ✓ To what extent does availability of qualified personnel influence maintenance of coastline structures?
- ✓ To what extent does government support influence maintenance of coastline structures?
- ✓ To what extent does availability of technology affect the maintenance of coastline structures?
- ✓ To what extent does management qualification and training of project managers influence maintenance levels of coastline structures?

## II. LITERATURE REVIEW AND THEORETICAL FOUNDATIONS

### A. FACTORS INFLUENCING MAINTENANCE OF COASTLINE STRUCTURES

Coastline structures may be at different states of structural integrity depending on the purposes for which they are used and the facilities available. The volume of traffic also dictates the different modes and frequency of maintenance. Well maintained coastline structures can be regarded as one which can handle the designed volume of traffic at all times without endangering the lives of the users or damage to property.

To ensure reliability and design integrity of coastline structures, the maintenance team need to have the relevant resources in place. This has sometimes rendered coastline structures maintenance programme in effective. Several factors are at play in ensuring that coastline structures are well designed, constructed and maintained (Hunt et al., 2014; SCCG, 2013 and Stamski, 2005). These factors include among others; availability of finances; availability of qualified personnel; accessibility to appropriate technologies; government support and qualifications as well as training of management team (IPCC, 2013; New York City Government, 2013 and Stamski, 2005).

**B. THE SYSTEMS THEORY**

This theory has been used to describe organization systems with components that interact with each other and their environment (Cole, 2003; Mullins, 2012). This theory guides this study in that the concept of maintenance requires proper coordination and collaboration of various actors to produce the desired outcome of safe coastlines. The systems theory is depicted by inputs, processes and outputs. The organizations also interact with the environment for various resources.

From this theory, maintenance of coastline structures can be well structured and guided in terms of resource attraction as well as coordinating other stakeholders and processes to ensure regular and reliability in output generation which is more safe coastline structures. Safe structures entail, following of designs and professionalism in implementation of coastline structures maintenance plans. It will also involve operating within a regulated framework with proper policies in place. The systems theory further helps us to understand the factors influencing maintenance programmes in place for coastline structures as well as the role of the various stakeholders in ensuring sustainable maintenance strategies.

**INDEPENDENT VARIABLES                      DEPENDENT VARIABLE**

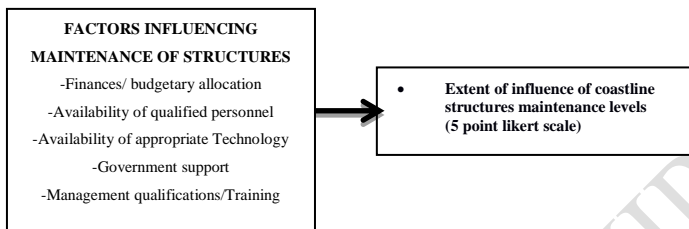


Figure 2.1: Conceptual Framework

**III. RESEARCH METHODOLOGY**

**A. RESEARCH DESIGN**

The study used descriptive research design to investigate the factors influencing maintenance of coastline structures in Kenya. Descriptive design therefore enabled the researcher to collect data which allowed the description of the phenomena of interest more accurately and reliably. It has been recommended as a reliable design to answer research questions adequately (Kothari, 2009; Kombo and Tromp, 2006; Saunders, et al., 2007).

**B. TARGET POPULATION AND STUDY LOCATION**

The study populations are located along the Kenyan coastline which runs from vanga in the south coast bordering Kenya and Tanzania all the way to Lamu and Kizingitini in north coast bordering Kenya and Somali. The study gathered data from coastline maintenance project personnel using a structured questionnaire which had questions on a 5 point likert scale. The target population was 90 employees but only 51 questionnaires were useful for analysis.

**C. DATA ANALYSIS AND PRESENTATION**

According to Schindler et al. (2005), data analysis involves reducing accumulative raw data to manageable size, developing summaries, looking for patterns and applying statistical techniques. Data analysis for this study was done by use of frequency tables, percentages and means as measures of tendency. To enhance visual emphasis, data was presented using bar charts.

**IV. FINDINGS AND DISCUSSION**

The findings are based on 51 responses from the implementers of coastline structures maintenance project. This represents 64% of the total sample which was considered adequate given the fact that most project workers are out in the field and rarely available for interviewing. The findings are discussed below as per the specific research questions guiding the investigation.

**A. FINANCE AND BUDGET**

Budget and finance represent a major contribution to any project. For coastline structures maintenance this was seen to be an important factor. The respondents rated this factor on a 5 point likert scale and the frequencies shows that 62% of the respondents rated it as contributing highly to the maintenance of the coastline structures. The fact that less than 20% rated it low is evidence that it was considered as a critical factor for carrying out maintenance work. The table and histogram below shows these findings in detail.

