# ASSESSMENT OF CLIMATE CHANGE IMPACT AND VULNERABILITY OF IMMOVABLE CULTURAL HERITAGE SITES: A CASE STUDY OF KENYA`S COASTLINE

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**A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Hospitality and Tourism Management of Murang'a University of Technology**

**October, 2022**

## DECLARATION

I hereby declare this thesis is my original work and to the best of my knowledge has not been presented for a degree award of degree in this or any other University

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## APPROVAL

The undersigned certify that they have read and hereby recommend for acceptance of Murang'a University of Technology a thesis entitled "**Assessment of Climate Change Impact and Vulnerability of Immovable Cultural Heritage Sites: A Case Study of Kenya`s Coastline.**"

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## DEDICATION

This thesis is dedicated to my parents Mr. and Mrs. Samuel Lagat, brothers and sisters for their immense financial and emotional support throughout my entire studies. Through them, I learnt hard work, perseverance and determination that guided me during my research period.

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## ABSTRACT

Researchers have developed interest on climate change as a contemporary affecting the tourism sector. Although climate change is widely acknowledged as a global phenomenon, the actual and projected effects are still being debated in the scientific and political forums. Locally, there is evidence of uncertain trends regarding the manifestation of global climate change and the required adjustments. Climate change is negatively affecting the tourism sector which is the backbone of economic development. Cultural heritage is important in that it provides tourism opportunities, enhances economic growth, stimulates learning and fosters cultural identity. Yet, change in climate elements of temperature, rainfall and rising sea level impacts the preservation of values embodied in the immovable cultural resources. Cultural heritage has survived the past centuries but the previous adaptation may not sustain them in the extreme climate conditions in the future. Some of the cultural heritage sites like Vasco da Gama, Fort Jesus and Jumba la Mtwana have been highlighted to have physical damage. The study was guided by the following objectives; general objective: assessing the effects of climate change and vulnerability of immovable cultural heritages and the responses strategies employed by the destination stakeholders. Specific objectives which include to: analyze the impacts of climate change on the immovable cultural heritage sites; assess the vulnerability of immovable cultural heritage sites to climate change; identify the adaptation strategies of the immovable cultural heritage sites; determine response to barriers in adapting immovable cultural heritage to climate change; identify how the stakeholder's, maximize opportunities that arise in adapting immovable cultural heritage to climate change. The study was guided by the theory of adaptation. The study covered eight immovable cultural heritage sites identified in Kilifi and Mombasa counties. Questionnaires, interviews and observation methods was used in data collection. The study used descriptive analysis in analyzing descriptive data and narrative analysis for qualitative data. The results of the findings indicated that apart from climate change impacts being a major threat to the immovable cultural heritages along Kenyan coastline, old age and human activities are also other factors facilitating the deterioration of the cultural heritages. Results of the study will provide information on existing knowledge gaps concerning the effects of climate change on the immovable cultural heritage thus increase baseline data and provide solutions to heritage sites facing the effects of climate change. The study further recommended the need for more and continuous research on the causes of cultural heritage sites deterioration and measurement of how the climate change elements affects the immovable cultural heritage sites.

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| **AMA** | Antiquities and Monuments Act |
| **EPA** | Environmental Protection Agency |
| **GDP** | Gross Domestic Product |
| **GHG** | Green House Gases |
| **GISS** | Goddard Institute for Space Studies |
| **GOK** | Government of Kenya |
| **ICOMOS** | International Council on Monuments and Sites |
| **ICONTEC** | Instituto Columbiano de Normas Tecnicas |
| **ICCROM** | International Centre for the study of the preservation and Restoration of cultural property |
| **IPCC** | Inter-governmental Panel on Climate Change |
| **ISO** | International Organization for Standardization |
| **ITCZ** | Inter- Tropical Convergence Zone |
| **KNBS** | Kenya National Bureau of Statistics |
| **MCTA** | Mombasa Coastal Tourism Association |
| **NASA** | National Aeronautics and Space Administration |
| **NCCRS** | National Climate Change Response Strategy |
| **NMHA** | National Museum and Heritage Act |
| **NMK** | National Museum of Kenya |
| **RTSAF** | Regional Tourism Sustainable Adaptation Framework |
| **SEI** | System Engineering and Integration |
| **UN** | United Nations |
| **UND** | United Nation Development |
| **UNEP** | The United Nations Environment Program |

| | |
|---|---|
| **UNICEF** | United Nation International Children's Emergency Fund |
| **UNESCO** | The United Nations Educational, Scientific and Cultural organization |
| **UNDP** | United Nation Development Program |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **UNISDR** | United Nations International Strategy for Disaster Reduction |
| **UNWTO** | United Nation World Tourism Organization |
| **USGCRP** | United States Global Change Research Program |
| **WHC** | World Heritage Convention |
| **WMO** | World Meteorological Organization |

## DEFINITION OF OPERATIONAL TERMS

**Climate:** This is the average weather condition of a place for a minimum period of 30 years

**Weather:** This is the daily atmospheric conditions of a place within 24 hours

**Climate change:** Refers to change in climate over period of time due to changes in natural causes or human activity

**Climate variability:** Refers to changes in the mean and average scale of climate more than the daily weather events

**Tourism:** This is the activity of a person travelling to and staying in places outside their usual environment for more than 24hrs and less than a year

**Tourist:** This is a person travelling from his/her place of residence to a destination area for more than 24 hours

**Vulnerability:** Refers to the inability to withstand the effects of a hostile environment

**Adaptation**: Is the changes in natural or human systems to fit the actual or expected conditions

**Immovable cultural heritage:** Refers to man- made features that cannot be transferred from its original location and conservation must be carried out in situ

**Adaptive capacity:** Refers to degree of change to cope with the consequences or damages

**Sensitivity:** Is responsiveness to the potential influence of a source of risk

**Exposure:** Refers to being subjected to a risk source

**Danger:** Refers to a relative exposure to a hazard

**Risk**: Refers to likelihood of a negative outcome

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background Information

UNESCO 1972 categorizes tangible cultural heritage into two: moveable cultural heritage sites that include: paintings, manuscripts and sculptures and the immovable that include Monuments, buildings and archaeological sites (Amar, 2017). The coastal stretch of Kenya has a number of immovable cultural heritages dating back to the exploration era, they include religious sites, Monuments, historical buildings, graves, historic Towns, rock paintings and transportation sites (Saur, 2000). However, extreme weather events have risen since early 2000. Coastal heritages are threatened by increased coastal erosion (Earlandson, 2012), coastal flooding, rising sea level, increase in acidity levels, increase in precipitation and frequent strong winds. Some of the sites have been reported to have visible cracks, peeling off of some parts, erosion of basement rocks and physical destruction. The current trend of annual increase in the number of cultural heritage sites being threatened by climate change notwithstanding, approaches used in assessing vulnerability are still comprehensive (Carter et al., 2007; Jopp et al., 2010).

Climate change encompasses changes in weather conditions due to human activities or natural causes (Hegerl et al., 2007). Global warming is caused by greenhouse effect that traps the energy released from the earth into the atmosphere instead of allowing it to escape into outer space. Greenhouse effect is due to high level of carbon IV oxide molecules and other gases in the atmosphere forming a sort of 'blanket' layer that traps the heat (NASA, 2017). A significant proportion of the effects of global warming have been recorded in the last thirty-five years with 2011

being the 16th of the 17 warmest years on record. 2016 was declared the warmest year with eight months from January to September except June out of the 12 months has been the warmest on record. The average sea levels have risen by 10 to 20 centimeters with an annual increase of 3.2 mm over the past twenty years as per the intergovernmental climate change panel. This is twice as much compared to the average speed recorded in the last eighty years (IPCC, 2017). Climate change is projected to likely have higher impacts at the coastal zones and mountainous regions.

African continent is highly vulnerable to climate change as per the statistical analysis of climate change obtained from historical records of rainfall, temperature, mountain glacier coverage and sea level rise. Estimated impact of climate change in Africa is moderately-strongly negative and the level of tourism and climate change knowledge is extremely poor (Hall, 2008). The southern and eastern coastline of Africa (consisting of coasts of South Africa, Mozambique, Tanzania and Kenya) is projected to be affected by cyclones and other weather events that pose risk to the development and infrastructure of these countries (UNFCCC, 2007).

Climate change is affecting the environmental and social conditions around the globe. Consequently, climate change is also affecting the immovable cultural heritage through biological, physical and chemical processes. Many researchers have identified causes of cultural heritage deterioration to include: hydrogeological factors (Piao, Fang, Field, Pan, Guo, Zhou & Tao, 2003), microbiological factors (Garg, Hodson, Dustman & Moran, 1995), air factors (De la Fuenta, Cestari, Diez-

Berart, Dunmur, Ferrarini, Jackson & Salud, 2011) and environmental factors (Wang et al., 2006).The right to cultural heritage is a core element of humanity as implied in article 27 of the united nation universal declaration of human rights (Mitsakaki & Laoupi, 2009).

Vulnerability assessment is crucial to changing climate although assessing the immovable cultural heritage is complex. Detailed analysis of building materials requires a lot of human and financial resources (Romaoa et al., 2016). Simplified, reliable and efficient methodology has been proposed by some researchers therefore the study adopted Romaoa et al (2016) methodology. United nation framework convention on climate change (UNFCCC) addressed the importance of mitigating and adapting to climate change. Mitigation involves setting up measures to minimize emission of greenhouse gases. On the other hand, adaptation refers to adjustment in the overall system to cope with changes in the environment (Carmichael et al., 2017). Mitigation was initially given attention with the formation of many conventions that regulated emissions from developed countries and travel sector. Since the late 1990s adaptation research gained greater interest in the topic since climate change impacts will continue to be felt therefore the need to adapt to the unavoidable (IPCC, 2015). UNESCO world heritage center-initiated assessment of impacts of climate change on the world heritage in 2005. This issue was brought Forth after the world heritage committee noted that climate change is most likely to affect many world heritage properties (Matiz, 2016). Despite this, solution to the problem is still debated. Cultural heritage can mitigate through improving energy efficiency of the buildings and adapt through constant monitoring and maintenance. Degradation of the cultural heritage sites is inevitable therefore;

development of sustainable adaptation strategies must be based on the vulnerability assessment of the sites. Global climate policies have also changed to accommodate the cultural heritage.

The 5th assessment report of IPCC (2013-2014) for the first time mentioned the need to take care of the cultural heritage in climate change adaptation policies (IPCC, 2015). Therefore, it is the duty of every party state to identify cultural heritage at risks and develop climate strategy for their cultural heritages. Cultural heritage adaptation to climate change encompasses the implementation of viable measures and strategies that aims at curbing the effects of climate change (WHC, 2006). Cultural heritage adaptation may be in two forms, first, is change in policies and guidelines that oversee monitoring and maintenance. Second, is physical adjustment in the original state of the heritage by either changing construction materials or building barriers (UNESCO, 2015). Every cultural heritage is exposed to a different level and degree of risk, which makes it difficult to generalize available adaptation options. Implementation of this adaptation is often a challenge. Adaptation requires intense financial and human resources, which are often limited. Other factors hindering adaptation implementation include technical barriers, institutional barriers and loss (Goosling et al., 2012). Therefore, it is best to assess the challenge and opportunities resulting from adapting and choose the best adaptation method. The study aimed at assessing the risk, vulnerability, adaptation options, barriers and opportunities to effective implementation of the adaptation measures. The study was confined to the setting of impacts from coastal climate change within Mombasa and Kilifi counties.

## 1.2 Statement of the Problem

Tourism industry research on climate change was lagging in about 5.7 years (Wolfsogger et al., 2008) but in the recent time, there has been an increase in climate change and tourism research. There is need to address the limited adaptation options for the cultural heritage due to climate change impacts (Nichols et al., 2014). If things continue unchecked, many coastal historical and cultural heritage sites would be completely submerged. According to Perez-Alvaro (2016) built heritage on the coastal areas are endangered by the rising sea levels with a prediction of 136 UNESCO world heritages expected to be submerged by 2100. Cultural heritage is a non-renewable resource hence the need to evaluate the possible dangers and provide scientific solutions for the benefit of future generations (Leissner & Fuhrmann, 2015). Addressing this knowledge, capacity and information gap by carrying out vulnerability assessment helps site managers in determining and prioritizing their destination actions (UNESCO, 2007). Some few research exists on climate change and heritage tourism despite the growth of interest in this topic (Hall et al., 2016). Attention on climate change and heritage is increasing in developed countries for political and geographical reasons compared to Africa, hence international collaboration is needed. This collaboration will help Africa benchmark against international practices of monitoring and reporting and then mitigating and taking corrective actions. According to Simpson and Hall (2008), regional knowledge gaps on effects of climate change on both natural and cultural resources are still major in Africa, Caribbean, South America, Middle East and large parts of Asia. Research knowledge gap is decreasing with the increase in number of published researches on cultural heritage especially in Africa such as in Mali and Tanzania. Therefore, in order for the African countries to preserve and

protect the cultural resources there is need for continuous research by site managers, policy makers, heritage organizations, academia and research centers in successful protection of heritages (Sesana et al., 2018). ICOMOS (2019) highlighted the need to have a cross-sectoral plans for cultural heritages since it's an important resource for the host community.

Majority of these coastal cities with historic Monuments and archaeological grounds are at a risk of sea level rise, these cities include Mombasa in Kenya, Alexandria in Egypt, Banjul in Gambia and Dhaka in Bangladesh (UN-habitat, 2008). The cities still face sea level rise as a major challenge especially with the intense impacts of climate change being felt in the 21st century. Sea level rise for instances affects the lowland coastal areas through flooding, salt water intrusion, erosion and increase frequent storm surges (Bicknell, Dodman & Satterthwaite, 2009; Nicholls et al., 2007).

Most of the countries within the tropics experiencing intense effects of climate change, Kenya included are third world countries, which according to the UNWTO, 46 out of 50 of these least developed countries depend on tourism as major foreign exchange earner (UNWTO, 2007, UNDP, 2005; Hall, 2007). Coastal region of Kenya bordering the Indian Ocean to the west is extensively affected by the rise in sea level, coastal erosion and strong sea waves. These affects the heritages outstanding universal value, authenticity and integrity, posing danger to their existences. Pressures also from carrying capacity and socio-economic developments are increasing on the sites` environment, which call for urgent action

(UNISDR, 2015). Therefore, a compelling need to increase their resilience and assess their susceptibility to effects of climate change (Throsby, 2012).

A number of researches have been done on the related topics of climate change and cultural heritages in the coastal region of Kenya. Namunaba (2003) conducted a study on the impacts of development projects on archaeological heritage, case study of selected coastal sites and Monuments. The study used an archaeological survey method and the findings of the study indicated that roads, suburban tracks, housing and hotel construction destroy archaeological sites and materials in absence of impact assessment reports. Mandela (2005) conducted a study to assess setbacks faced in conserving the heritage of Mama Ngina Drive in Mombasa County. The study a qualitative research design. Both primary and secondary data collections methods were used in the study. The findings outlined the challenges to sustainability to include: erosion, different vegetation growth, change of a site due to economic incentive, development of the site, change of the site and the need to protect the site from unsympathetic use. Kabede (2010) researched on the impacts of climate change and sea level rise, a preliminary case study of Mombasa, Kenya. The study made a first quantitative estimate using GIS to analyze on the total assets and population that will be subjected to sea level rise in the then Mombasa district. Findings indicated that 190,000 people and assets worth over US$470 million are already exposed to a 1:100 year return- period of extreme water levels in Mombasa district. Later on, Njoroge (2014) designed an enhanced "Regional Tourism Sustainable Adaptation Framework" (RTSAF). The study aimed at determining the susceptibility of Mombasa as a result of climate change. The enhanced model was developed from regional tourism adaptation framework

(RTAF) Jopp et al. (2010) which was criticized for being business oriented, lack of explicit adaptation options, limited community involvement and lack of feedback. Despite the increase in research on these topics in Kenya, limited studies have been done on the impacts of climate change on the immovable cultural heritage which made it a potential topic of study in the area.

Tourism industry in Kenya is among the leading drivers of economic development and is susceptible to climate change; however, there is limited research data on vulnerability and adaptation in tourism sector (Rosenzweig et al., 2007) which is still limited especially for cultural heritages. Both the political and business sector responses on climate change has never been strong, therefore tourism sector can increase effort in understanding the implication of climate change (Scott et al., 2016). Assessment of climate change impacts for the cultural heritage especially in Kenya is still limited with the need to involve the host community in the decision making for the protection of the immovable cultural heritages in providing baseline data (Bertolin, 2019). Therefore, the study aims to find out climate change impacts and vulnerability assessment for the cultural heritage along the Kenyan coastline which are at high risk of climate change in the 21$^{st}$ century. Spennemann and Graham (2007) argued that post disaster damage of the heritage sites may result to serious emotional damage to the host community, therefore such cases should be avoided from happening. Therefore, understanding these extreme events and coming up with measures on how to combat climate change is the major challenge to tourism industry and other sectors. IPCC emphasizes that Africa needs to adapt to climate change impacts through developments. Furthermore, Haughen et al. (2018) emphasized the need for long-term monitoring, rehabilitation and renovation

as some of the sustainable ways to preserve the immovable cultural heritages that has been used in many of the first world countries.

## 1.3 Objectives of the Study

### 1.3.1 General Objective

To assess climate change impacts and vulnerability of immovable cultural heritages and the response strategies employed by the destination stakeholders in Mombasa and Kilifi counties.

### 1.3.2 Specific Objectives

i. To analyze the impacts of climate change on the immovable cultural heritage sites in Mombasa and Kilifi counties
ii. To assess the vulnerability of immovable cultural heritage sites to climate change in Mombasa and Kilifi counties
iii. To identify the adaptation strategies of the immovable cultural heritage sites in Mombasa and Kilifi counties
iv. To determine response to barriers in adapting immovable cultural heritage to climate change in Mombasa and Kilifi counties
v. To identify how the stakeholder's, maximize opportunities that arise in adapting immovable cultural heritage to climate change in Mombasa and Kilifi counties

## 1.4 Research Questions

i. How are climate change elements threatening immovable cultural heritages existence in Mombasa and Kilifi counties?
ii. Are there any visible physical damages on the immovable cultural heritage structures in Mombasa and Kilifi counties?

iii. What adaptation strategies have already been adopted in the immovable cultural heritage sites in Mombasa and Kilifi counties?

iv. How do the stakeholders eliminate the barriers in adapting immovable cultural heritage to climate change in Mombasa and Kilifi counties?

v. How are the stakeholders making effective use of opportunities that arises in adapting immovable cultural heritages to climate change in Mombasa and Kilifi counties?

### 1.5 Significance of the Study

Globally, the study seeks to add knowledge to the field of cultural heritages that will help the convention bodies like world heritage in putting up the right strategies and adaptation programs. The tourism industry will then implement the strategies in destinations affected by climate change (UNWTO, 2008). The research results will be used to provide management actions to the structures at site level. Results of the study also will provide information on existing knowledge gaps concerning the effects of climate change on the immovable cultural heritage thus increase baseline data. The study will not only help the chosen sites of study but the scientific data will also help managers of other sites where little research exist on setting policy and research agendas.

### 1.6 Scope of the Study

The study was carried out in two counties in the coastal region of Kenya due to limited resource. Change in climate elements like temperature, humidity, wind, precipitation and the resulting changes in sea level was examined into during the study. The coastal stretch of Kenya has immovable cultural heritages dating from pre historic to historic times representing the continuation of the early Indian Ocean international trade. Most of these heritages were built by the Arabs, Swahili,

Portuguese and British settlers. Old buildings, Monuments and sites are put at a risk by dangers in the general environment such as flooding and coastal erosion. Immovable cultural heritage sites within Mombasa and Kilifi counties were the target of the study. The study used a qualitative case study research design. Sixteen immovable cultural heritages were the target population of which sample size of eight cultural heritages was achieved after using a convenience sampling method. Data was collected through use of questionnaires, interviews and observation. Quantitative data was analyzed by use of SPSS and qualitative data was analyzed based on themes.

### 1.7 Limitations

There is inadequate data existing in understanding expected impacts of climate change on the immovable cultural heritage sites, vulnerability assessment methodologies and the response strategies. Lack of enough resources and capacity for carrying out research on climate issue and its implementation in third world countries is still a problem. Inadequate knowledge and capacity make it difficult to determine the loss of heritage values.

### 1.8 Assumptions

The study was based on the following assumptions that:

i. People living in the research area have knowledge of the study topic
ii. Data collection was carried out at a time when the weather in coast region is favorable
iii. All the study objectives were achieved at the end of the study
iv. Respondents gave correct and reliable responses towards the completion of this study.

## 1.9 Conceptual Framework

According to Mugenda and Mugenda (2003) conceptual framework is a brief description of event under study using a physical representation of the major variables of the study. Mathieson (2001) defines conceptual framework as a graphically representation of the main things that was studied in terms of key factors, variables, concepts and the relationship between them. Therefore, conceptual framework is a research tool that creates a picture to enhance understanding of the relations that exist between the variables. Climate change is the independent variable while the immovable cultural heritage is a dependent variable whose existence is determined by the change in internal and external factors. The independent variable is climate change which includes the following elements: rise in sea level, strong winds, increase in temperature, change in acidity levels and frequent heavy rainfall. While dependent variable is immovable cultural heritage which exhibited the following features; cracking walls, corrosion of roofs, submergence of structures, rotting of timber in buildings and infestation of pest and insects. The figure 1.1 gives a diagram representation of the variables.

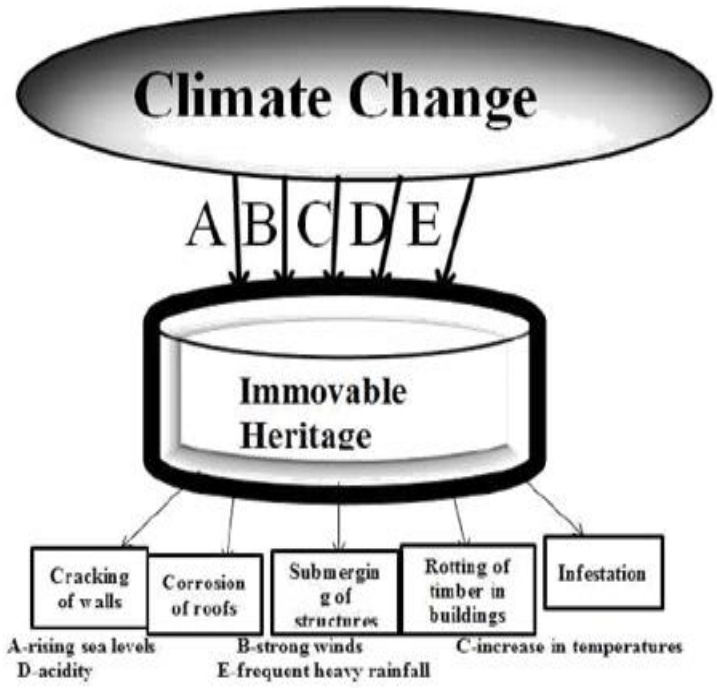


**Figure 1.1: Conceptual framework**

## 1.10 Contribution of the Thesis

The contributions made by this thesis include the following:

i The findings of this research highlighted major issue that needed to be addressed in conservation of the immovable cultural heritages in Kenya.

ii This research fills the gap of the lack of adequate research on the immovable cultural heritages in third world countries.

iii The research covered all the immovable cultural heritage sites in the coastal region of Kenya regardless of their status fulfilling the UNESCO urgent call for assessment of the current state of heritage sites not included in the world heritage list.

iv Images captured at the sites gave evidence that Kenya like other countries is facing the harsh effects of changing climate therefore the need to address climate change in all platforms globally.

v A book chapter containing the results of this study has been published and tourism terms and terminologies used in this study have also been published in tourism encyclopedia.

## 1.11 Organization of the Thesis

The content of this thesis has been organized into five chapters as highlighted below:

Chapter One which is Introduction gives broad and wide discussion on the Background of the Research, the Problem Statement, the Objectives of the Study, the Research Questions, the Significance of the Study, the Scope of the Study, assumptions of the study, the Limitations of the Study, conceptual framework and the Contributions of the Thesis.

The next is Chapter Two which is Literature Review gives broad discussion on the works of other scholars in the field of climate change and immovable cultural heritage.

Chapter Three which is the Methodology outlines the research design, methods of data collection, tools and instrument of data collection, data collection process, data analysis methods and ethics observed during the research.

Chapter Four present results and a discussion of the findings based on the research objectives. The chapter also gives the demographics of the respondents according to age, sex, education level and place of residence.

Chapter five highlights the summary, conclusion made by the study findings, recommendations and future research that needs to be done.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

This chapter includes analysis and comparisons between several arguments and perspectives pertaining cultural heritage, vulnerability assessment, adaptation strategies and options, barriers and opportunities in improving cultural heritage amid climate change. Literature review provides an overview and synthesis of past studies (Kombo & Tromp, 2006).

## 2.2 Background

### 2.2.1 Correlation between Tourism and Climate Change

The two main elements utilized in determining and shaping tourism products of a particular destination are weather and climate. Consequently, changes evident in atmospheric conditions culminate several effects (Becken, 2010; Becken & Hay, 2007; Martin, 2005; Hall, 2008; Smith, 1993, Waller & Badke, 1994).

Relationship between climate and tourism is clearly evidenced in nature based, coastal and mountain-based tourism. Tourism is a climate sensitive industry. Climate defines the quality and length of tourism seasons. The interrelationship is highly complex; the tourism industry, locally and internationally consumes significant amounts of energy. Such a phenomenon can be attributed to GHGs emissions from the transport and accommodation sectors resulting to 4.4% of global $CO_2$ emissions. This is estimated to grow at an average of 3.2% annually up to 2035 (Peeters & Dubois, 2010). Secondly, tourism as a mitigation tool for climate change

through reforestation and conservation (Goosling et al., 2012). Thirdly, climate as a major resource for tourism that determines the location for tourism activities (Hamilton et al., 2005; Lemieux & Scott, 2011). Tourism sector rely on the predictions of the season in order to attract visitors based on their taste and preference of leisure activities. Change in the weather pattern affect the tourist flow leading to reduced income on the tourism dependent countries. Climate has direct influence on environmental conditions that can deter tourist like spread of infectious diseases, extreme events, outbreak of wildfires, and spread of waterborne pests.

According to the international conference that file reports on issues related to climate change, the existent correlation between tourism and climate change should be comprehended, the impacts on sustainability of tourism and the obligation of tourism to honor agreements aimed at fighting climate change (UN, 2003). Climate change impacts affect the tourism industry both directly and indirectly (Goosling et al., 2012). There are four major categories of how climate change affects the sustainability and competitive advantage of tourism destinations as shown in Figure 2.1. The tourism sector: climate change issues (UNWTO, 2009; Goosling et al., 2012). Such effects include;

1.Direct effects,

2. Indirect effects linked to changes in climate patterns,

3. The effects of mitigation strategies on tourist mobility, and

4. Indirect effects of changes in the society

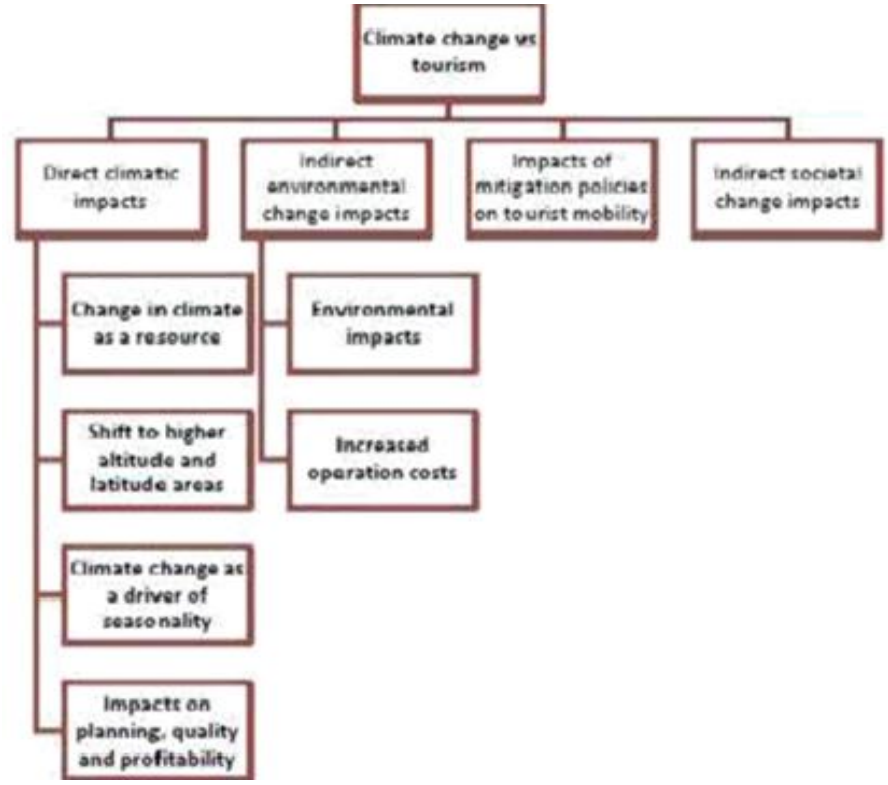


**Figure 2.1: Climate change impacts on tourism**

**Source: (UNWTO, 2007; Scott & Becken 2010, p.182)**

Direct climatic impacts: Change in climate as the principal resource for tourism globally affects suitability of a wide range of tourism products. Change in seasonality influences the total operating cost such as insurance cost, water and food supply cost and cooling and heating cost. Competitive ability of some destinations is expected to decline due to changes in tourists' preference loyalty. Climate is the central motivator for tourism thus changes result to consequence for the tourism demand at various levels. Tourism demand is also projected to shift to higher altitude and latitude areas where climatic conditions was favorable (Hamilton et al., 2005; UNWTO, 2007; Boko, 2007). Climate defines planning, quality and profitability of local outdoor activities like sporting events and beach use (Lemieux & Scott, 2011).

Indirect effects: climate induced environmental changes will have a great negative impact on the destination. Variations in the availability of water, aesthetic value loss, biodiversity loss, coastal erosion, altered agricultural production, increase in the manifestation of natural hazards and the rising risk of vector borne diseases will affect tourism industry (UNWTO, 2007). These impacts will result to imposing pressure on the tourism resources.

Impact of mitigation policies on tourist mobility: tourism encompasses the mobility of people from their places origin to destination area. This movement involves use of means of transport that emit the gases to the atmosphere. Global tourism emissions are estimated to be 4.5 % to 5 % of the overall emissions with 75 % from the travel sector, 25 % from onsite consumption where 21 % is from accommodation and 4 % from tourist activities (Dubois et al., 2009; Peeters & Dubois, 2010). Therefore, these emissions need to be reduced by about 36 % to avoid more climate change. Putting up mitigation policies like tax, putting a price on GHGs emissions and changes in the market undertakings may lead to an increased travel prices thus change in tourists' decisions regarding travel.

Indirect effects: climate change affects all the sectors driving the economy negatively causing decrease in the country`s GDP meaning the overall consumer discretionary wealth will reduce (Goosling et al., 2012). Climate change threatens the growth of economies and stability of some countries. The number of international tourists' declines when there is unrest. Other effects include a projected decline of twenty per cent during this century (Stern et al., 2006). Decline

in tourists will reduce the destination`s economic performance and developments. Summary of impacts are highlighted on Table 2.1.

**Table 1.1: Impacts and implications on tourism**

| Impact | Implications for Tourism |
|---|---|
| Warmer temperatures | Altered seasonality, heat stress for tourists, cooling costs, changes in plant-wildlife-insect populations and distribution, infectious disease ranges |
| Increasing frequency and intensity of extreme storms | Risk for tourism facilities, increased insurance costs/loss of insurability, business interruption costs |
| Reduced precipitation and increased evaporation in some regions | Water shortages, competition over water between tourism and other sectors, desertification, increased wildfires threatening infrastructure and affecting demand |
| Increased frequency of heavy precipitation in some regions | Flooding damage to historic architectural and cultural assets, damage to tourism infrastructure, altered seasonality |
| Sea level rise | Coastal erosion, loss of beach area, higher costs to protect and maintain waterfronts |
| Sea surface temperatures rise | Increased coral bleaching and marine resource and aesthetics degradation in dive and snorkel destinations |
| Changes in terrestrial and marine biodiversity | Loss of natural attractions and species from destinations, higher risk of diseases in tropical-subtropical countries |

**Source: Adapted from UNWTO (2007)**

All models projected an increase in mean surface temperature due to emissions of greenhouse gases. Rainfall is also expected to increase in some areas while arid and semi -arid areas will experience more frequent droughts. Storms and sea levels are also expected to increase. According to IPCC it's very likely that extreme weather conditions will be more frequent. Tropical cyclones will be frequent and intense. Trust is decreasing in projection of a global number of tropical cyclones. Major tourist destination will be affected hence creation of awareness and preparation for natural hazards at local levels is required. Observed decrease in snow is also projected to increase (IPCC, 2015). Figure 2.2 provides a global forecast for different regions.

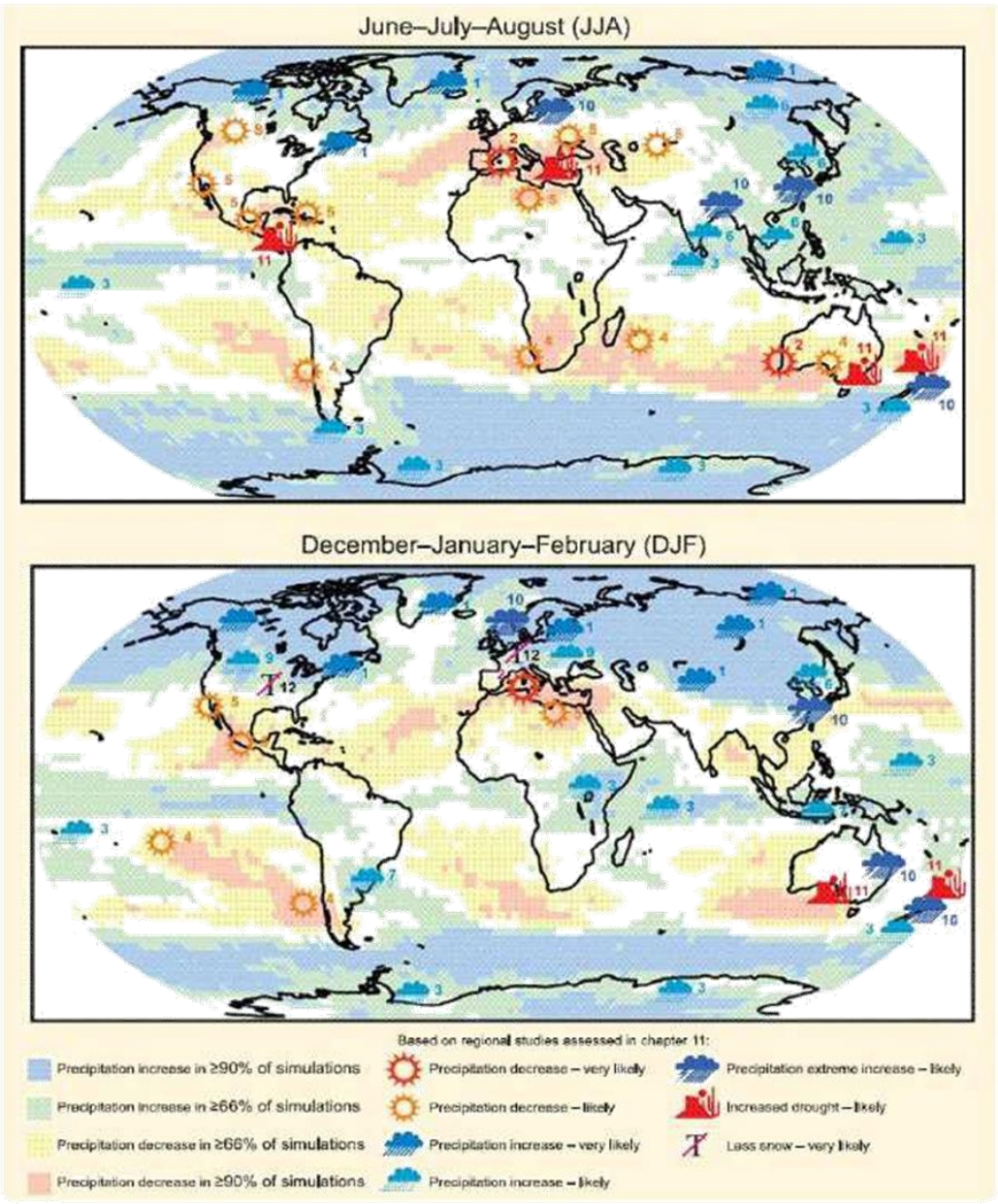


**Figure 2.2: Expected patterns of climate change**

**Source: UNWTO-UNEP-WMO (2008, p.10)**

### 2.2.1.1Tourism Vulnerability Hotspots

Climate change effects will result to varying consequences for the tourism industry globally. Negative impacts on one aspect of tourism may create an opportunity for other aspect of tourism activity. Figure 2.3 indicates the vulnerable tourism destinations at risk from mid to late 21st century.

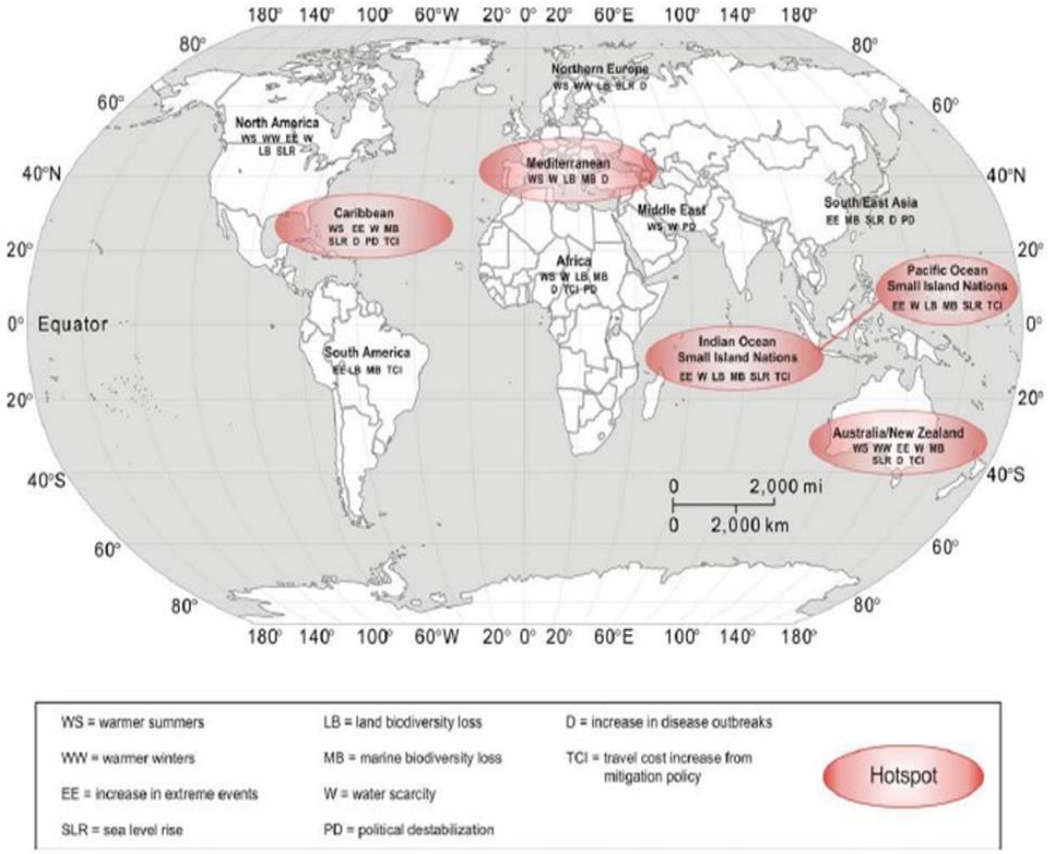


**Figure 2.3: Tourism vulnerability hotspots**

**Source: UNWTO-UNEP-WMO (2008, p.14)**

### 2.2.2 Climate Change in Africa

African nations are adversely affected by climate change due to low capacity, inability to adapt and highly depend on agriculture (Awuor et al., 2008; Houghton, 2009; Niang, 2014). African continent constitutes different climate zones. Such climate zones include humid-equatorial, arid Tropical and Mediterranean climate. Consequently, it becomes difficult to predict the variations. Many factors contribute to Africa's low capacity in curbing the negative impacts of climate change; poverty, illiteracy, weak institution policies, limited infrastructure, poor technology, low capacity in management, civil and political upheavals and poor access to the required resources (UNDP, 2006).Warming on oceans has had an impact on marine

life and the coastal communities relying on ocean for primary source of food, like the case in West Africa where there is great erosion and infrastructural damage.

Warming of the Indian Ocean has led to the destruction of coral reefs. Coral reefs play instrumental roles in supporting fishing and tourism. They also safeguard shorelines. Sea temperatures are estimated to continue rising from 0.62 ºC to 0.85 ºC over the coming years and from 2.44 ºC to 3.32 ºC in the long run (IPCC, 2015). Africa is also susceptible to several diseases linked to climate: malaria, tuberculosis and diarrhea (Guernier et al., 2004). Increase in temperatures is correlated to dynamic geographical distribution of diseases. For instance, when malaria is considered, it becomes evident that mosquitoes are shifting to higher altitude areas exposing high number of people to malaria risk (Boko et al., 2007). Decrease in the population of African penguins over the last fifteen years by ninety percent has also been noted.

**Table 2.2: Regional impacts and vulnerabilities to climate change in Africa**

| Impacts | Sectoral vulnerabilities | Adaptive Capacity |
|---|---|---|
| Temperature<br>– Higher warming (x1.5) throughout the continent and in all seasons compared with global average.<br>– Drier subtropical regions may become warmer than the moister tropics.<br><br>Precipitation<br>– Decrease in annual rainfall in much of Mediterranean Africa and the northern Sahara, with a greater likelihood of decreasing rainfall as the Mediterranean coast is approached.<br>– Decrease in rainfall in southern Africa in much of the winter rainfall region and western margins.<br>– Increase in annual mean rainfall in East Africa.<br>– Increase in rainfall in the dry Sahel may be counteracted through evaporation.<br><br>Extreme Events<br>– Increase in frequency and intensity of extreme events, including droughts and floods, as well as events occurring in new areas. | Water<br>– Increasing water stress for many countries.<br>– 75–220 million people face more severe water shortages by 2020.<br><br>Agriculture and food security<br>– Agricultural production severely compromised due to loss of land, shorter growing seasons, more uncertainty about what and when to plant.<br>– Worsening of food insecurity and increase in the number of people at risk from hunger.<br>– Yields from rain-fed crops could be halved by 2020 in some countries. Net revenues from crops could fall by 90% by 2100.<br>– Already compromised fish stocks depleted further by rising water temperatures.<br><br>Health<br>– Alteration of spatial and temporal transmission of disease vectors, including malaria, dengue fever, meningitis, cholera, etc.<br><br>Terrestrial Ecosystems<br>– Drying and desertification in many areas particularly the Sahel and Southern Africa.<br>– Deforestation and forest fires.<br>– Degradation of grasslands.<br>– 25–40% of animal species in national parks in sub-Saharan Africa expected to become endangered.<br><br>Coastal Zones<br>– Threat of inundation along coasts in eastern Africa and coastal deltas, such as the Nile delta and in many major cities due to sea level rise, coastal erosion and extreme events.<br>– Degradation of marine ecosystems including coral reefs off the East African coast.<br>– Cost of adaptation to sea level rise could amount to at least 5–10% GDP. | Africa has a low adaptive capacity to both climate variability and climate change exacerbated by existing developmental challenges including:<br>– low GDP per capita<br>– widespread, endemic poverty<br>– weak institutions<br>– low levels of education<br>– low levels of primary health care<br>– little consideration of women and gender balance in policy planning<br>– limited access to capital, including markets, infrastructure and technology<br>– ecosystems degradation<br>– complex disasters<br>– conflicts |

**Source: Boko et al. (2007), Christensen et al. (2007) cited in UNFCCC (2007, p.19)**

The influence of warming currents on both sides of the continent are driving huge schools of sardines on which these penguins feed on further south towards cooler waters. Coastal floods often end up draining into the sea reducing the salinity of water and causing the fish to move further offshore. From 1901 to 2010 the average

sea level in the world increased by nineteen centimeters. This affected the African coastline including the degraded coral reefs on the eastern coast (Kumssa & Jones, 2010). Most islands have been submerged in several countries such as Mozambique. Erosion has eaten up about three kilometers (IPCC, 2015).