	Frequency	Percent	Valid Percent	Cumulative Percent
very low	5	9.8	9.8	9.8
Low	5	9.8	9.8	19.6
Moderate	9	17.6	17.6	37.3
high	15	29.4	29.4	66.7
very high	17	33.3	33.3	100.0
Total	51	100.0	100.0	

Table 4.1: Finance and Budgets

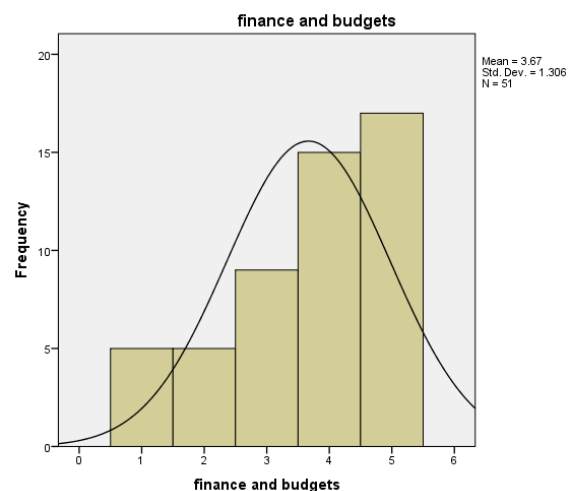


Figure 4.1: Finance and Budget

**B. AVAILABILITY OF QUALIFIED PERSONNEL**

Personnel of the relevant qualification is necessary for implementing any task. This research however indicate that it was not highly rated as affecting the maintenance of coastline structures. Majority (39%) of the respondents considered it to be of moderate importance. This can be attributed to the fact that capacity is not lacking in the Kenyan market as evidenced by the high number of middle and higher level training institutions in Kenya. The table and chart below gives this finding in detail.

	Frequency	Percent	Valid Percent	Cumulative Percent
very low	3	5.9	5.9	5.9
low	12	23.5	23.5	29.4
moderate	20	39.2	39.2	68.6
high	10	19.6	19.6	88.2
very high	6	11.8	11.8	100.0
Total	51	100.0	100.0	

Table 4.2: Availability of Qualified Personnel

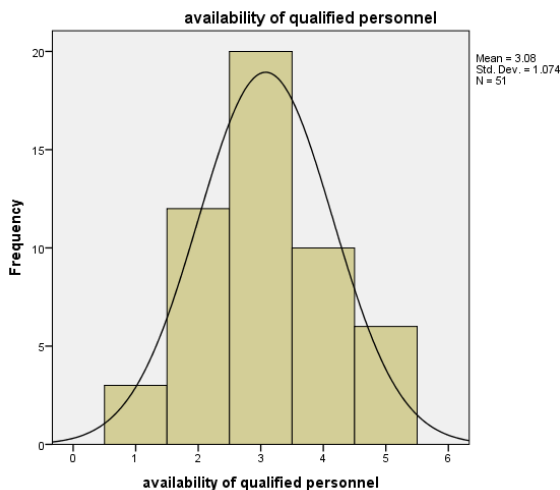


Figure 4.2: Availability of Technology Ratings

**C. AVAILABLE TECCHNOLOGY**

Though technology has been found to be important in other researchers, in this study it was rated moderately as a factor affecting maintenance of coastline structures in Kenya. This is shown by 45% repondents ratng it as moderate. This shows that it is neither very important nor less important. This can be attributed to the fact that it cannot work alone without the requisite personnel and financial resources which we found wanting from the other findings. The table and figure below gives these findings.

	Frequency	Percent	Valid Percent	Cumulative Percent
very low	4	7.8	7.8	7.8
low	4	7.8	7.8	15.7
moderate	23	45.1	45.1	60.8
high	14	27.5	27.5	88.2
very high	6	11.8	11.8	100.0

Total	51	0	100.0	100.0
-------	----	---	-------	-------

Table 4.3: Available Technology

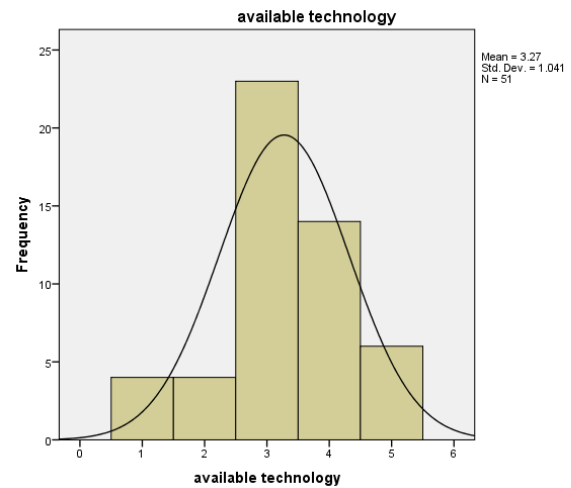


Figure 4.3: Available Technology Ratings

**D. GOVERNMENT SUPPORT**

Key to any major project is the support of the government. This study proves this view by the perceived role of government support in any key infrastructure project. From the findings it shows more than half (59%) of the respondents rated government support as highly in maintenance of coastline structures. Only 16% of the respondents underscored the importance of the government in maintenance of coastline structures. The findings are shown below.