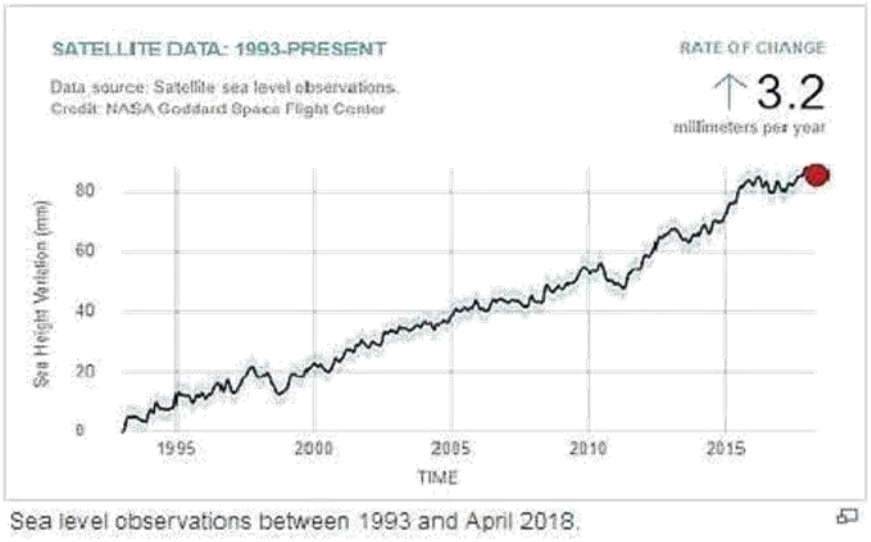


**Figure 2.4: Sea level observations**

**Source: NASA, 2018**

According to World Bank report (2016) communities in West Africa have been displaced by coastal erosion resulting to economic loss of 2.3 % of Togo's GDP. Coral reefs located east of the Indian Ocean have reduced by thirty-five percent because of bleaching events in 1998, 2010 and 2016 caused by ocean acidification. Coral bleaching of 1998 cost scuba dive tourism industry an estimate loss of 2.2 million dollars in Zanzibar and up to 15.9 million dollars in Mombasa, Kenya and Seychelles as a result of warming from El Niño weather. Coral reefs provide protection from coastal erosion for hotels on islands and are important tourism attraction. According to (IPCC) 82 % of Mt. Kilimanjaro`s ice cap and Mt. Kenya have disappeared in the last hundred years. If these glaciers continue to be lost at this speed, they may get exhausted in the next ten years (Kumssa & Jones, 2010).

The last five decades have seen the increase of mean temperatures in eastern Africa. Nations that are adjacent to the Western Indian Ocean recorded higher temperatures and more frequent heat waves between 1961 and 2008. Projected future trends for 2080-2099 period of yearly surface temperatures are expected to rise between 3 $^{\circ}$C and 4 $^{\circ}$C. This is higher when we consider the period spanning from 1980 to 1999 (Boko et al., 2007). Africa`s land surface temperature for the past centuries (1904-2004) annual mean minimum and annual mean maximum have been increasing (Hope, 2009).

**Table 2.3: Projected climate change events**

| Climatic changes and trend | Likelihood of global scale change in early 21st century (2016-2035) | Likelihood of global scale change in late 21st century (2081-2100) |
|---|---|---|
| Warmer and/or fewer cold days and nights over most land areas | Likely | Virtually certain |
| Warmer and/or more frequent hot days and nights over most land areas | Likely | Virtually certain |
| Warm spells/heat waves. Frequency and/or duration increases over most land areas | Unknown | Very likely |
| Heavy precipitation events. Increase in the frequency, intensity, and/or amount of heavy precipitation | Likely over many land areas | Very likely |
| Increases in intensity and/or duration of drought | Low confidence | Likely on a regional to global scale |
| Increases in intense tropical cyclone activity | Low confidence | More likely than not |
| Increased incidence and/or magnitude of extreme high sea level | Likely | Very likely |

**Source: Qin et al. (2013, p.178)**

The effects are expected to be dire; of loss of lives and declining economic activities (IPCC, 2014). The Marrakech climate conference in Egypt (2016) announced an "African Package for climate resilient ocean economies" to help African coastal communities mainly affected.

### 2.2.3 Climate Change in Kenya

Kenya lies within longitude 34° E and 42° E and latitude 6° N and 6° S on the Eastern Africa coast. The country categorized into two by the equator and the altitude rises from 0 m to over 5000 meters above sea level (Mutimba et al., 2010; Mc Sweeney et al., 2010). Kenya has different climatic zones that are influenced by the topography, Inter-Tropical Convergence Zone (ITCZ), nearness to the Indian Ocean and proximity to the equator. The coast region consists of hot and humid; the inland has the temperate and the north and north eastern regions are dry. The

annual rainfall variation in dry areas is about 200 mm while in the wetter areas it ranges from 1200-2000 mm (Mc Sweeney et al., 2010). The hottest period begins from January and ends in February while the coldest periods begin in June to July. Surface temperature ranges from 27-31 °C in hot areas and 10-24 °C in cold areas (Mutimba et al., 2010). Kenya has about 1500 km coastline that's a home to diverse resources like the mangroves, coral reefs, sandy beaches and the sea grass bed (Hinkle & Klein, 2009).

Kenyan coast is vulnerable to tides and rise in sea level (Awuor et al., 2008). Scientists have recorded that average sea level has been rising across the world. Over 30 years of sea level data derived using the Mombasa tide gauge shows a gradual increase in sea level over the period 1986-2012 of about three millimeters annually, a phenomenon matching prediction made so far (IPCC, 2013). Seasonal variations in sea levels occur with maximum values usually observed in the period April-May and October. The inter-annual variation of sea level is influenced by thermal changes in sea water which emanates from global warming (Government of Kenya, 2017).

The monthly mean sea level variation at the KMFRI GLOSS Mombasa tide gauge station between 1986 and 2012.

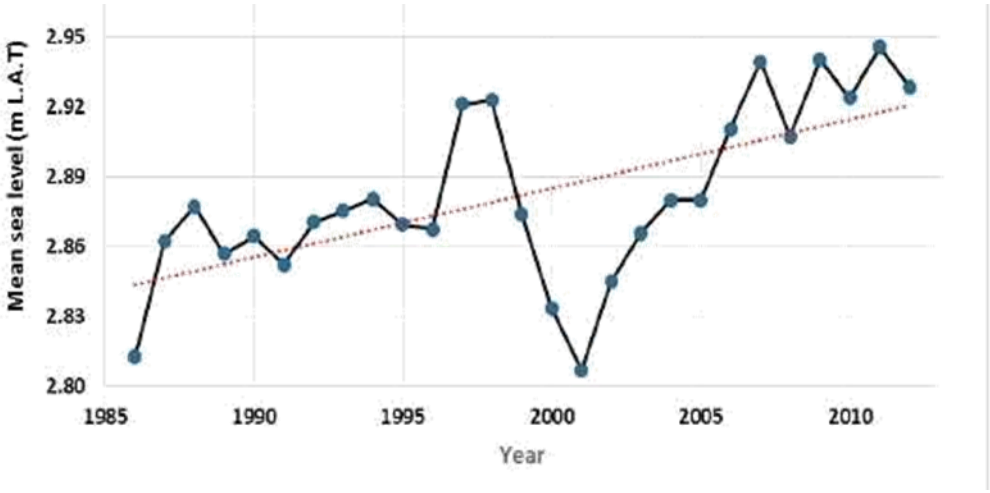


**Figure 2.5: Monthly Sea level variation**

**Source: Kimeli (2013) cited in GoK (2017, p.32)**

According to IPCC the global sea level has risen by ten to twenty centimeters. Oceans absorb about 90 % of atmospheric heat which are as a result of human activities. Such warming culminates in thermal expansion. Consequently, it increases the melting rate for glaciers and sheets of ice (IPCC, 2015). As per the national oceans service, sea level has been increasing by an eighth of an inch every year. Rising sea levels are threatening to wipe out the coastal heritages and submergence of hotels and beach resorts which forms the backbone of tourism. Sea level rise has caused shoreline erosion, decrease in light penetration, salt water intrusion and changes in sediment pattern (Awuor et al., 2007; Fischlin et al, 2007). Sea level rise is not uniformly felt, it varies depending on number of factors: topography, geology, adaptive capacity, levels of environmental damage and local geomorphology. According to IPCC climate model's sea level is expected to continue rising. Thermal expansion of 1.3(±) 0.7 mm per year is projected during 2000 to 2020 period. The country is experiencing increase in temperature with several regions affected by climate change such as flooding in Mombasa and Kisumu counties (Awuor et al., 2008; Kabede et al., 2012). Flooding is a serious

issue (UNDP, 2009) especially in the low-lying areas. The coast region has history of disaster events with recent severe flooding of October 2006. Approximately 60,000 people were affected with the flooding that was as a result of intense precipitation. Analysis shows an estimated 10,000 to 86,000 people are set to be adversely affected in the next decade. More over tourism infrastructure, water resources, marine parks and agriculture will also be affected. Mangroves, coastal ecosystem and beaches were deposited by sediments and other pollutant materials.

**Table 2.4: Climate disaster types, trends and impacts in Kenya**

| Disaster type | When it is/was experienced | Established incidence rate or return period | Impact profile |
|---|---|---|---|
| El-Nino | 1947, 1961 and 1997 | Approximately 5 years | Increased disease incidents (cholera, typhoid cases) -Loss of human lives from starvation (not quantified) -Poor economic productivity |
| Floods | Frequently (almost annually) | unpredictable | Houses destroyed -Property lost -Human lives lost -Increased disease incidents (cholera, typhoid cases) - poor drainage structures or systems affected |
| Tsunami | 2006 | Unpredictable | -several boats reportedly destroyed - human life reportedly lost |
| Drought | 1998 2005/6 2008-2011 | Every 4-5 years | -Agricultural activities affected. - Droughts also cause Famine |
| Hunger/Famine | Every year | Every year | -Loss of human lives from starvation (not quantified) -Poor economic productivity |

**Source: Adapted from Danda (2006) and Awuor et al. (2007) cited in Munyiri (2015.p.40)**

According to the Kenya meteorological department, Kenya's daily temperatures are ranging between 25 ºC and 27 ºC indicating a steady rise over the years. Kenya being a third world country doesn't contribute directly to global warming but is bearing the implications of climate change as a result of geographical and economic factors as well as reliance on natural resources. The soft white layer on Mt. Kenya

is melting away at a fast rate than expected. Projected climate change economic cost in Kenya stands at three percent of economic output per year by 2030 and more than five percent of economic output annually in the next thirty years (SEI, 2009). Climate change requires local, national and global attention (Mutimba et al., 2010). In august 30th 1994 Kenya ratified the UNFCCC by signing to be part of the international community in combating climate change. The country participated in the UNFCCC first national commission in 2002 (GoK, 2002). A communication policy, at the national level is important in the dissemination of important information regarding hazards and creating the required awareness.

### 2.2.4 Aspect of the Immovable Cultural Heritage

One of the tools used across the globe in facilitating protection of natural and cultural heritage for the sake of humankind is the WHC-World Heritage Convention. Unique and remarkable universal value is the main point of reference regarding the heritage sites which is vigorously assessed by convention's advisory bodies. Once the property is listed it is used to promote international cooperation though its conservation, protection and management remains the duty of party state (article 4). In order to ensure that heritage is safeguarded, the convention's article 5 stipulates the duties that each party state shall endeavor to fulfill (UNESCO, 1972):

1. Adoption of heritage policies
2. Hiring competent staff to serve in the sites
3. Conducting research
4. Implementing scientific and legal measures
5. Facilitate the training of staff

Loss of unique features that led to listing of the heritage due to factors such as climate change, results to deleting of the property from the list (paragraph 176(e), operational guidelines). Cultural heritage is broadly divided into intangible heritage such as traditions, language, music and the tangible heritage which includes moveable and immovable cultural properties.

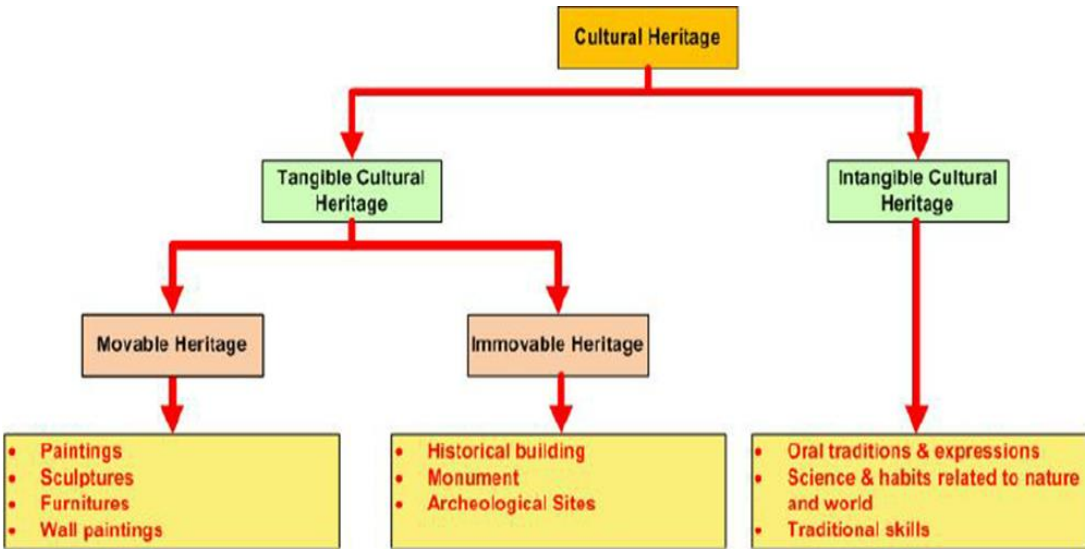


**Figure 2.6: Cultural heritage (UNESCO 1972, p. 178)**

The World Heritage Convention (UNESCO, 1972) further divides the immovable heritage into three categories (Amar and Armitage, 2017):

i Monuments: are structures, Pillars and buildings of historical importance,

ii Groups of buildings: are isolated buildings with important values, and Sites:

iii sceneries and landscapes that mirror people's lifestyles

Immovable cultural heritages are a representation of human history and its adaptation to the changes in the environment. Heritages are of social and economic importance for local communities and national states through provision of substance, character and revenue (Choi et al., 2010). Built environment is important in understanding cultural aspects that are not tangible (De la Torre, 2002). Immovable cultural heritages are of aesthetic, historic, economic, scientific and social value. Cultural heritages answer questions through research and archives of

the remains of the past for scientific and historic purposes. Local community depend on the immovable cultural heritage for economic benefit if well preserved (Choi et al., 2010). Human artistic messages, objects and materials used in construction give understanding of the way of life in the past and can be used for education purposes. Changes in the development of structures throughout different generation may lead to loss of significant values (Worthing & Bond, 2008). Therefore, the fragility of the intangible heritage aspects is the reason we need to conserve the tangible cultural heritages.

### 2.2.5 Cultural Heritage in Kenya

Kenyan laws preserve, protect and conserve the tangible cultural heritage within the stipulations in the AMA (Antiquities and Monuments Act). The NMK-National Museums of Kenya is a culmination of Museums and Heritage Act (NMHA, 2006). The NMK is mandated with preserving heritage (NMHA, 2009).

Cultural heritage under the statute refers to:

i Monuments- Architectural works

ii Groups of buildings - Work of humanity or the combined works of nature and humanity with outstanding value from the historical, aesthetic, ethnological or anthropological point of view.

Coastal region has many historical and archaeological sites including old mosques, ancient city houses and tombs with majority of them being linked to development

of Swahili culture in East Africa (Bissell, 2011). Sites are essential tourist attractions. However, only few of the sites like Fort Jesus have been well marketed. Heritages are a renaissance of civilization to the future generation. Sites offer insights on the identity of various places and countries thus boosting heritage. Heritage value in the old buildings may not be fully realized by a generation but having a sentimental value of these structures in our minds enable us to recognize its usefulness in our lives (Barry, 2016). These tourism resources are currently under threat from climate change due to increase in sea levels.

Climate change remains a universal threat, but building resilience, adaptation, mitigation and preservation is local (Choi et al., 2010). Climate change accelerates major existing managerial problems thus affecting the integrity of these properties. Effects of climate change should be evaluated through periodic reporting, reactive monitoring and vulnerability assessment (Mackay, 2008). Cultural heritages are also facing extinction due to urbanization and human encroachment. According to Namunaba (2003) lack of impact assessment of the development projects has also resulted to loss of cultural heritage sites in the coastal cities of Kenya. Urbanization is the new face of the old Towns and in the rapid development and construction of new structures cultural heritages are often the major structures being demolished for new ones to take face. Human beings are also contributing to lose of cultural heritage sites due to demolition of the structures to get land for agricultural use.

Kenya remains a leading tourist destination in the continent and attracts millions of tourists every year. Vision 2030 blue print aims at marketing Kenya among the top ten overhaul holiday destinations in the world. Values attached to the old structures

are the remains of civilization, preserving and protecting their lives keeps the memories refreshed. Old structures are reference point in which people learn and analyze the past. They provide evidence that is important in educating the society over time in the history and identity of a community (Waterton &Watson, 2013). Less effort has been setup by the government in protecting the sites from human encroachment and other destructions despite the evidence on potential of the coastal region as home to the history and archaeology of Kenya (Namunaba, 2003).

Currently the efforts to protect the sites are still limited. There is need for proactive adaptation planning especially for heritages in coastal areas to reduce their vulnerabilities and promote effective responses to climate change (Fatoric & Seekamp, 2017). Strategies utilized in scaling down the impact of climate change on cultural heritage remain inadequate especially in Kenya; where the protection strategies have begun recently only in Fort Jesus. World heritage convention can provide a voice on climate change that points out on the irreversible damage and the loss of biodiversity on these heritages due to climate change (WHC, 2008). Their preservation is the wheel to sustainable growth and progress. Climate is the principal resource for tourism. Climate of the earth has been changing throughout history but today, concern over climate change issues is increasing because it is clear that humans are responsible for the change (UNWTO, 2007).

Kenya is ranked among countries producing a small percentage of Global greenhouse gas (GHG), but with its attainment of vision 2030 development goals, it will contribute a higher percentage of the emissions. Kenya meteorological department argues that rainfall patterns have shown increase in irregularities and

variability with total annual average decreasing as shown in the long rainy season of March to May. According to researchers, Indian Ocean sea level has been rising by 2.2 millimeters annually (Standard Newspaper, 7th June 2014). Impacts vary depending on the coastal structure (Edward & O`Sullivan, 2007) however those on low-lying coastal areas and near high water points require urgent concerns. Furthermore, research findings indicate that a rise of sea level by 30 centimeters will result to submergence of Mombasa and 17 % coastal areas with 267,000 people are likely to be affected by flooding by 2030 if no measures are taken. About 40 % of Mombasa with 2.4 million people is exposed to sea level rise at the end of 21st century while 64 % of Lamu Island a UNESCO heritage is prone to flooding (Ochanda, 2015). About 2.6 % of Kenya`s GDP is estimated to be used in dealing with floods and drought cases by 2030 with long term effects on the larger environment and global economy (World bank report, 2015).

### 2.2.6 Cultural Heritage in Kilifi

Kilifi County is situated in Kenya's coastal region. The size of Kilifi County is 12,609.74 $Km^2$. Kilifi County is home to 1,109,735 people- Forty-eight percent are male while fifty-two percent are female (KNBS, 2015). The main communities living here are the Mijikenda, Swahili, Bajuni, Indians, Arabs and Europeans settlers. Mijikenda is the widely spoken language across the county comprises of nine dialects; Digo, Giriama, Kamabe, Chonyi, Kauma, Jibana, Rabai, Duruma and Ribe (Mcintosh, 2005). According to Kenya meteorological body, the county records warm temperatures throughout the year; ranging from 21 ºC during the cold season of June and July. The county records a mean temperature of 32 ˚C during

January and February which are regarded as the hottest months. Rainfall ranges between 900 mm and 1000 mm annually.

The main economic activities in Kilifi County include agriculture, tourism and fishing. Kilifi County is renowned for its tourist attraction including Vasco da Gama Pillar, Mnarani and Gede Ruins. Such sites are vital in creating employment for the locals (Kilifi County, 2013).

### 2.2.7 Cultural Heritage in Mombasa County

Mombasa derived its name from an Arabic word 'Manbasa', which in Swahili means kisiwa cha Mvita-translated to mean the war island. The county is an island lying on the Indian Ocean with a population of 939,370 according to 2009 Kenya population and housing census (KNBS, 2015). Mombasa is an economic and cultural hub in the region. To the South, Mombasa is linked through the Likoni Ferry, to the west- Makupa causeway and to the north- Nyali Bridge. It has a cosmopolitan population although a significant proportion of the population includes the Mijikenda and Swahili. Mombasa is a home to several attractions distributed across the city and to the interior for both nature and history lovers (GoK, 2013).

According to Kenya meteorological department, the region's climate can be described as tropical wet and dry with varying rainfall and temperatures depending on seasons. High temperature ranges 28.8-33.7 ºC while summer in March daily temperature ranges 33.7- 22.5 ºC and warm winters of august ranges 28.8-19.3 ºC daily average. Mombasa is subjected to the consequences of fluctuating climate. Coastal erosion has affected counties infrastructure and tourism. Coastline of 2.5-

20 cm has been eroded per year as a result of rise in sea levels which has exacerbated the prevalence of floods (Kebede et al., 2010). Immovable cultural heritage in Mombasa include Fort Jesus. The site was declared a heritage site by UNESCO in 2011. The base of Fort Jesus is being steadily eroded by the rising sea tides. Mombasa old Town consist of ancient buildings with architecture design of Arabs. The old Town is on the tentative list to qualify for inclusion in the world heritage list. The Town basically describes the time when Mombasa was under heavy influence of Arab culture. The place is famous for tourists because of its antique and souvenirs.

In order to safeguard these cultural heritages UNESCO outlined some actions that need to be taken. First is taking the preventive actions which involve monitoring and reporting environmental changes. Secondly, putting corrective actions which encompass local, regional and global management plans can help in adapting to climate change. Knowledge-sharing among other heritage destinations through education and training, research, communication, capacity building, public and political support can also aid in combating the scourge (UNESCO, 2015).

### 2.2.8 Cultural Heritage and Risk

According to UNESCO guidelines terms like risk, danger and threat have been used interchangeably to refer to factors that impact the cultural heritages. There are several threats that seek to jeopardize the conservation of natural and cultural sites. These factors are multiple and changes overtime, they include natural disasters: earthquakes, floods, fire outbreaks and effects of weathering while the man- made factors are impacts of pollution, wars, urban pressures and industrialization (ICOMOS, 2000). Brimblecombe (2014) referring to increasing damp, extreme

weather patterns (rainfall and wind), relative humidity and extreme changes in humidity, and pest and diseases.

In Australia, the phenomenon is also evident (Krause & Farina, 2016). Such manifestations include changes in soil structure and moisture. Others include fluctuations in water levels, humidity, vegetation cover and the migration of pests. Advance planning to protect cultural heritage needs to be done in terms of heritage attributes and risks (Stovel, 1998). Some of the identified risks to cultural heritage include:

**(a) Environmental factors**

These are elements of nature that occur periodically, as emergency or continuous process (EPA, 2002). Environmental factors vary in intensity and frequency they can be natural hazards or climate change.

**(b) Sociopolitical factors**

Sociopolitical factors can be attributed to human activities. Such activities are characterized by negligence, lack of awareness, vandalism and little community participation in the preservation of cultural heritages. Political circumstances revolve around governance issues such as conflicts among nations and lack of policies in place for conservation of cultural heritages.

**(c) Economic factors**

Economic factors are risks that arise because of need for money at the expense of conservation of the heritages. Mass tourism results to damage of environment

despite the increase in revenue earned. Development pressures from expansion of economic structures cause demolition of some existing heritages.

**(d) Physical factors**

Physical factors risks are associated with intrinsic characteristics of the site or its construction features that cannot be controlled or managed.

**(e) Managerial factors**

These risks arise from the management body in charge of planning, executing and monitoring conservation actions. The management team contributes to the risk's factors affecting cultural heritages through lack of adequate conservation actions, poor maintenance, lack of monitoring, inadequate guidelines and programs to protect the site.

In order to understand these risks most cultural heritages lack adequate finance resources to sustain maintenance and monitoring. Most of the heritage sites around the globe don't have conservation plans in place. Limited studies exist on risk factors affecting heritage sites, available data is from the UNESCO, ICOMOS and ICCROM. Furthermore, the existing studies only focused on the world heritage properties while those cultural heritages without status receive less attention (Matiz, 2016). Stovel (1998) pointed some risks to cultural heritage to include: depredation of war, irruptions and eruptions, political and economic pressures, slow decay, neglect, attrition and hand of the over-zealous conservator (p.56).

Climate change, resilience, sustainability and precautionary actions were added into actions from natural disasters and armed conflict as the risks that affect cultural heritage (StaniForth, 2013). Earth quakes for example in Nepal, China and Chile in

2008 and 2012 and the case of tsunami that affected Japan in 2013 exposed cultural heritages to major damages. Recent attacks in Syria due to political instability resulted to damage of the immovable cultural heritages. Attention is increasing on the susceptibility of sites to long-term effects of catastrophic events (Sabbion, Brimblecombe, Cassa & Noah's ark project, 2010). Natural disasters and armed conflict are on top of the list in the risks threatening the world heritage sites. Paragraph 179 of UNESCO's operational guidelines highlight danger that the property faces;

**(a) Evident danger**

- Gross deterioration of materials
- Structural loss
- Gross deterioration of architecture
- Natural environment destruction
- Declining historical aspects' authenticity
- Cultural value loss

**(b) Prospective threat or danger**

- Degradation of heritage
- Ineffective conservation policy
- Challenges in regional planning
- Armed conflict
- Threatening climate change effect (UNESCO, 2015 p.40)

Cultural heritage sites face the threat of hazards more than natural heritage sites. Cultural heritage sites face a combination of hazards such as natural disasters, climate factors, armed conflict, managerial and socio-economic factors (Matiz,

2016). Figure 2.7 indicates the number of cultural properties facing danger each year from 1978 to 2015 according to UNESCO.

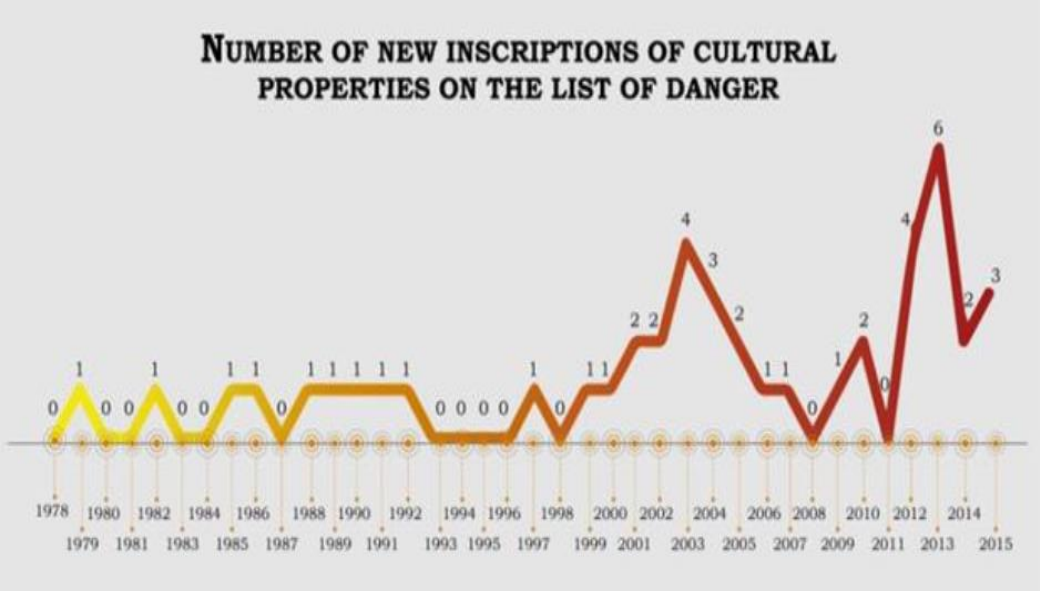


**Figure 2.7: Endangered cultural sites**

**Source: (Matiz 2016, p.37)**

Risk in cultural heritages need to be assessed and integrated into management plans. Risk management strategies should be prioritized by putting into consideration the diversity and varied impacts of risks. Training and creation of awareness of the re-occurring risks should be provided to the stakeholders. Carrying out risk assessment and vulnerability of the immovable cultural heritage needs vast resources and efforts. Such resources are not sufficient especially in the developing countries. Risk factors causing heritage deterioration in Kenya has not been fully explored.

### 2.3. Heritage and Climate Change

The effects of climate change are evident (IPCC, 2007). Scientists have observed that change in the global temperature is as a result of human activities (IPCC, 2014). Systematic observations of climate elements are done by the national

meteorological departments and other specialized centers. Observations are taken at standard pre-set times and place of variables include rainfall, temperature, sea level rise, sea surface temperature wind speeds and cyclones. During the twenty ninth session of the WHC (World Heritage Committee, 2005), delegates observed that climate change is affecting a significant proportion of world heritage sites. The Figure 2.8 indicates how climate change affects the cultural heritages.

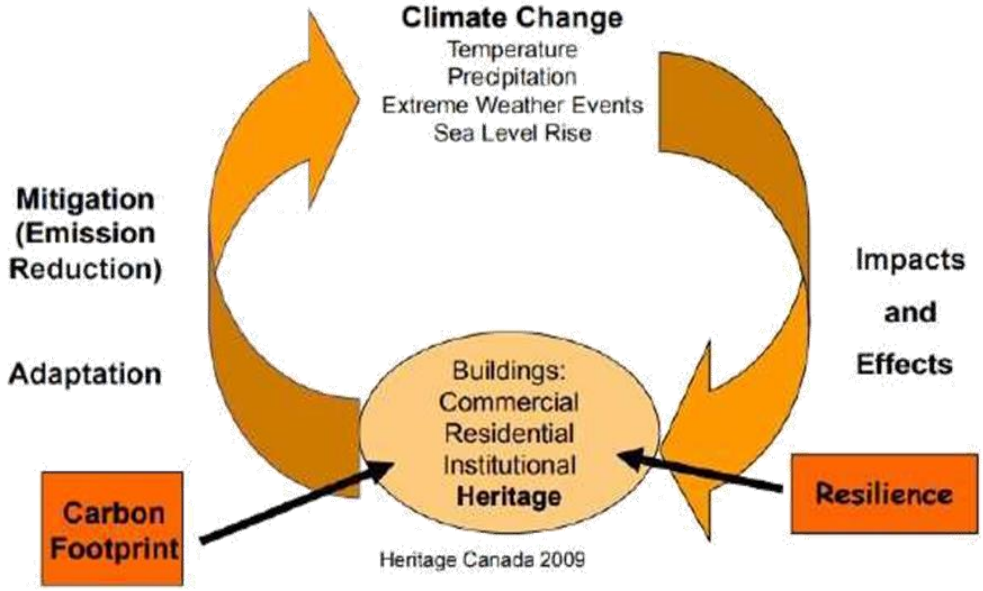


**Figure 2.8: Heritage and Climate Change**

**Source: (Bell & Paterson, 2009, p.5)**

According to the historic environment report, English heritage (2002), climate change threatens the existence and survival of cultural and natural environments. The study of climate change impacts has only attracted attention in the recent years on the diverse cultural sites such as archaeological, historic Monuments and cultural landscape in the recent years (Rowland & Ulm, 2012; Sabbioni et al., 2006; Harvey & Perry, 2015). According to Fatoric and Seekamp (2017) research on impact of climate change have increased in Europe as documented in (Bonazza et al., 2009a, 2009b, 2017; Ciantelli et al., 2018; G´omez- Bolea et al., 2012; Grossi et al., 2008,

2011; Sabbioni et al., 2012). However, knowledge is still growing in reference to climate change and cultural heritage in Africa.

Further investigation regarding the effects of climate change on cultural processes is required (WHC, 2006). Global bodies such as UNESCO work with universities and research institutes in publishing on cultural heritages listed world properties. Regionally, some of the highlighted UNESCO properties include Timbuktu in Mali, Songo Mnarani and Kilwa Kisauni in Tanzania, the sites are facing threats from climate change. There are seven Kenyan sites recognized as global heritage sites. They include Fort Jesus in Mombasa, lakes in the Rift Valley, Lamu old Town, Lake Turkana national park, Mt. Kenya natural forest, the Kaya forests and the recently added Thimlich Ohinga Ruins. Lamu old Town, Thimlich Ohinga and Fort Jesus are the immovable cultural heritage on the list while some like Mombasa old Town are in the tentative list. Considering that the coastal region is affected significantly, there is a need to assess preservation of the sites.

A study on conservation problems facing Lamu a UNESCO heritage exist but others like Fort Jesus and those not in the world heritage list have not been assessed regarding the effects of climate change. According to UNESCO carrying out a study on the cultural heritage without status is the duty of the party state. Countries like United Kingdom have produced several reference materials for its cultural heritages through the English heritage and historic Scotland while others like Kenya almost have none.

Historical structures such as Monuments are permanently tied to locality of a place (Australia ICOMOS, 2013). A majority of historical structures have various types

of disruptions (Canuti et al., 2009). In 2006, experts from the heritages and climate change came together and produced a report on assessing the effects and mitigation strategies. Later on, the world heritage committee also produced a report to guide the heritage destination in implementing appropriate management responses. As a result of these initiative few researches have been completed on climate change and the heritages, the Noah`s ark and the climate for culture financed by the EC-European Commission. A number of world heritage properties both cultural and natural have been highlighted to be in danger. Some studies are currently being conducted in various sites (Matiz, 2016).

Climate change elements that alter the original state of the heritage include changes in temperature, sea level rise and change in atmospheric moisture, precipitation and wind (WHC, 2006). Rise in sea level cause damage to the historical building and the social fabric of the historic sites, due to increase in soil moisture hence rise in saline crystallization which damages the decorated surfaces. Increase in humidity may lead to the buildings subsiding or ground heave (Sabbbioni et al., 2008).

Heritage preservation involves the conservation of both tangible and intangible resources for their adaptive reuse and recycling for the future. Cultural resources loose part of their importance when they are moved (Jarvis, 2014). Heritage sites are affected by several factors that relate to climate change- (extreme wind and rainfall, saltification, damping, sea level rise and coastal erosion). The old buildings are more porous than modern buildings, therefore easily draw water through capillarity and loses it through evaporation causing salt weathering. Change in soil moisture and water temperatures destabilizes the structures foundation. Water is the

most destructive agent of decay (English heritage, 2008). Heavy downpour results to flooding that may result to catastrophic destruction of all elements of historic environment. Organic materials like timber suffer pest and fungal infestation when they get dumpy and split when exposed to high temperatures(historic England, 2015).On the other hand Longfield and Macklin (1999) argues that the inorganic materials suffers erosion and contamination when salt content, water together with the materials undergo chemical reaction due to different varying conditions they are exposed .Although most of these cultural heritages are made of stone which is assumed to be a strong material, which is not always true (Hambrecht & Rockman, 2017). Goudie (2016) reveals the worrying susceptibility of stones affected by moisture and vegetation. Rock types such as limestone and soapstone are soft rocks hence get eroded more quickly (Routoistenmaki, 2006).

**Risks associated with climate change and effects on cultural heritages**

Climate change has affected the tourism sector- just like other economic sectors- agriculture, energy, and insurance and transport sectors. The change in climate has influenced decision making in tourism globally. Climate change impacts the overall destination competitiveness and sustainability.

**Table 2.5: Risks of climate change and effects on cultural heritage**

| Climate Change Indicator | Risk associated with Climate Change | Socio-cultural and physical effects |
|---|---|---|
| Atmospheric pressure change | Flooding in seas and rivers Heavy rainfall | Loss of structure |
| Temperature changes | Storms Ice changes Freezing | Damaged ceramics, bricks and stones |
| Sea level rises | Floods in coastal areas | Submersion of structures |
| Wind | Sand, salt and rain driven by wind | Damage and collapse of structures |
| Desertification | Drought | Abandoned structures |

| | | |
|---|---|---|
| Pollution | Pollutants | Corrosion and blackening of structures |
| Biological effects | Invasive species | Native species decline |

**Source: WHC (2006, p.30)**

## 2.4 Assessing the vulnerability of the destination

Carrying out vulnerability assessment of a destination is important in understanding shortcomings, the capacity to adapt and the resilience on which the development of adaptation strategies measures can be implemented. Vulnerability assessment is achieved by identifying the tourism system of the destination, evaluating the vulnerability, risk and opportunities and the resilience.

### Vulnerability assessment of immovable cultural heritage

Further studies can enhance comprehension on sites and climate change issues (Sabbioni et al., 2008). Kenya's coastal region provide the best cultural resources, vulnerability of the immovable cultural heritage to the rise of sea levels requires investigation. First, study of cultural heritage assets is complex as a result of insufficient knowledge (Romaoa et al., 2016). Vulnerability of the structures is assessed in terms of temperature rise, floods, sea level rise, salt intrusion, increase precipitation, strong winds, coastal erosion, increase in acidity and the biological infestation. Holistic approaches in risk management are fundamental in preserving heritage. Such approaches can calculate the true cost of loss and damage. Addressing vulnerability of building contents and significant value which are often large in number and have different sensitivity levels to a given hazard is difficult. The use of methods such as those in Waller (2013), Michalski (2007) and Romaoa et al. (2016), oversimplified the assessment since they don't include the influence of construction characteristics. Proposed framework is adopted from Romaoa et al.

(2016) who argued that the framework can apply to any immovable cultural heritage facing any type of hazard.

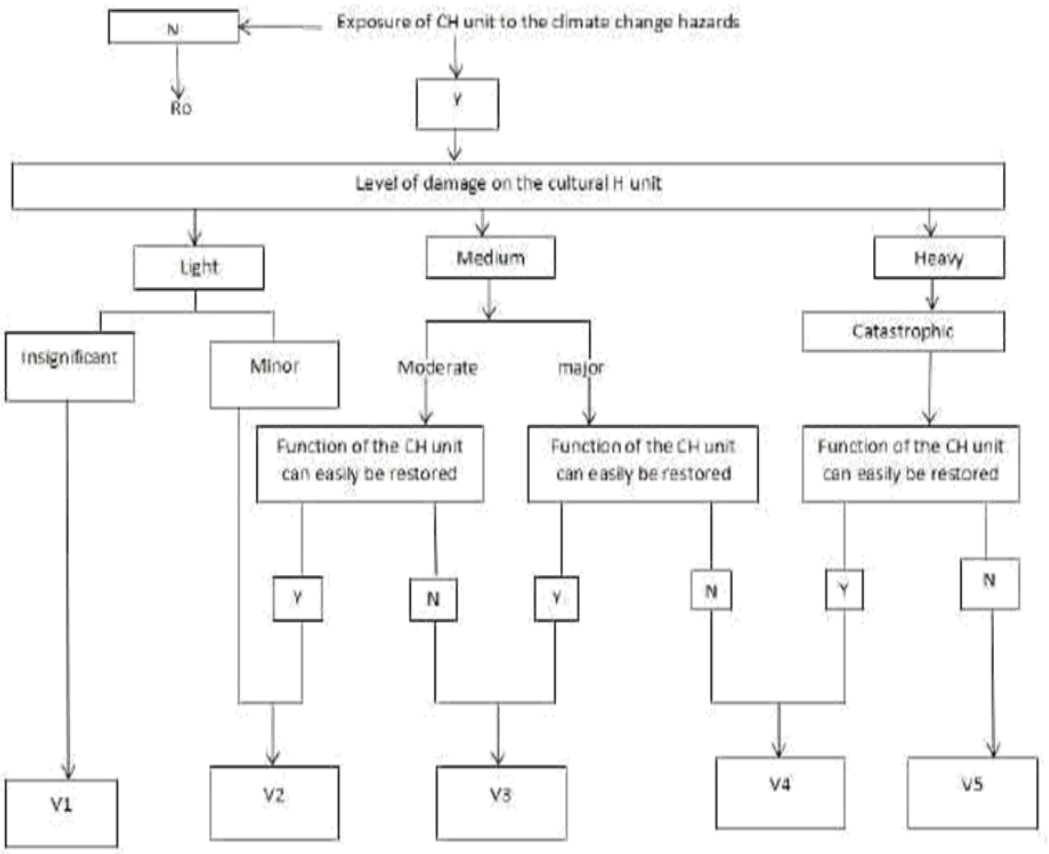


**Figure 2.9: Proposed vulnerability assessment methodology for the cultural heritage**

**Source: Adapted from Romaoa et al. (2016)**

Vulnerability assessment of immovable cultural heritage requires more skilled personnel, time and financial resources which are often limited. Therefore, using the adopted framework combines simplicity, efficiency and reliability in handling many heritage structures. Carrying out assessment using the proposed framework only required basic data that was provided by the site curators. The first step involved classifying damages into three categories: light, medium and heavy.

Heavy damage is evident in scenarios whereby the cultural sites exhibit a lot of structural damage that leads to partial or total collapse. The light category is for insignificant and minor damages, medium category is for moderate and major damages while the heavy category is for catastrophic damage. Qualitative scales for impacts of hazards.

**Table 2.6: Qualitative scales for impacts of hazards**

| **Qualitative scales for impacts** | | |
|---|---|---|
| **Rate** | **Descriptor** | **Description** |
| 1 | Insignificant | There is no damage |
| 2 | Minor | There is a slight damage |
| 3 | Moderate | There is some damage |
| 4 | Major | There is considerable damage |
| 5 | Catastrophic | Significant damage or loss |

**Source: Adapted from the standard ISO 31000 and technical norms for risk management. (ICONTEC, 2004 and ISO, 2007) cited in Matiz (2016, p.82)**

Step two identifies the type of damages that can be repaired in order to restore the functions of the cultural heritage unit. Function of the cultural unit was considered restorable if:

i Restoring the materials without compromising the authenticity of the cultural heritage unit.

ii Stabilization of the damaged elements without hiding the results of the repair carried out in the cultural heritage unit.