	Frequency	Percent	Valid Percent	Cumulative Percent
very low	3	5.9	5.9	5.9
low	5	9.8	9.8	15.7
moderate	13	25.5	25.5	41.2
high	19	37.3	37.3	78.4
very high	11	21.6	21.6	100.0
Total	51	100.0	100.0	

Table 4.4: Government Support

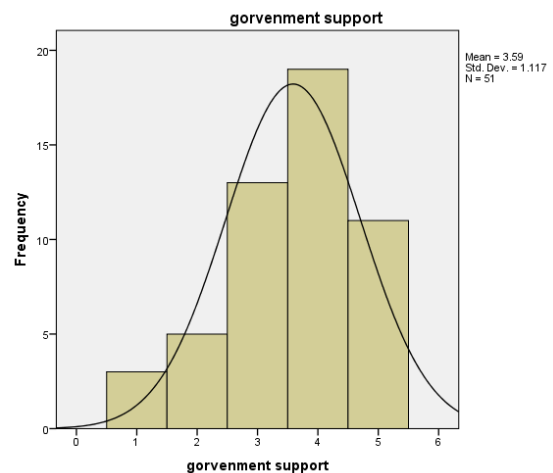


Figure 4.4: Government Support Ratings

E. MANAGEMENT QUALIFICATION AND TRAINING

Project managers play a major role in directing and coordinating project implementation programmes. However in this study respondents rated it moderately as a factor affecting maintenance of coastline structures at 39%. However it is interesting that close to 75% of the respondents consider management qualification as somehow important as shown from the findings of those of who rated it moderately, high and very high. The findings are presented below in the table and chart.

	Frequency	Percent	Valid Percent	Cumulative Percent
very low	2	3.9	3.9	3.9
low	11	21.6	21.6	25.5
moderate	20	39.2	39.2	64.7
high	14	27.5	27.5	92.2
very high	4	7.8	7.8	100.0
Total	51	100.0	100.0	

Table 4.5: Management Qualification and Training



Figure 4.5: Management qualifications Ratings

V. SUMMARY OF THE FINDINGS

The factors perceived to be affecting maintenance of Kenyan coastline structures can be therefore summarized as; finance and budgeting; government support; technology; management qualification and training and availability of qualified personnel in that order. The following table of mean scores supports these findings.

	finance and budgets	availability of qualified personnel	available technology	government support	management qualification and training
Valid	51	51	51	51	51
Missing	0	0	0	0	0
Mean	3.67	3.08	3.27	3.59	3.14

Table 5.1: Mean Scores of factors influencing Coastline Structures Maintenance

A. CONCLUSIONS AND RECOMMENDATIONS

From the findings discussed above we can conclude that several factors influence the maintenance levels of coastline structures in the Kenyan coastline. The factors are however perceived to have varying degrees of influence. This implies that when designing maintenance strategies, the project designers ought to pay more attention to finance and budget and government support. The other factors of management qualification and training; available technology and qualified personnel also need to be considered alongside project implementation to complete set of necessary resources in maintenance projects.

This study therefore recommends that the government of Kenya should provide strong support in any maintenance project as well as ensuring that adequate financing and budgetary allocations are in place among other factors.

REFERENCES

- [1] Anyona S., and Rop B.K., (2016). *Global warming and its Impact on Kenya's Coastal Structures*. Proceedings of the 2016 Annual conference on Sustainable Research and Innovation. 4<sup>th</sup>-6<sup>th</sup> May, 2016.
- [2] Awour B.C., Orindi V.A., and Adwera O. A., (2008). *Limite Change and Coastal Cities: The case of Mombasa*. International Institute of Environment and Development, Vol. 20(1) 231-242; Doc 10.1177/0956624780809158. www.sage publications. Accessed on
- [3] Kombo, D. K. & Tromp, D.L. (2006). *Proposal and Thesis Writing*. Don Bosco Printing Press, Nairobi.
- [4] Kothari, C. R. (2009). *Research Methodology: Methods and Techniques*: New Age International (P) Limited. New Delhi: India
- [5] Mugenda, A. G. & Mugenda, O. M (2009). *Research Methods: Quantitative and Qualitative Approaches*. Acts Press. Nairobi, Kenya.
- [6] Mugenda, A. G. & Mugenda, O. M (1999). *Research Methods: Quantitative and Qualitative Approaches*. Acts Press. Nairobi, Kenya.
- [7] Mwanje J.I., (1997). *Socio –Economic Impacts of Coastal Instability (Erosion) in Kenya: A case Study*. Center for Environmental Research and Extension (CERE). Institutional Research, Kenyatta University- Kenya.
- [8] New Brunswick Department of Environment and Local government (2002). A coastal Areas Protection Policy for New Brunswick. <http://www.gnb.ca/eld-egl/0371/002>. Accessed 20/05/2016.
- [9] Saunders, N., Lewis P. & Thornhill, A. (2007). *Research Methods for Business Students*. F.T Prentice Hall, Harlow.