The last step categorizes the level of vulnerability from number one being less vulnerable to number five being most vulnerable. The level of vulnerability depends

on the level of damage and whether the damage can be repaired. The framework did not include the loss of value category since most of the heritages have not been classified according to their importance thus the difficulties. The proposed framework was applied to individual immovable cultural heritage in Mombasa and Kilifi counties.

### 2.5 Determining the adaptive capacity

Adaptive capacity refers to ability of tourism system to respond successfully to climate change by adjusting to behavior, technology and resource use (Simpson et al., 2008). Adaptive capacity of every destination varies with different attractions, businesses and tourists (Becken & Hay, 2007). It depends on the amount of time, knowledge and money. Adaptation strategy goes alongside mitigation (Ratter & Kannen, 2015; Weaver, 2011).

However due to trapped Green House Gases in the atmosphere, mean global temperature will continue to rise (Barker et al., 2007; Mc Carthy et al., 2001) therefore the need to adapt. Adaptation is done at the destination level where the cost is incurred and benefit obtained is felt unlike mitigation that is felt globally. Adapting doesn't mean accepting climate change rather it provides quick relief from the impacts of climate change. Adaptation requires the capacity to learn from previous experience in order to cope with future events.

Tourists have high adaptive capacity because they are flexible on making decisions and money, time and knowledge is at their disposal. They decided where to go and what activities to indulge in. Tourism suppliers have less adaptive capacity. They are in a better position to adapt than those who own the infrastructure who have low

adaptive capacity. Suppliers can produce products according to customer demand and provide information to influence customer`s choice. They can also shift their business in case of occurrence of a risk. Destination and the local community have the least adaptive capacity. Community's adaptive capacity depends on existing interrelationship with infrastructure, ecosystem, social changes and physical changes. Their investments are immovable structures that cannot be easily liquidated.

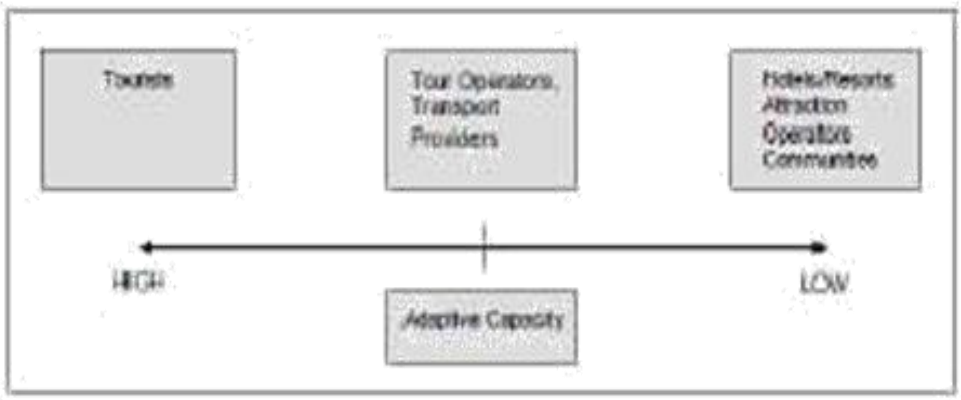


**Figure 2.10: Relative adaptive capacity of the tourism stakeholders**

**Source: UNWTO-UNEP-WMO (2008, P.18)**

Philips (2015) adaptive capacity of cultural heritages is the approach of investigating the state of management of cultural heritage sites in consideration of climate change. Key determinants of adaptive capacity are learning capacity, room for autonomous change, access to resources and leadership in an institution. Adaptation to the adverse effects of climate change through relocation of moveable cultural heritage from its original site causes a negative effect on the value of the site. Therefore, despite the fact that cultural heritages are subjected to severe climate change conditions in their climatic, social and cultural environment and are by nature immovable means adaptation has to take place.

Forces that enable a system to adapt are the drivers of adaptive capacity (Kasperson Kasperson, 2005; Walker, 2005). Factors that influence ability to adapt include local knowledge and skills, institutional governance, political influence and networking, technology and information, built infrastructure, availability of finances and managerial abilities (Smit & Pilifosova, 2003; Folke et al., 2010). Systems' capacity is not static it depends on interaction of determinants which vary in time and space (Smit & Wandel, 2006). Climate change adaptation is bound with the concept of vulnerability. Assessment of adaptation requires identification of both the system and the hazard involved, that's who is adapting to what? Adaptive capacity of a site is evaluated through vulnerability analysis (Parry et al., 2007). Analysis entails looking deeply into factors that promote or inhibit adaptation (Eriksen & O'Brien, 2007).

Cultural heritage adaptation to the impacts of climate change is a new field that was first mentioned in 2014 at a chapter in Europe on the fifth assessment report (AR5) of intergovernmental panel on climate change. In 2017 at the world heritage committee of UNESCO annual session, they requested UNESCO world heritage Centre to support state parties in managing the impacts of climate change and strengthening their relationship with UNFCCC and the IPCC. IPCC took the initiative and consulted UNESCO on the topics that would like to be incorporated in the sixth assessment report to be published in 2021. In the fifth assessment report climate change impacts were briefly mentioned with reference to the Noah's ark (2003-2007) and climate for culture (2009-2015) projects that were funded by the European commission (Carmichael et al., 2017).

### 2.5.1 Adaptation options for cultural heritage

Most of the climate related publication in bibliography deals with impacts and majority outline mitigation measures than adaptation (Scott et al., 2006). Adaptation therefore continues to be a critical research gap in climate change and tourism sector literature. Some existing studies on climate change include impacts on the wetland sites (Chapman, 2002): national heritage properties (Cassa & Pender, 2005): built heritage and cultural landscapes (Sabbioni et al., 2006: Blankholm, 2009): natural and cultural world heritage listed properties (UNESCO, 2006) and architectural surfaces and structures (Brimblecombe et al., 2011; Bonazza et al., 2008; Mc Cabe et al., 2011).

Adaptation strategies for European cultural heritage identified by Sabbioni et al. (2006) include both physical and adjustment practices which were later adopted by Italian strategic agenda. Adaptation plans majored on monitoring, maintenance and preparedness to floods. Historic England climate change adaptation plans described by (Heathcote et al., 2017), involved developing approaches to deal with changes and loss. In Norway, Grontoft (2011) discussed adaptation options for surface of heritage materials to the impacts of climate change.

UNESCO and ICOMOS recommended a number of adaptation options for the cultural heritage which include increasing research, knowledge, education, engagement, upgrading of management plans and monitoring procedures to increase resilience of the sites (Cassar, 2016). Pollard-belsheim et al. (2014) analyzed the effectiveness of existing adaptation options of building watertight

barriers, wooden breakwaters and gabion rock wall on coastal archaeological sites. Adaptation research for cultural heritage sites is still limited in Africa.

Local stakeholders are more knowledgeable on the impacts of past and present weather events (Reid et al., 2009). Given the future climate predictions as likely to increase cultural heritage sites need to adapt by reducing exposure and sensitivity to past extremes (Smit & Pilifosova, 2003; Hofmeijer et al., 2013: IPCC, 2014). Adaptation options can either be reactive that is takes place after an impact is experienced or proactive adaptation that is implemented before the impact occurs, it is based on projected data.

### 2.5.2 Principles of good climate-change adaptation

According to Webb and Beh (2013), the following are the main principles;

1. Engagement of all stakeholders
2. Sustainable leadership.
3. Explicit scoping (determining the extent of an issue)
4. Stipulating clear objectives.
5. Relevant methodology
6. Several issues and barriers
7. Methods that conform to local needs
8. Related initiatives
9. Address spatial and temporal scales.
10. Options assessment and decision-making processes.
11. Adaptive management strategies

A number of existing publications mentioned adaptation using words like cope, adjust and respond without providing a full discussion of adaptation options

available to specific tourism destination (Scott et al., 2006). Limited adaptations for the entire tourism industry exist. Scott et al. (2012) proposed adaptation options for the tourism sector which includes technical, institutional, legal, policy, planning, economic and behavioral strategies.

**Proposed adaptation options for the tourism sector**

**Table 2.7: Proposed adaptation options for the tourism sector**

| Types of tourism adaptation | Tourism operators/business industry | Communities | Government and Financial Sector/insurance |
|---|---|---|---|
| **Technical-Snow making** | Enable Slope countering access to rainwater early warning<br>Collection and equipment to recycling systems tourism<br>Cyclone proof operators<br>Building design –develop and structure websites with practical information on adaptation measures | Reservoirs and destination plants<br>Fee structure for water consumption<br>Weather forecasting and early warning systems | Reservoirs and destination plants fee structure for water consumption<br>weather forecasting and early warning systems |
| **Managerial water conservation** | Condition lows season reports through closures the media<br>Product and -use of short market term<br>Seasonal diversification<br>Forecasts for regional planning<br>Diversification of marketing business activities<br>Operations-training<br>Redirect clients` programs away from climate impacted change<br>Destinations adaptation<br>Encourage environmental management with firms | Convention/event interruption<br>Insurance<br>Business subsidies<br>Impact management plans<br>Coral bleaching Response | Adjust insurance premiums or not renew insurance policies restrict lending to right risky business operators |
| **Research** | Site location-assess awareness of business and tourists and knowledge gaps | Awareness of business, tourists and knowledge gaps | Extreme exposure risk event |
| **Education** | Conservation education<br>Education campaign for employees and guests | Campaigns on the dangers of UV radiation | Water education to potential conservation and existing customers Campaign<br>Extreme event -good practice in house<br>Recovery marketing |

**Source: UNWTO-UNEP-WMO (2008) cited in Njoroge (2014, p.5)**

Cultural heritage experts in Europe listed the following adaptation options for the cultural heritages according to Sesana et al. (2018).

1. **Managerial and decision adaptation**
    - i Increase knowledge on climate change and cultural heritage
    - ii Adequate financial resources
    - iii Dissemination of information
    - iv Engagement of stakeholders involved in cultural heritage
    - v Strengthen monitoring and maintenance
    - vi Values preservation
    - vii Stronger regulations on climate change
    - viii Mitigation strategies
2. **Practical adaptations**
    - i Building defenses, roofs and shelters
    - ii Improving drainage systems
    - iii Move the heritage
    - iv Improve use of building materials such as avoiding cement mortar, harling surfaces, avoid use of moisture barriers, developing new materials well-matched with the historic ones. Improving or strengthening monitoring
    - v Digital recording of cultural heritage resources

### 2.6 Overcoming barriers in heritage preservation

Barriers or challenges refer to obstacles that make climate change adaptation impossible to achieve. Barriers may be from the site physical characteristics, nature of the system involved or the relationship between the two variables. Challenges may prevent policy implementation, participation in the adaptation planning, hinder implementation of adaptation measure or prevent uptake of new frameworks.

Concept of barriers became widely used after their inclusion in the intergovernmental panel on climate change 4th assessment report on adaptation (Adger et al., 2007). Later on, two reviews argued the advance in knowledge through seeking to identify underlying drivers of barriers and limits to adaptation (Biesbroek et al., 2013 and Eisenack et al., 2014). Therefore, the study seeks to add more knowledge on how the stakeholders in the destination overcome these barriers to achieve successful adaptation.

Barriers occur at all phases of the adaptation process from identifying the impacts, planning adaptation, choosing best adaptation option and implementing the strategy (Matasci et al.,2014). In US, Fatoric and Seekamp (2017) listed three categories of barriers to adaptation of cultural heritage to climate change: institutional barriers, technical barriers and financial barriers. Barriers related to governance and compatibility with current management framework in Australia was identified (Carmichael et al., 2017). Since a number of studies have listed the barriers and opportunities, the study identified how to minimize the barriers that affect the successful adaptation of cultural heritage to climate change and on the other hand make use of the opportunities that result from the adaptation process.

a) Diversification

Generalizing adaptation solutions is difficult because of diverse typologies of cultural heritages, different geographical location and the different climatic factors they are exposed to. Cultural heritages are also facing different risk factors that cause their deteriorations. Intrinsic characteristics of the cultural heritage vary their ages, construction materials and the rate of decay.

b) Inadequate financial resources

Carrying out multi-hazard risk analysis of the cultural heritage often requires budgets due to their complex nature in determining the value. Implementation of adaptation strategies also requires finances in making up the necessary changes in the structures.

c) Uncertainty

Moving from reactive to proactive adaptation is often accepted with a lot of uncertainty since future climate cannot be well predicted. Climate is changing on a daily basis and we cannot rely on the projections because it is subjected to errors.

d) Preservation of values, integrity and authenticity

Climate change does not only affect the physical cultural heritage but also the intangible heritages that are memories associated with a society. Lived experience of culture identity belonging and sense of place together with values, traditions and cultural practices need to be taken into consideration in accepting climate change adaptation solution.

e) Institutional barriers

There is Lack of policies and guidelines at both local and national level that emphasize on heritages protection. Collaboration and partnership between cultural heritages and other sector is also missing.

f) Technical barrier

There is lack of knowledge on cultural heritage preservation due to limited research on cultural heritage and climate change. Inadequate technology and lack of skills among the staff to support adaptation process is still a challenge

g) Loss

Loss of cultural heritage due to climate change has already been cited in literature.

h) Resignation

Preserving cultural heritage requires site managers' involvement in the research and management process.

### 2.7 Maximizing opportunities in heritage preservation

Adapting to climate change for the cultural heritage may create some opportunities that facilitate preservation of the heritages into the future generation. Some of the listed opportunities are highlighted below. The study looked into how the stakeholders make use of these opportunities when they unfold.

i. Proactive, planned approach collective mitigation strategies. Both adaptation and mitigation measures of cultural heritage to climate change risks go hand in hand as recommended by UNESCO.
ii. Strengthening monitoring and maintenance- Assessing climatic conditions and their effects remains essential.
iii. Making adaptive change- The implementation of changes in the cultural heritage leads to conflict.

### 2.8 Theoretical framework

#### Theory of adaptation

The theory of adaptation was developed by Linda Hutcheon in 2006. According to her book on a theory of adaptation, adaptation must always be different from the original but still maintains the originals' important ideas (Hutcheon, 2012).

Hutcheon discusses adaptation in two ways as a process and as a product. Adaptation as a product in that change is embraced and there is no faithfulness to originality. Adaptation as a process in that it becomes part of the change in the original to give it a new meaning which in the long run becomes part of the public history of a story in reference to the future adaptations. Furthermore, there is a reason for each adaptation and they are always diverse. The book listed the reasons for adaptation to include economics, personal interest, building of culture, sheer entertainment and social commentary (kinney, 2013).

According to Hutcheon (2012) there is need for every scholar to list the reasons for every adaptation proposed. The theory gives the importance of adaptation to include time, space, race and culture, politics, place and gender. Hutcheon theory is in agreement with adaptation theories of other scholars such as Brian McFarlane, Robert Stam, Thomas Leitch, Julie Sanders and Christine Geraghty all of whom are in agreement that adaptation is very complex and can alter the way we view variety of cultural products (kinney, 2013).

From this study perspective a theory of adaptation means before implementing an adaptation strategy in immovable cultural heritage. It is important for the management to understand why to adapt, who is adapting and adapting to what? the reason and importance of the adaptation and the changes that comes with the adaptation. Therefore, this was noted to be considered in the immovable cultural heritage sites that had implemented an adaptation strategy which captures what the theory highlights.

## 2.9 Summary

The review of literature was based on the broad areas of climate change and cultural heritage from a global, regional, national and local perspective. First, the chapter gives a detailed definition of climate, climate change, tourism and the relationship between tourism and climate, further the aspect of cultural heritage and the impacts of climate change on the heritage sites is also given a keen and detailed elaboration. Second, reviewing of literature focuses on the assessment of the vulnerability of immovable cultural heritage in which framework used in research was adopted. Third, the origin of adaptation and the existing research on the adaptation strategies for immovable cultural heritage sites has been discussed. Fourth, barriers that prevent successful implementation of adaptation strategies of cultural heritage in different localities have been reviewed. Finally, few literatures exist on opportunities that arise in adapting immovable cultural heritage and on maximization of the opportunities in which the research focused on and a theory of adaptation on which the research was based on. Therefore, the research gap was filled through analysis of existing literature in reference to the area of study and through the lens of a theory of adaptation.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter discusses the research site, research design, target population, sampling technique and sample size, data collection methods, data collection instruments, data collection procedure, data analysis and ethical consideration.

## 3.2 Research site

Research was conducted in Mombasa and Kilifi Counties. Both Kilifi and Mombasa covers 12,862 square kilometers excluding 174 square kilometers of water mass. The two counties lie between latitudes 2° 16´ 22´´- 4º 10´ south and longitudes 39º 5´ 0´´- 40º 14´ 34´´ east and rises from sea level to 900 meters to the west. Kilifi County has six immovable cultural heritages. Gede Ruins a 12$^{th}$ century Swahili village is located deep within the Arabuko Sokoke forest. Jumba la Mtwana an important slave port in the 14$^{th}$ and 15$^{th}$ century is located 20 km off Mombasa road close to Mtwapa creek in Malindi. Mnarani Ruins consist of the remains of two mosques dating from the 14$^{th}$ century is located on the south bank of Kilifi creek in northern coastline. Vasco da Gama Pillar is a bell-shaped architecture built in the 13th to 14th century in Malindi beach. Portuguese chapel a spectacular Monument built in the 16th century lies along seafront near Malindi museum. Watamu Monument is a historical site dating back to 13$^{th}$ century is located in Watamu. Mombasa County has two immovable cultural heritages: Fort Jesus is a Portuguese Fort built between the year 1593 and 1596 along the coastline near the old Town. Mombasa old Town started in the 6$^{th}$ century and covers an area of 180 acres.

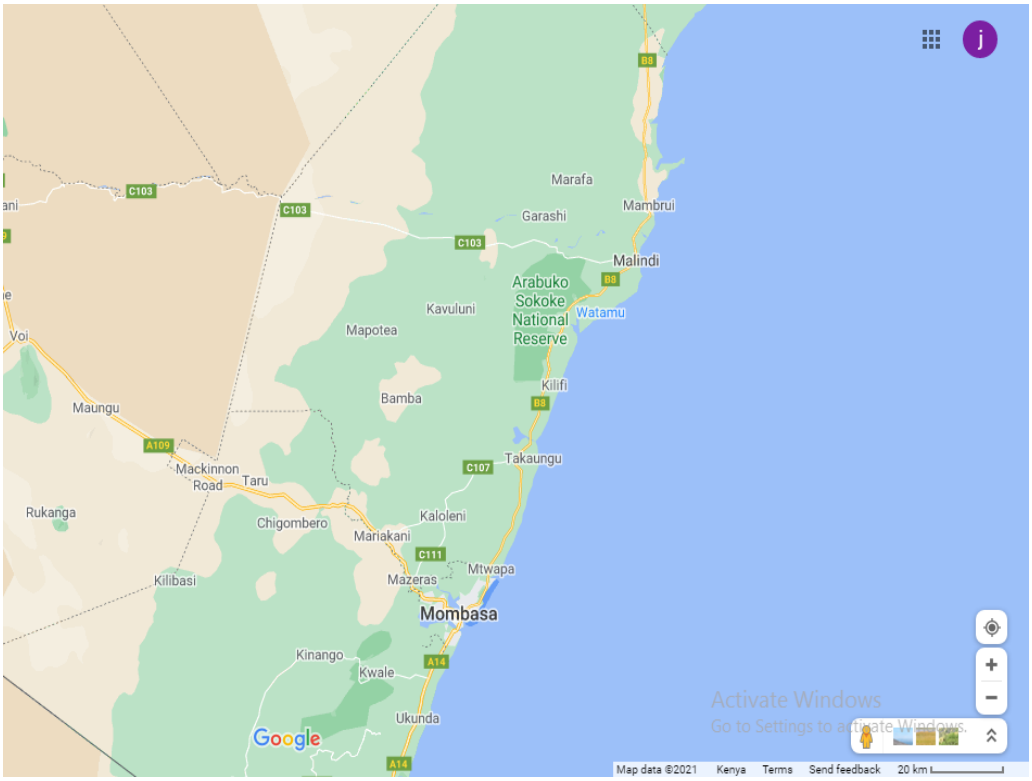


**Figure 3.1: Research site**

**Map of Mombasa and Kilifi Counties obtained from google maps.**

**Plate 3.1: Image showing location of the immovable cultural heritage in Mombasa and Kilifi counties**

### 3.2.1 Case studies

#### 3.2.1.1 Fort Jesus

Fort Jesus was built in the 16th century (1593-1596) by the Portuguese to protect the Mombasa Town from invaders. The Fort was designed to take the shape of a man and stands still on the spur of coral rocks. Fort Jesus, overlooking the entrance to the old port of Mombasa was built to protect the trade route to India. The Portuguese first inhabited the Fort but in the year 1698, the Oman Arabs took control. In the year 1895 the British transformed the Fort into a prison where slaves were held captive and tortured. Later on, the Portuguese recaptured the Fort. The Fort has since then been refurbished several times revealing Portuguese, Arab and British influences. In the year 1858 the Fort became a national park and in 2011 it became a UNESCO world heritage site, inscribed on the list because of its brilliant and unique structures from the 16th century. It's today hailed as one of the best examples of the 16th century Portuguese military architecture (Kirkman, 1974). The Fort displays mainly archaeological findings and the old law court gallery host temporary exhibitions. The base of Fort Jesus has been steadily eroded by the rising sea tides.

#### 3.2.1.2 Mnarani Ruins

The Ruins of Swahili settlements of Mnarani Ruins date back to the 13th century and are located on the south bank of Kilifi creek on Kenya's north coast. Mnarani settlement covered 16 acres of land contains vestiges of two mosques, several tombs and one with a striking Pillar of about 10 meters high. The Pillar with incised decorated tombstones sits on the basal construction course of the tomb, wells and several mounds remain of residential buildings. The site flourished in the 16th century but was abandoned in the 17th century and later on destroyed by warring

Galla people. Today the site is covered with indigenous trees of high medicinal value, sykes and vervet monkeys also take cover in the site.

### 3.2.1.3 Jumba la Mtwana Ruins

'Jumba la mtwana' (large house of slaves) is the remains of a 12th century settlement believed to be built around 1350 inhabited then later abandoned. The Ruin is believed to be inhabited by the Muslim evidenced by the existence of 4 mosques, water cistern and washing platform. These houses are identified as House of the Cylinder, House of the Kitchen, House of the many Pools and the Great Mosque. Jumba boost of magnificent remains of domestic houses, mosques, tombs and carved niches. The ancient Town covers 12 acre and available ceramics depict evidence that the Town was abandoned in the 15th century due to wars and diseases. The Ruins were excavated in 1972 by James kirkman and in 1973, it was opened to the public and gazetted in 1982 as a national Monument.

### 3.2.1.4 Gede Ruins

Gede Ruins a 12th century Swahili village is located deep within the Arabuko Sokoke forest, 16 km south of Malindi. Gede represents the remains of a prosperous Town which flourished until its abandonment in the 17th century due to water shortage, civil wars and diseases. The Ruins lie on 45 acres of land with original forest reflecting a unique architectural style and wealth of many Swahili Towns of that period. The site was excavated in the late 1940s and 1950s where many domestic, religious and commercial structures were unearthed. The site has numerous Ruins of palaces, palace annexes, houses, elaborated tombs and mosques which evidence that Gede had a large and wealthy population. In 1948 Gede was declared a national park an archaeologist was appointed as a warden until in the year 1969 when the administration was taken over by museum trustees.

The Ruins have been justified for its outstanding universal value under criteria (ii), (iv), and (iii). According to the national museums of Kenya, Gede Ruins present unique evidence of a historic city with complex architectural design at this period in history. Furthermore, the historic city represents a testimony to the social and economic inhabitants of Gede around the 13th century.

### 3.2.1.5 Portuguese chapel

Portuguese chapel a spectacular Monument built in the 16th century with its eastern side bearing the pulpit. The chapel lies along the seafront near Malindi museum few meters from the famous Vasco da Gama Pillar. Outside the chapel is a graveyard for Portuguese among those buried here are pioneer commander Mr. Lawford of the famous Law- ford hotel and the first British DC of Malindi Mr. Bell Smith. The history of the chapel is obscure but is believed to be the first Christian church in East Africa built in the 1490s. After Portuguese left Malindi in 1593, the chapel was deserted until the arrival of British in 1893. The chapel was gazetted as a national museum in 1935.

### 3.2.1.6 Vasco da Gama Pillar

Vasco da Gama Pillar was built by the Portuguese explorer Vasco da Gama in Malindi and is the oldest remaining European Monument in tropical Africa. It was built in 1498 and is today visited as an architectural treasure. The Pillar with a sign of the cross on the top (known as Padro) was made from Lisbon limestone and bore the arms of Portugal (still faintly visible). The Pillar was erected on a hilly ground to provide direction for the seafarers. The Pillar was gazetted in 1935 as a national Monument. It attracts large numbers of visitors particularly from Germany, Portugal and Italy**.**

### 3.2.1.7 Mombasa old Town

Mombasa old Town started in the 6th century and covers an area of 180 acres. Mombasa old Town consists of ancient buildings with architecture design of Arabs. The old Town is on the tentative list to qualify for inclusion in the world heritage list. The Town describes the time when Mombasa was under the heavy influence of Arab culture. The place is famous for tourists because of its antique and souvenirs. The old Town is predominantly Muslim and there are several fine old mosques. Listed buildings within Old Town include; Fort Jesus, Mombasa Club, Africa hotel, Mandhry mosque, old post office, old port, Sanaa gallery, Bohra mosque, Leven house and steps, Reitz house, probable site of old Portuguese church, Mombasa house, white house, Lookmanji curio shop, Ali curio market, Jubilee hall, Mazrui graveyard, Datoo`s salerooms, Pigott place, Basheikh mosque, Treasury square, Swahili cultural centre and Alien registration buildings.

### 3.1.1.8 Watamu Monument

Watamu Monument is a historical site dating back to the 13th century when Gede and Malindi were occupied. The Monument is located on the beachfront of temple point hotel in Watamu. The Monument is visible on from the beach especially to those visiting Watamu marine parks. The Monument has a hidden history behind it pending archaeological excavation to reveal the truth.

## 3.3 Research design

Kothari (2004) defines research design as a conceptual structure within which research is conducted aimed at the collection of relevant evidence with minimal use of time, money and effort. According to Creswell (2009) research design is a plan and procedure used for research to span broad decisions to detailed methods for

data collection and analysis. The study adopted a qualitative case study research design. According to Creswell (2002), Pope and Mays (1995), Denzin and Lincoln (1994) qualitative research is used to explore, understand and interpret social phenomena in its natural setting. Qualitative research depends on data collected through observations, interviews, questionnaires, recordings and focus groups. Case study is used to explore and understand complex scenarios of past events. The findings were reported as a qualitative with some statistics as stipulated by Creswell (1994) and the results were presented as in descriptive, narrative form rather than a scientific report. Qualitative research provides the researcher with opportunity to ask questions that can't be put into numerical to understand human surrounding and experience.

The survey was conducted through the distribution of questionnaires among 60 respondents. Six interviews were conducted through snowballing to gain more knowledge of the topic. Qualitative researches require minimum sample size of at least 12 to reach data saturation (Clarke & Braun, 2013; Fugard & Potts, 2014; Guest, Bunce & Johnson, 2006), therefore response rate of 32 was adequate for research. The research design was best for the study in that it allowed the collection of both quantitative and qualitative data in a single research study (Gay, Mills & Airasian, 2009).

### 3.4 Target population

Population refers to all items in any field of inquiry also known as the universe (Kothari, 2011). Mugenda and Mugenda (2012) defines the target population as that population in which the researcher wants to generalize the results of the study. The project covered immovable cultural heritage sites in Mombasa and Kilifi counties.

Both counties have ancient buildings and structures ranging from Monuments, museums, Ruins, Pillars, temples and old Town. Sixteen immovable heritages were identified as the target population of the study. They include Fort Jesus, Mbaraki Pillar, Kitoka site, Mombasa old Town, Mosque on Cottington`s plot, Gedi Ruins, Mamburui Ruins, Vasco da Gama Pillar, Magangani-Kilepwe Ruins, Mosque on Pritchards plot-Watamu Monument, Jumba la Mtwana, Mnarani Ruins, Kiburugini, Jemedari mosque and the Portuguese chapel. Respondents of the study were all the staff that work in the immovable cultural heritage.

### 3.5 Sampling Technique and Sample Size

Sampling is the process of choosing research subjects (Garson, 2012). A sampling technique is defined as the procedure used to gather data (Orodho, 2012). The study used convenience sampling in sampling the immovable cultural heritage sites in Kilifi and Mombasa counties. Convenience sampling refers to using the samples that can be accessed for the study. A total of 16 immovable cultural heritages were identified along the Kenyan coastline within Mombasa and Kilifi counties. According to Berg et al. (2009), a sample frame comprises all those elements that can be sampled including individuals, household or institutions.

#### Sample Size

Kothari (2013) defines sample as a collection of units chosen from the universe to represent it while Bryman (2008) and Spiegel (2008) defines sample as part of the total population. To achieve the sample size, the immovable cultural heritages were classified based on the management. Snow balling sampling method was used in identifying the heritage sites used for the study. Those managed by the national

museums of Kenya were the main target of the study. Their accessibility was also considered in choosing the sites of the study.

**Table 3.1: Sample size**

| Immovable cultural heritage | Management | Accessibility |
|---|---|---|
| Mbaraki Pillar | NMK | Accessible (under construction) |
| Fort Jesus | NMK | Accessible |
| Mombasa old Town | NMK | Accessible |
| Jumba la mtwana | NMK | Accessible |
| Kitoka site | Private | Not accessible |
| Mosque on Cuttington plots | Private | Not accessible |
| Kiburugeni | Private | Not accessible |
| Gede Ruins | NMK | Accessible |
| Watamu Monument-mosque on Pritchard`s plot | Private | Accessible |
| Portuguese chapel | NMK | Accessible |
| Vasco da Gama Pillar | NMK | Accessible |
| Jemadari mosque | Private | Not accessible |
| Mambrui Ruins | NMK | Not open to public |
| Magangani-Kilepwe | NMK | Not accessible |
| Mnarani Ruins | NMK | Accessible |
| Pillar tomb- Malindi | Private | Not accessible |

Therefore, eight immovable cultural heritages were identified for the study in both counties. They include Fort Jesus, Mombasa old Town, Gedi Ruins, Vasco da Gama Pillar, Jumba la Mtwana, Mnarani Ruins, Watamu Monument and the Portuguese chapel. Eight which represents 57 % of the target population is a good number because it is more than 30 % of the target population observed by Mugenda and Mugenda (2012) as a good representation. The respondents of the study from the eight immovable cultural heritage sites were sixty-six. The six of the respondents were experts who were interviewed where two were the coastal conservators and

four were the site curators, sixty respondents are the staff that worked in the eight immovable cultural sites.

### 3.6 Methods of Data Collection

Data is defined as anything admitted as a fact on which research inference is based (Oso & Onen, 2011). Mugenda and Mugenda (2012) and Cooper and Schindler (2011) argues that data collection instruments are tools and procedures used in the measurement of research variables. Cooper and Schindler (2011) further state several data collection methods to include: interviews, surveys, focus groups, field notes, telephone interviews, questionnaires or taped social interaction. The study used the following methods to collect data considered appropriate: literature review, observation, interviews and questionnaires

#### 3.6.1 Literature Review

The first method used to collect data was a literature review. This involved doing reviews of published journals, papers, books and other online websites to obtain the baseline data that the research topic and objectives were hanged–on. Information obtained from this research method provided a base knowledge understanding of climate change and its evidence, impacts of climate change, a clear understanding of cultural heritage, risks to cultural heritage, various respond strategies to climate change and the barriers to conservation. Through analysis and reviewing of the literature, it provided a research gap that needs to be addressed through research. Furthermore, the literature also provided support to the research findings.

#### 3.6.2 Observation

Observation method is mostly used in social sciences where we observe things around us (Kothari, 2004). Information is collected by the researcher`s direct observation without asking respondents. The researcher carried out observation of

the immovable cultural heritage sites to understand their current situation. This method was best for this study because it involved researching on objects that are not capable of giving verbal reports of their feelings. Observation data were obtained by use of a checklist and also photographs to provide evidence and illustration.

### 3.6.3 Interview Schedule

Kothari (2013) defines interviews as a systematic way of talking and listening to respondents using open questions. According to Kothari (2004), descriptive studies often use a structured interview technique because of being economical and provide a basis for generalization. The interview involves asking questions in a face-to-face contact with the respondent. Cooper and Schindler (2011) give the advantage of using interviews in that there is a high return rate, the researcher is at ease of recording or observing non-verbal cues and high chances of probing opportunities. Interview schedule gives a researcher a sense of order to draw questions from unplanned encounters and help in the identification of key themes (Kothari, 2011). The experts interviewed were selected through snowballing. A total of six interviews were conducted during the study, four heritage site curators and two coastal conservationists.

### 3.6.4 Use of questionnaires

A questionnaire is a technique of data collection in which every person is asked to respond to the same set of questions in a predetermined order (Cooper & Schindler, 2011; Burns & Burns, 2012). Questionnaires are the most commonly used method for collecting primary data (Creswell, 2011). Questionnaires consist of typed open and closed-ended questions in a definite order in a form. Questionnaires were

preferred for the study based on their ability to collect a large amount of data within a short period. Besides, questionnaires help reduce the biases (Kasomo, 2010) and are easy to administer and score (Kothari, 2011). Furthermore, questionnaires enable respondents to share their views without disclosing their identity. Questionnaires used for data collection were self-designed and consisted of both open and closed-ended questions. The respondents were given a one-week duration to fill the questionnaires. A total of sixty respondents were issued with questionnaires during the study.

### 3.7 Data Collection Instruments

Data collection instruments used include; Questionnaires, Interviews and observation. Questionnaires help in obtaining information quick and easily from the target population. Interviews were conducted to broaden knowledge on answers given through questionnaires and to get in-depth knowledge on the topic through moderating the survey. The observation was done to get real and accurate information about the situation on the ground.

### 3.8 Validity and Reliability of Research Instruments

#### 3.8.1 Validity

Validity refers to the ability of research findings to reflect accurately the present. It is concerned whether the findings are about what they appear to be about (Saunder et al., 2009). The selected instrument and the research questions should be relevant to the gap established in the topic. Before the actual study validity of the research

instruments were discussed with the research supervisors and their feedback was used in modifying the questionnaires.

### 3.8.2 Reliability

According to Saunder et al. (2009) reliability refers to the extent to which data collection techniques would yield consistent results. Mugenda and Mugenda (2012) argues that if a researcher administers a test to a respondent twice and gets the same score as the first then the research instrument is reliable. It may involve administering questionnaires more than once to the respondents. Test re-test method was used through administering the same questionnaire twice to the same respondent.

## 3.9 Data Collection Procedure

The researcher obtained clearance from Murang'a University of Technology and National Commission for Science, Technology and Innovation (NACOSTI). The clearance facilitated the easy movement of the researcher and involvement of respondents in the study area. Once in the study area, the researcher introduced herself to the respective respondents and inform them about the purpose of the research. Questionnaires were administered to the respondents by the researcher and collected after one-week duration. The researcher requested the experts if they could be interviewed, when and where they were comfortable doing the actual interviews.

## 3.10 Data Analysis

Descriptive statistics include statistical procedures that produce indices that summarize data and describe sample (Mugenda and Mugenda, 2012). Collected data first underwent the processing operations of data cleaning, editing, coding, data entry, classification and tabulation before being analyzed. Quantitative form of data

was analyzed using SPSS (version 16) employing the use of means, mode, frequencies, standard deviation and percentages. Results were presented in form of tables, percentages, graphs and charts. Qualitative data were analyzed using content analysis based on emerging themes.

### 3.11 Logistical and Ethical Consideration

During the field study, the following ethical considerations were considered: informed consent, anonymity, confidentiality and accuracy. Before being used as a respondent for the study, the researcher informed the individual of the purpose, aim and uses of the information to the research. Respondents voluntarily participated in the study. The anonymity of the respondents was guaranteed in that they were not asked to indicate their names while filling the questionnaires.

Information obtained from the respondents was treated confidential and used for the study only. High level of accuracy was maintained during coding to ensure there is no omission and fabrication of the data. Furthermore, authorization letters to carry out research were sought from Murang'a University of Technology and National Commission for Science, Technology and Innovation.

### 3.12 Summary

The chapter outlined the methodology: steps and procedure followed in choosing sample size, research design, data collection instruments, methods used in the data collection, data analysis and ethical considerations.

# CHAPTER FOUR

# RESULTS AND DISCUSSION

## 4.1 Introduction

This chapter outlines the findings of the study that were analyzed using SPSS (version 16) and content analysis then presented in tables, themes, charts, Figures and graphs. Brown (2001) highlights that the process of reporting the findings varies from project to project and report to report because of the difference in structure. Furthermore, the reporting and presentation of the findings are done according to the specific design the data were gathered and analyzed. The chapter gives a deeper understanding on the: response rate, demographics, climate change and the physical evidence on the individual site, assessment of the vulnerability of immovable cultural heritages, strategies for adapting immovable cultural heritage to climate change, barriers to adapting to climate change, opportunities from adapting to climate change and the conclusion.

## 4.2 Response Rate

A total of 60 questionnaires were issued to the respondents, 32 filled questionnaires were received, 19 unfilled questionnaires were received and 9 questionnaires were not returned. More than half (53 %) response rate was achieved after the researcher made several visits to remind the respondents to fill and return the questionnaires. According to Mugenda and Mugenda (2012) a response rate of 50 % is adequate for analysis and reporting while 60 % response rate is good and above 70 % is excellent.

### 4.3 Demographics

Background information of respondents was analyzed ranging from their age, gender, the level of education, county of residence, years of residence and occupational status.

#### 4.3.1 Gender of the Respondents

The gender of the respondents was sought and the majority were male (66%) compared to females (34%). Nevertheless, the views and opinions of both sexes were represented.

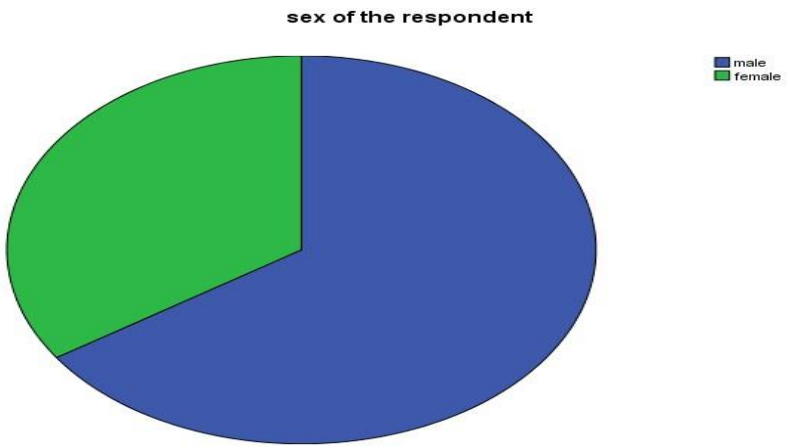


Figure 3: 4.1: Gender of the Respondents

**Figure 4.1: Gender of the Respondents**

#### 4.3.2 Age of the Respondents

The study sought to investigate the age of the respondents. Respondents' age mainly concentrated on the 18 to below 25 (38%) and 45 to below 55 (28%) age bracket. The other age category represented a small number of the respondents, 25 to below 35 (16%), 35 to below 45 (12%) and 55 and above (6%). This is a clear indication that the majority of the people working in the cultural heritage sites are young and energetic.

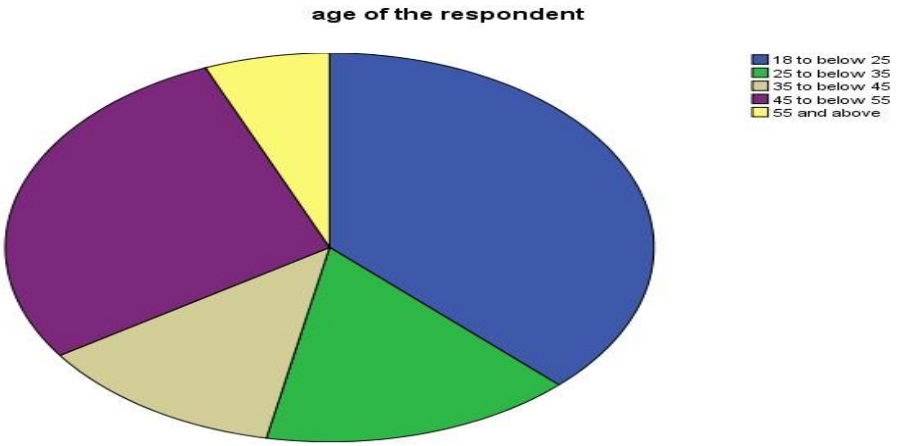


**Figure 4.2: Age of the Respondents**

### 4.3.3 Level of Education

Majority of the respondents had an undergraduate degree (41%) and a diploma education (34%) followed by college certificate (13%). The rest of the respondents had primary education (3%), secondary education (3%), postgraduate (3%) and others (3%). This is a clear indication that employment is based on merit and therefore the respondents understood the questions well and have knowledge on the topic of study.

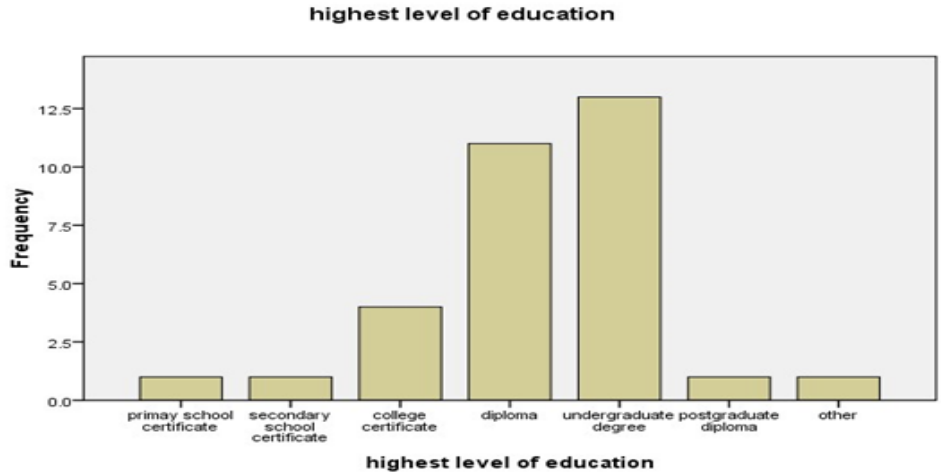


**Figure 4.3: Level of Education**

### 4.3.4 Years of Residence

The study sought to establish the year of residence the respondents have lived in the study area. Majority of the respondents (31%) have stayed in the area for less than a year, followed by (19%) who have stayed for 1year to below 5years and other (19%) who have stayed for 10 to below 15 years. Those who have stayed for 5 to below 10 years were (13%), 15 to below 20 years was (3%), 20 to below 25 years were (6%), 25 to below 30 years was (3%) and 30 years and above were (6%). This indicates that most of the respondents were new in the area compared to those who have stayed for a longer time in the area. Out of the total respondents (56%) reside in Mombasa County, (38%) in Kilifi County while (6%) were from other counties. Furthermore, (63%) of the respondents were employed, (31%) unemployed while (6%) were self -employed. This indicates that the majority of those who filled the questionnaires have worked in the heritage sites and therefore their level of knowledge is high and dependable.

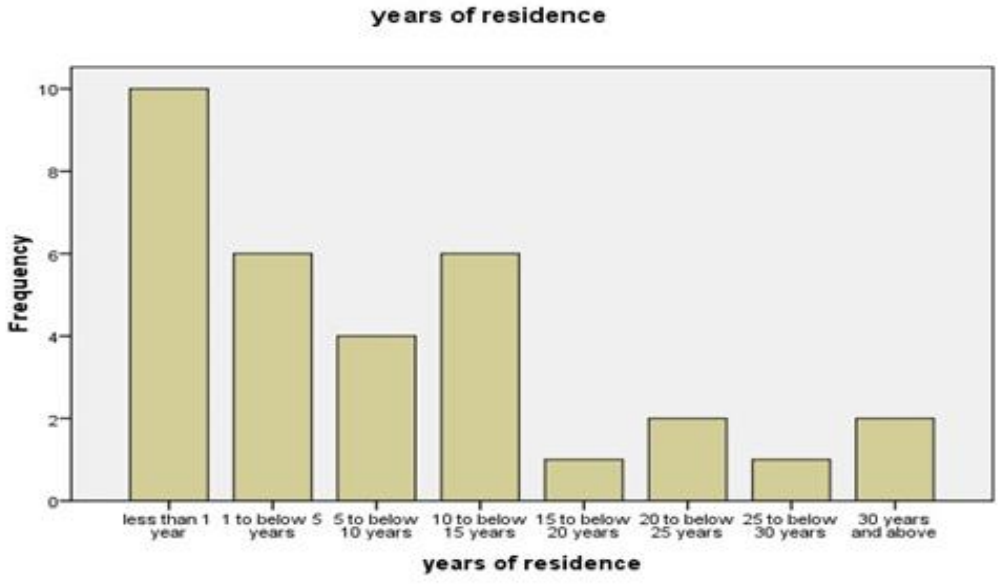


**Figure 4.4: Years of residence**

### 4.4 Climate Change Elements and Physical Evidence on the Site

The study sought to evaluate the impacts of climate change on the immovable cultural heritage through conducting interviews on the site managers and conservationist. A total of six interviews, four interviews were conducted on site curators and two interviews on the coastal conservationist. Climate change has been highlighted as the major problem to humanity and the environment in the 21st century. Carrying out assessment impacts is therefore essential in every sector to understand how to cope with the changes in the climate.

When asked if they have witnessed any changes in the environment for the period they have stayed in the area, 84.4% of the respondents agreed to have witnessed changes in the environment since the beginning of the 21st century. The changes they have witnessed include a change in the weather pattern, temperature change, change in plant and animal species.

The experts on the other side said that; "*Greening of the walls due to chemical reactions began in the early 2000s, residing of the sea line, accumulation of the sand on the shore and fish disappearance on the shore". The observed changes have caused a lot of negative impact on human life, human activities and tourism resources, especially along the Kenyan coastline.* Observed changes in the environment are directly and indirectly related to climate change. Mombasa and other East Africa parts along the coast could be lost by 2080 due to sea level rise (IPCC, 2013). Some of the most affected tourism resources are immovable cultural heritage.

**Table 4.1: Climate change a major threat to cultural heritage**

| climate change major threat to cultural heritages | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | strongly disagree | 2 | 6.2 | 6.2 | 6.2 |
| | disagree | 2 | 6.2 | 6.2 | 12.5 |
| | undecided | 9 | 28.1 | 28.1 | 40.6 |
| | agree | 11 | 34.4 | 34.4 | 75.0 |
| | strongly agree | 8 | 25.0 | 25.0 | 100.0 |
| | Total | 32 | 100.0 | 100.0 | |

The Table indicates respondents' opinions when asked if climate change is a major threat to cultural heritages in the coast region. 25 % of the respondents strongly agreed that climate change is a major threat to the immovable cultural heritage, 34.4 % agreed, 28.1 % were undecided, 6.2 % disagreed while 6.2 % strongly disagreed. Therefore 59.4 % which represents more than half of the respondents agrees that climate change is the major threat to the heritages. This finding is in agreement with climate change being a new threat that will continue to threaten cultural heritages in several ways, therefore, need for further study (Cassar, 2005; O'Brien et al., 2015; UNESCO World Heritage Centre, 2007, 2008).

When asked to identify some of the major threats to immovable cultural heritages these were listed: sea-level rise, heavy precipitation, high temperatures, coastal flooding, coastal erosion, strong winds, ocean acidity and strong ocean currents. The findings are in agreement with Brimblecombe (2014) listing of the possible climate in relation to English damp that includes; rainfall, flooding and soil moisture content, extreme weather (rainfall and wind), temperature and relative humidity, pest and diseases (humidity and temperature affect pests).

When asked to list any immovable cultural heritage sites facing threat from climate change along Kenyan coastline. The respondents highlighted the following: Fort

Jesus, Vasco da Gama Pillar, Mombasa old Town, Gede Ruins, Takwa Ruins, Lamu old Town, Portuguese chapel, Watamu Monument and Jumba la Mtwana.

When asked if cultural heritage is of any importance, all the respondents agreed that the immovable cultural heritage is of great importance, therefore, the need to protect the sites. The respondents listed some of the following importance of cultural heritage: it's a tourist attraction, its source of identity among the locals, creates employment for the locals, used for education and research purpose and it reminds them of their history. This is in agreement with O'Brien et al. (2015) who noted that cultural heritage is important to the people living in the area, domestic and global tourist and the large global community. Heritage value is not often evident like the value of other infrastructure (Harvey & Perry, 2015). Furthermore, cultural heritage contains both tangible and economic value by providing employment and as a major attraction to tourists (Howard, 2013; O'Brien et al., 2015; Philips, 2015). Sites and buildings hold an emotional attraction for both locals and visitors that provide a link to the past (Nettley, DeSilvey, Anderson, Wetherelt & Caseldine, 2014; O'Brien et al., 2015) and therefore should be passed to the future generations (Colette, 2007; Smith et al., 2010).

### 4.4.1 Sea Level Rise

Sea level has been rising since the start of the 20$^{th}$ century. Sea level is the major worrisome for the preservation of cultural heritage because most of the world`s cultural and archaeological heritage lies along the coast (Erlandson, 2008;

Marzeion & Levermann, 2014). According to data collected from satellite, sea level rose by 7.5 cm from 1993 to 2017. Human-induced global warming causes melting of ice glaciers and thermal expansion of ocean water thus rise in sea level (Mengels et al., 2016). Thermal expansion of oceans is estimated to contribute 42 % to sea level rise, melting of temperate glaciers, 21 %, Greenland, 15 % and Antarctica, 8 % between 1993 and 2018 (IPCC, 2014). Scientists expect further acceleration in the 21st century. According to USGCRP (2017) an increase in temperature by a Celsius degree results to sea level rise by 2.3 meters.

Sea level rise is not uniformly felt around the globe. Literature review on the impacts of climate change on sea level in Africa is very limited (Kabede & Nicholls, 2011).

The experts interviewed along the Kenyan coastline warned that; "*rise in sea level causes coastal flooding that has a major impact on the environment. Sea level rise, coastal erosion and extreme weather conditions present serious irreplaceable damages to coastal communities"*. The magnitude of degradation on the heritages will increase depending on the rate of sea-level rise and exposure of their location. 109 world heritage sites will be affected by sea-level rise with the current warming trends plus an additional 27 sites if the global temperature rises (Marzeion & Levermann, 2014). Forty-seven of the Mediterranean world heritage sites are threatened by coastal erosion and storm surges with the number expected to rise at the end of 21st century due to predicted sea-level rise (Reimann et al., 2018).

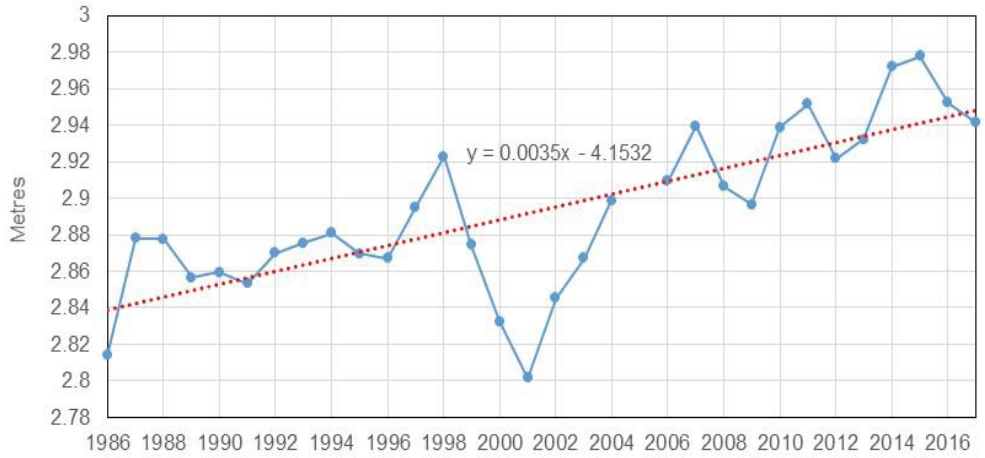


**Figure 4.5: Mean annual sea level variation recorded by the KMFRI tide gauge in Mombasa**

**Source: Kimeli (2013)**

**Fort Jesus**

The Fort is located on Mombasa Island which has a high vulnerability to sea-level rise due to its low altitude of about 45 meters above sea level rise. "*The basement area of Fort Jesus has been badly corroded. Despite the Fort been made from limestone and coral rocks, the foundation has been affected by sea level"* said the Fort Jesus education officer. Stones are vulnerable to moisture and vegetation (Goudie, 2016) with softer stones such as limestone and soapstone being easily eroded according to the Routoistenmaki (2006). On the other hand, Longfield and Macklin (1999) argue that the inorganic materials suffer erosion and contamination when salt content, water together with the materials undergo chemical reaction due to different varying conditions they are exposed.

**Plate 4.1: Fort Jesus (Mombasa) a UNESCO world heritage**

**Jumba la Mtwana**

Jumba la Mtwana being located on the ocean shores has lost a large part of the Ruins to sea level rise and coastal erosion.

**Plate 4.2: Jumba la Mtwana Ruins (Kilifi)**

**Vasco da Gama Pillar**

Malindi museum curator noted that; "*Over the last 50 years, the basement on which the Pillar stands on has been eroded by the action of sea water. Reinforcement was then done but the Pillar now exhibits signs of collapse with cracks being visible on*

*the Pillar"*. The erosion of the Vasco da Gama is evident clearly on the below photo taken at the site.

**Plate 4.3: Vasco da Gama Pillar (Malindi)**

### 4.4.2 Temperature rise

The earth's temperatures are getting warmer annually. According to scientists at NASA, Goddard Institute for space studies (GISS) average global temperatures on earth has increased by about 0.8 degrees since the 1880s. UNDP estimates Kenya's average annual temperature to rise between 1 degree (lowest estimate) and 5 degrees (highest estimate) during the next century. Two-thirds of the warming has occurred since 1975 (NASA, 2010). A small change in global temperature is enough to cause a lot of impact on land and oceans. Warming of the land causes glaciers and ice masses to melt while at the same time rise in ocean temperature cause thermal expansion leading to sea-level rise. Global warming resulted in the overall change in climate witnessed since the beginning of the 21$^{st}$ century. Incoming solar radiation heats the immovable cultural heritage directly or indirectly. Daily temperatures in the coast region range between 20 ºC and 28 ºC. The coast region is hot and humid throughout the year but the heat is tempered by the monsoon winds.

The earth heating process has an impact on the construction materials used in building immovable cultural heritages making them expand and contract simultaneously. Over the years the impact may cause peeling off, cracks and splitting of the walls. Suitable temperatures provide a conducive environment for the growth of plants and infestation of insects on the immovable cultural heritage. Insects like termites survive in cold areas below 25 ºC in unattended structures but the majority of the insect life cycle survive in temperatures ranging from 18 ºC to 40 ºC. Experts interviewed noted that; "*Temperatures within the coast region are suitable for insects to breed in the immovable cultural structures. Plants also survive within these conditions, plants such as algae, mosses, lichens and fungi are visible on the structures. These plants increase the water retention capacity causing more dampness that deteriorates the old buildings"*.

On the other hand, fungi require at least 70 % relative humidity and suitable temperatures either cold or warm to thrive on building structures. Presence of algae, moss, lichens and moulds were evident in the old structures. Temperatures are projected to continue rising globally.

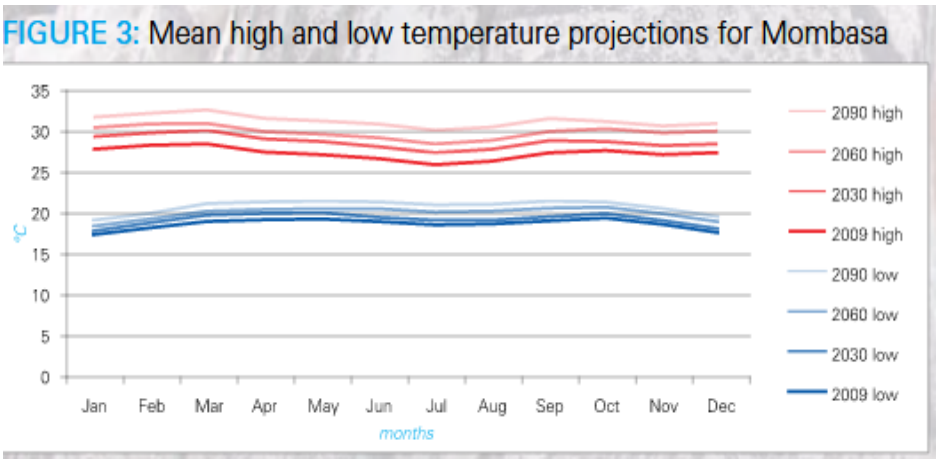


**Figure 4.6: Temperature Projection for Mombasa**

**Source: UNICEF (2010)**

According to scientists, the earth temperatures are increasing, this is not much different from the findings in the coastal region where respondents were asked if they think the earth temperature has increased, majority 40.6 % of the respondents noted that temperature rise is very likely to occur supported by 28.1 % who noted its likely to occur. On the other hand, 3.1 % said temperature rise is unlikely to occur, another 3.1 % very unlikely while 25 % were undecided.

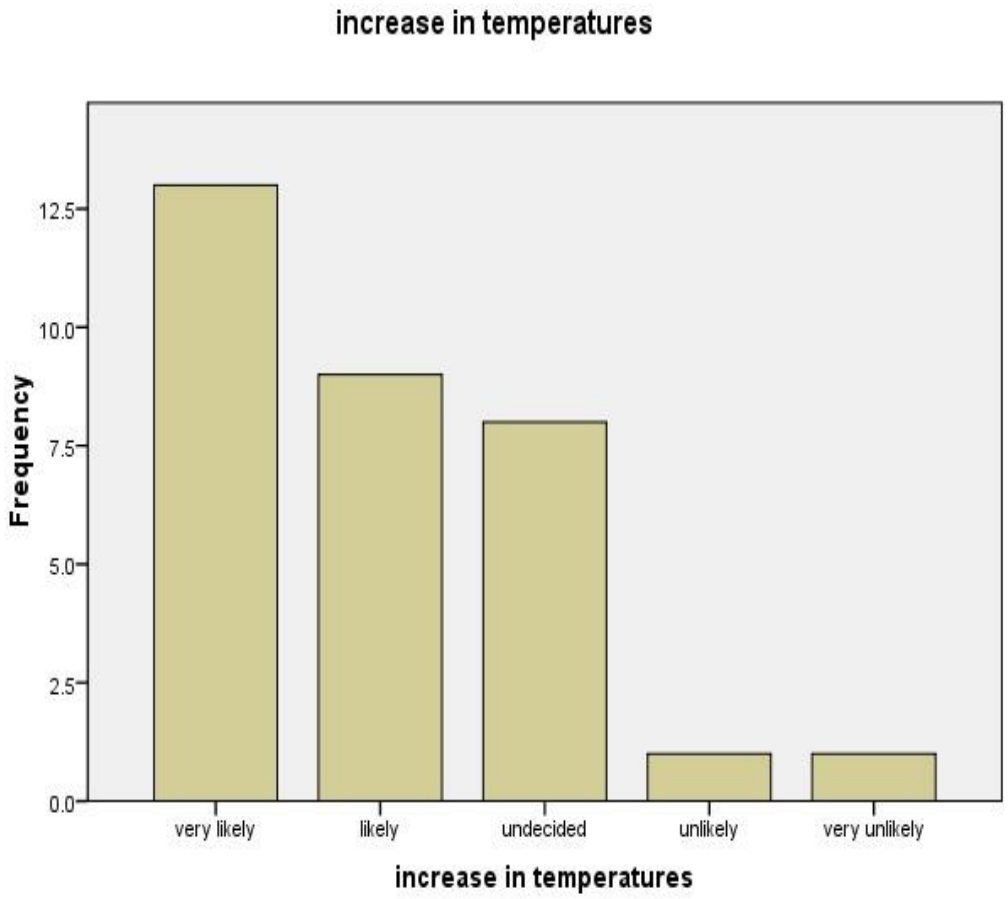


**Figure 4.7: The likelihood of temperature increase**

**Mombasa Old Town**

From the findings, Mombasa old Town is the most affected immovable cultural heritage by temperature rise. A high number of respondents noted temperature rise

is very likely to occur translating the impact directly to be major and moderate on the old buildings.

The conservationist from Mombasa old Town said that; "O*ld structures within the Town exhibited a lot of cracks on the walls, window frames and roofs that are formed due to expansion and contraction as a result of temperature change"*.

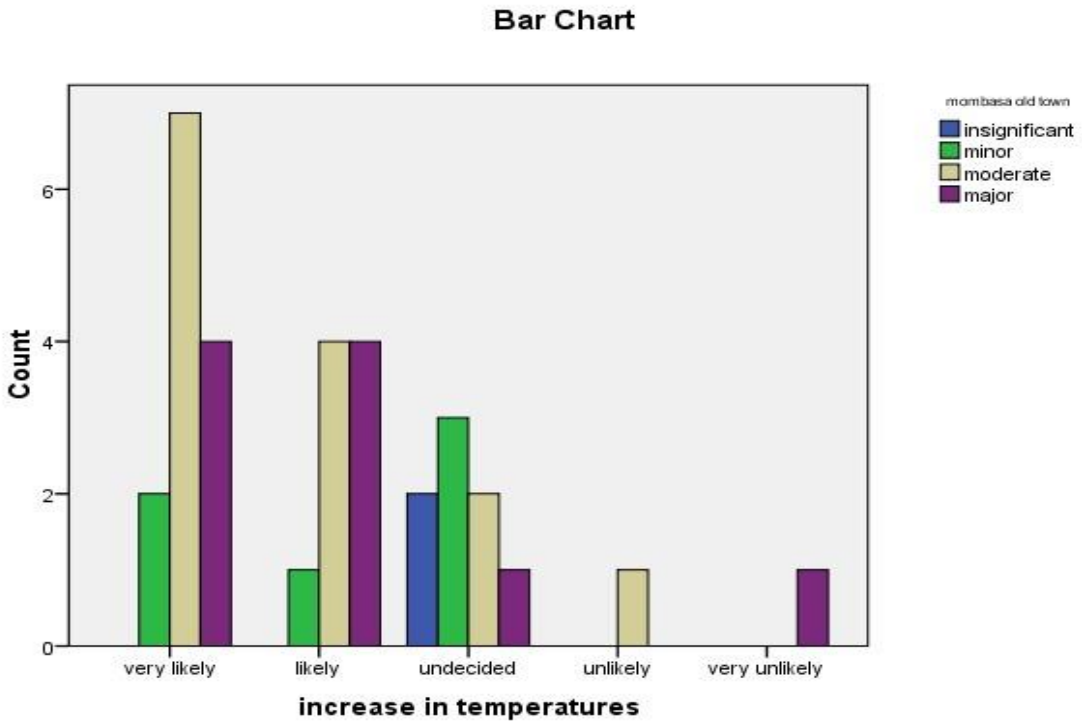


**Figure 4.8: Impact of temperature on heritages**

### 4.4.3 Coastal Flooding

As the earth warms due to global warming, the land ice and glaciers melt and flow into the ocean thus increases the volume of water. At the same time, ocean water undergoes thermal expansion due to an increase in temperature causing sea level rise. Increase in water level causes coastal flooding during high tides and stormy seasons. Frequent coastal flooding causes damage to the infrastructure. The experts interviewed noted that; "*Coastal region of Kenya is prone to flooding due to its low*

*altitude with a poor drainage system. When it floods due to heavy rains the water accumulates in the structures making them damp due to caPillarity action"*. Structural damage may include deposition of debris, damage of paints, partial or total damage of building contents (Dassanayake & Oumeraci, 2011). The dampness of construction materials increases the rate of deterioration through the growth of plants, infestation of insects and splitting of some parts due to rotting. Floods may cause physical, chemical or structural damage on the heritage (Dassanayake & Oumeraci, 2011). Stagnant water results to soiling of lower floors and basement, increase in moisture and water levels in the buildings (Taboroff, 2000).

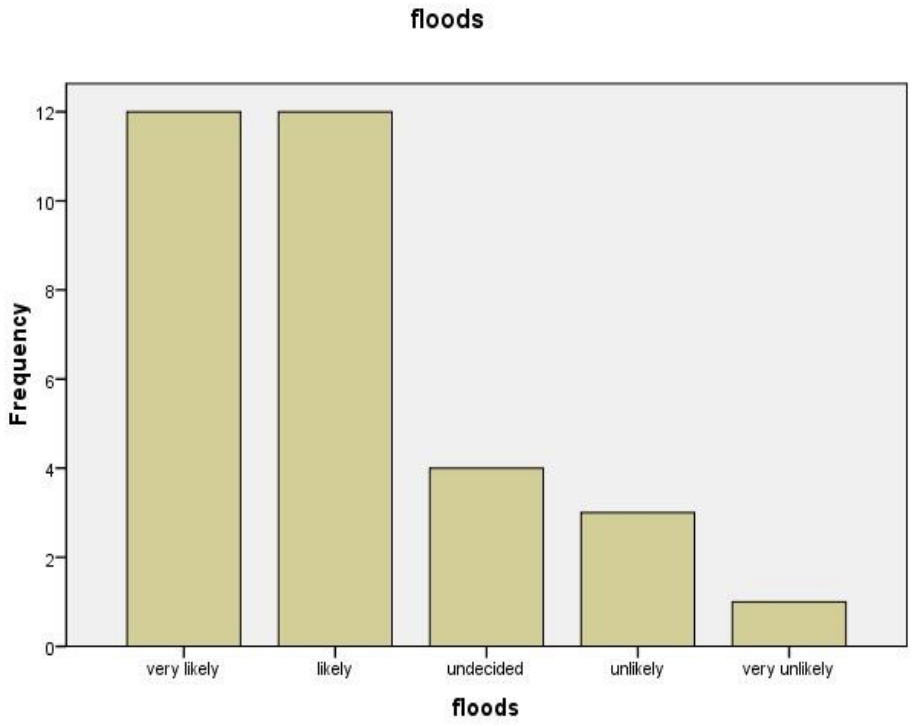


**Figure 4.9: Likelihood of floods occurring**

When asked the likelihood of coastal flooding occurrence, 37.5 % of the respondents noted that floods are very likely to occur, 37.5 % likely, 12.5 % were undecided, 9.4 % unlikely and 3.1 % very unlikely. This is a clear indication that the coastal region of Kenya is prone to flooding.

**Vasco da Gama Pillar**

Coastal flooding is normally due to heavy precipitation, sea level rise and high tides. During high tides, the water flows with high speed towards the land. Coastal flooding causes major and catastrophic damage on Vasco da Gama when it occurs frequently.

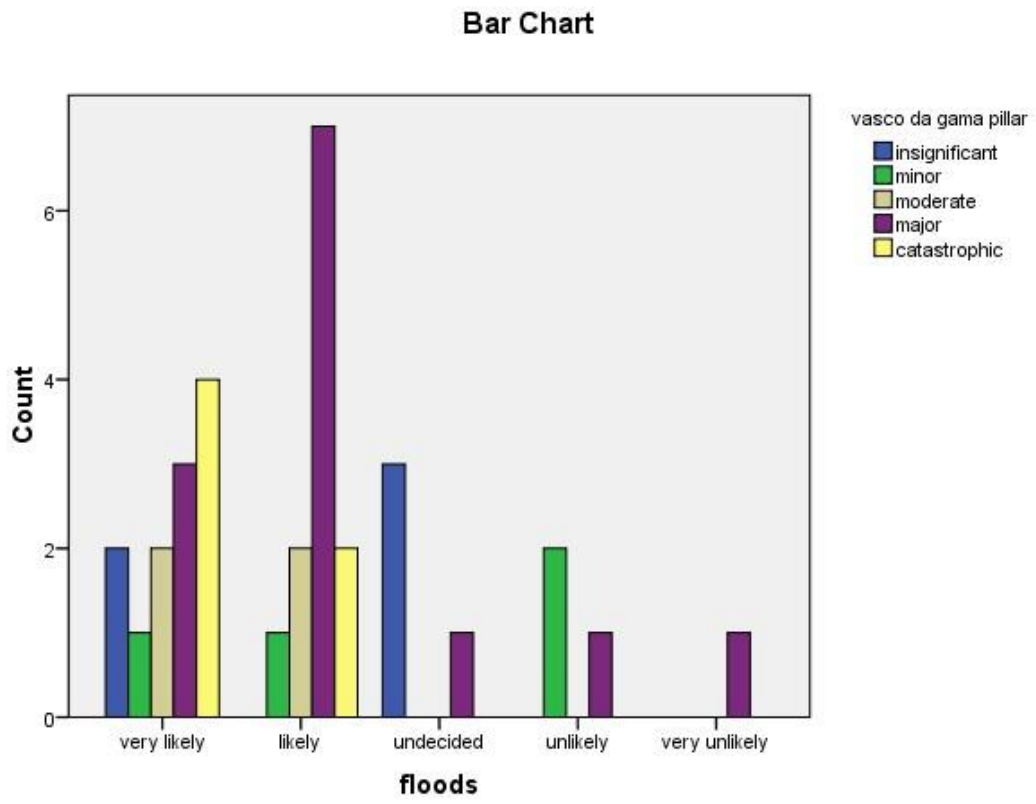


**Figure 4.10: Impacts of floods on heritage**

### 4.4.4 Coastal Erosion

Coastal erosion is the process of wearing off of material from a constant force. Coastal erosion is a long-term process caused by strong winds, high tides, storm surges and high waves. Constant friction between water and built infrastructure leads to erosion of walls due to chemical reaction. A rise in sea level cause tidal inundation and initiate coastal erosion. Coastal erosion is predicted to occur at a

rate of 2.5-2.0 cm per year along the Kenyan coastline (Mwakumanya & Bdo, 2007).

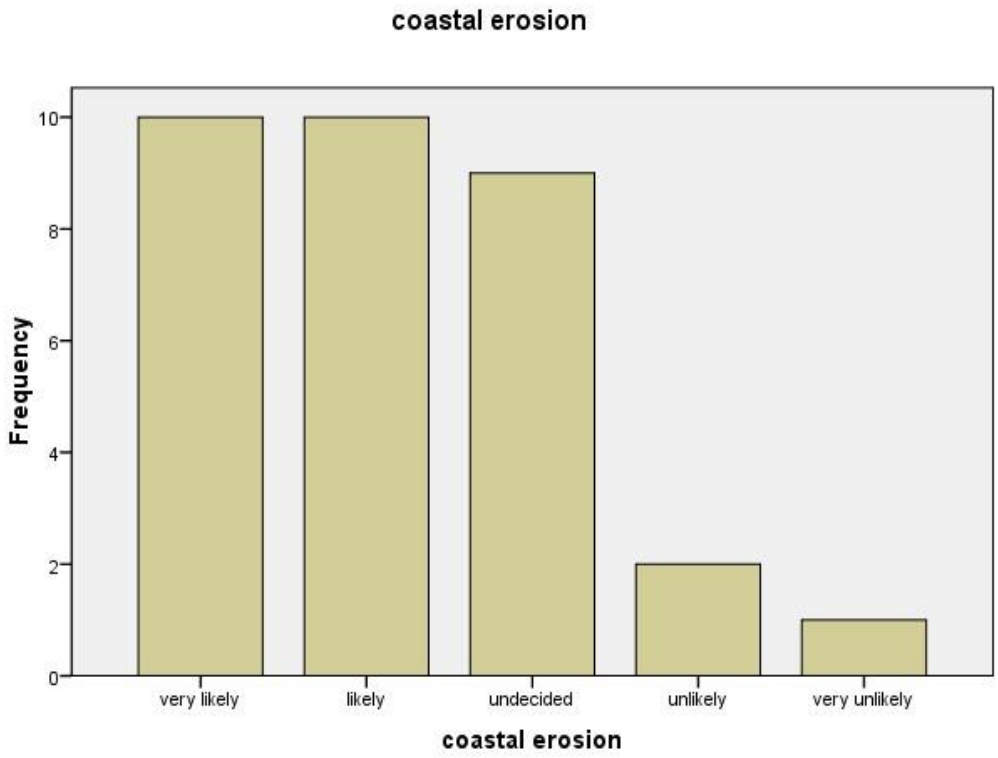


**Figure 4.11: The likelihood of coastal erosion occurring**

Coastal erosion is frequent along the coastline due to continuous flow and receding of water along the shoreline. When asked the likelihood of coastal erosion occurring, 31.2 % cited coastal erosion as very likely to occur in addition to 31.2 % who said it's likely to occur, while 3.1 % noted it as very unlikely to occur, 6.2 % unlikely and 28.1 % were undecided.

**Fort Jesus**

Figure 4.12 indicates the impact of coastal erosion on Fort Jesus. Fort Jesus is the most affected heritage with coastal erosion due to its nearness to the ocean. The impact of coastal erosion on the site is major. Part of the basement of the Fort has been lost due to coastal erosion.

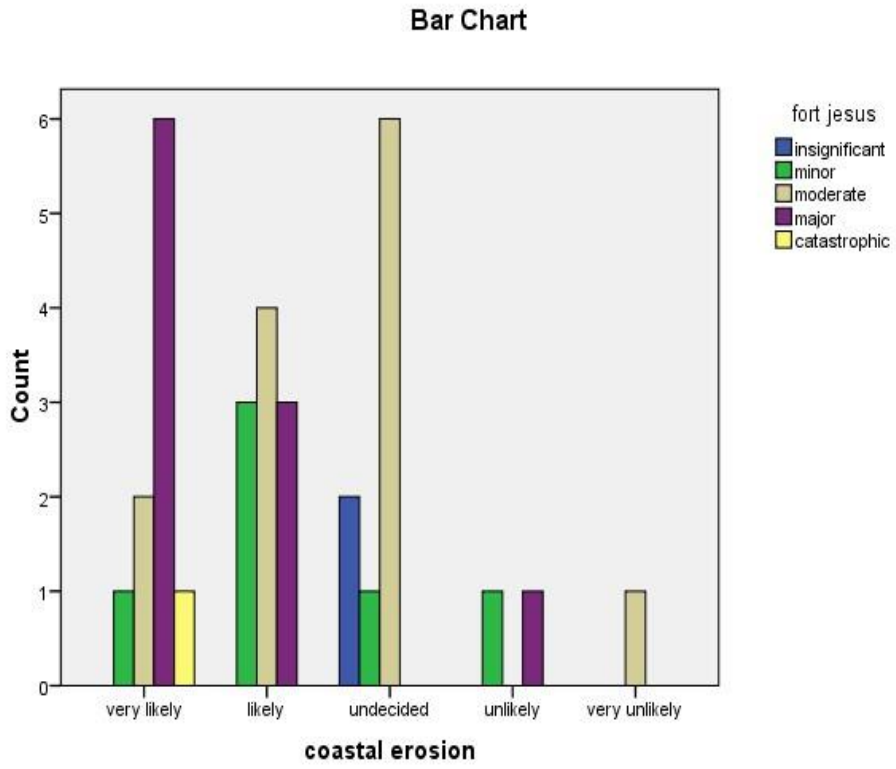


**Figure 4.12: Impact of coastal erosion on heritages**

### 4.4.5 Frequent Strong Winds

Wind refers to air in motion. The difference in atmospheric pressure and the difference in solar heating brings about the wind. Strong wind destroys the build structures through the breaking of rooftops and trees that later fall on the immovable cultural heritage. Wind also acts as an agent that transports salt components from the ocean to the structures on the land. Salt has adverse impacts on the structures; it causes wearing and tearing off of the structures when rapid evaporation and crystallization takes place on the walls. Strong coastal winds associated with storms often cause serious problems to structures especially those with existing cracks or openings on the walls. Wind combines with dust and sand particles causes abrasion on the walls of the immovable cultural heritage. Wind associated with rain causes major destruction on the structures which may result in collapse.

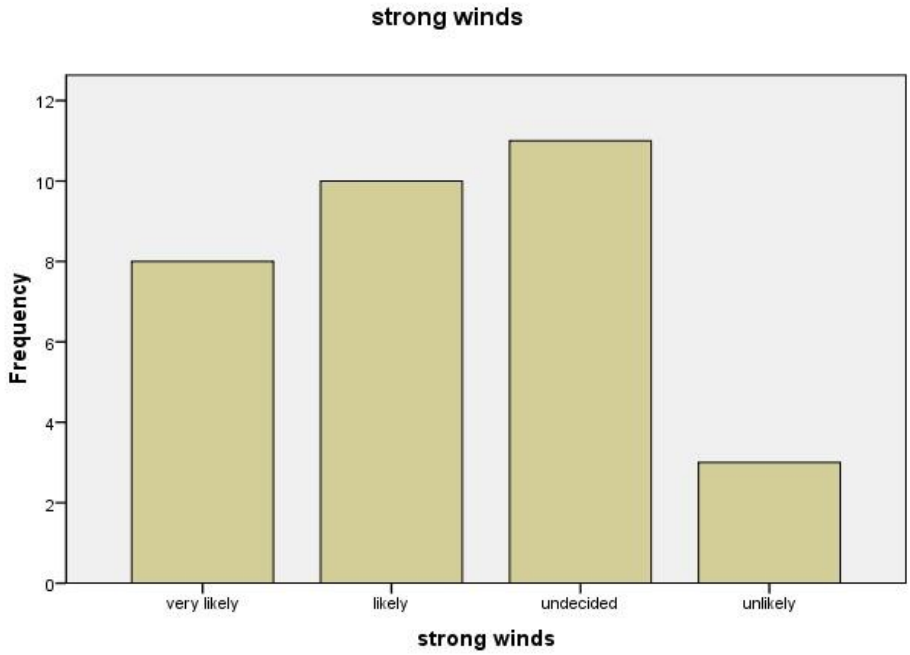


**Figure 4.13: The likelihood of strong winds occurring**

When asked what the likelihood of strong winds occurring is, from the findings it is observed that 25 % noted it is very likely to occur and 31.2 % noted it as likely to occur. This is clear evidence that strong winds are frequent in the coast region compared to 9.4 % who responded as unlikely to occur and 34.4 % who were undecided.

**Watamu Monument**

Figure 4.14 indicates the impacts of strong winds on Watamu Monument. The site is located on the ocean shores surrounded by overgrown trees that have destroyed the top part of the Ruins during strong winds season. The impact on the Ruin is moderate with few catastrophic impacts during stormy winds season.

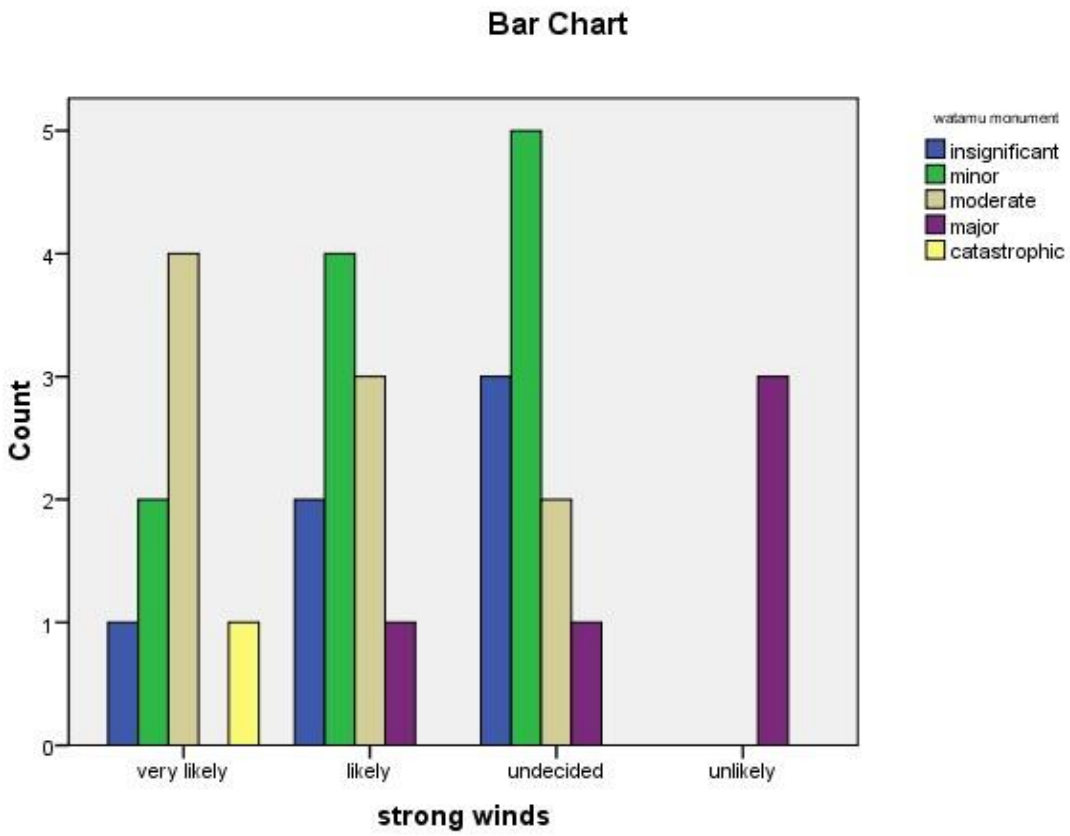


**Figure 4.14: Impacts of strong winds on heritages**

Watamu Monument is located along the shoreline, the remains of an old mosque have been greatly destroyed by strong coastal winds. Most of the upper parts of the Ruin are missing. Trees have grown in the area hence when strong winds blow, trees tend to be swayed hence hitting against the walls causing cracks which later leads to falling off of some parts.

**Plate 4.4: Watamu Monument**

### 4.4.6 Heavy Precipitation

Heavy precipitation refers to a situation where rainfall received in an area exceeds the normal amount. Parts of equatorial East Africa is projected to experience 5-20 % increased rainfall from December- February and 5-10 % decreased rainfall from June- august by 2050 (Hulme, Doherty, Ngara, New & Lister, 2001). Change in climate affects the intensity and frequency of precipitation of a locality. Increase in temperatures leads to a high rate of evaporation from the land and water bodies thus the atmosphere holds a large quantity of moisture that falls back to the earth in the form of rains. The potential impact of heavy precipitation includes flooding, erosion and other water-related damages. Direct rainfall especially acidic rain speeds up rate of deterioration on the immovable cultural heritage depending on the permeability of construction materials. Structures build with limestone reacts faster with acidic components in the rainwater to form an aqueous solution, therefore, loss of structures parts. Direct rainfall on structures like Ruins causes dampness on the construction materials resulting in peeling off of the walls. Changes in humidity cycle affect the growth of micro-organism on the walls. Peeling off of paints and plastered walls is also due to reaction between rainfall that's in contact with

atmospheric oxides such as nitrogen oxides and sulphur dioxides forming weak acidic falling on the immovable cultural heritage.

The interviewed experts said that; "*Majority of these immovable cultural heritages were built with limestone which is very porous and has been exposed to direct rainfall for ages. The limestone allows easy penetration of water which increases the dampness of the building materials causing splitting and peeling off of plasters on the walls. Acid deposit on the old buildings due to acid rains causes corrosion of the limestone and carbonate stones in the structures.*

*Acid rain also causes corrosion of metals. Corrosion occurs when water and oxygen come in contact with a metallic material. metallic Pillars are used in reinforcing the buildings, so when water penetrates the metallic Pillars it causes them to be weak and may cause them to bend slightly or break. Roofed structures with iron sheets have eroded due to deposits of acids and salt particles on the iron sheets which speeds the rate of rusting".*

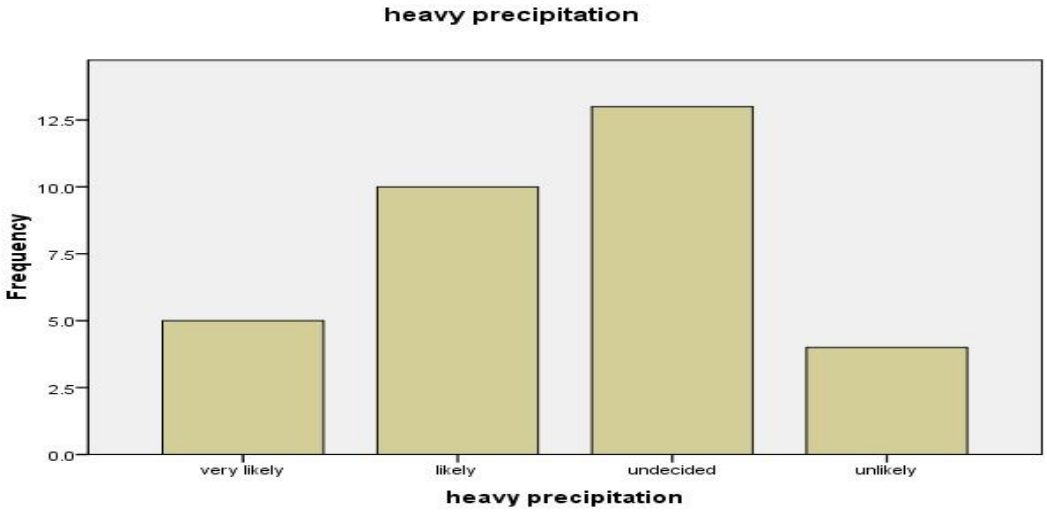


**Figure 4.15: The likelihood of heavy precipitation occurring**

When asked what is the likelihood of heavy precipitation occurring in the coast region. Heavy precipitation is likely to occur in the coastal region as suggested by

31.2 % of the respondents in addition to 15.6 % who suggested that it's very likely to occur whereas 12.5 % suggested to unlikely occur and 40.6 % were undecided

**Mombasa old Town**

Figure 4.16 indicates that heavy precipitation is very likely to occur with the resulting impacts being moderate and major for the old Town. This is evident with the presence of rotten wooden parts in the old buildings, corroded iron sheets and eroded wall paints.

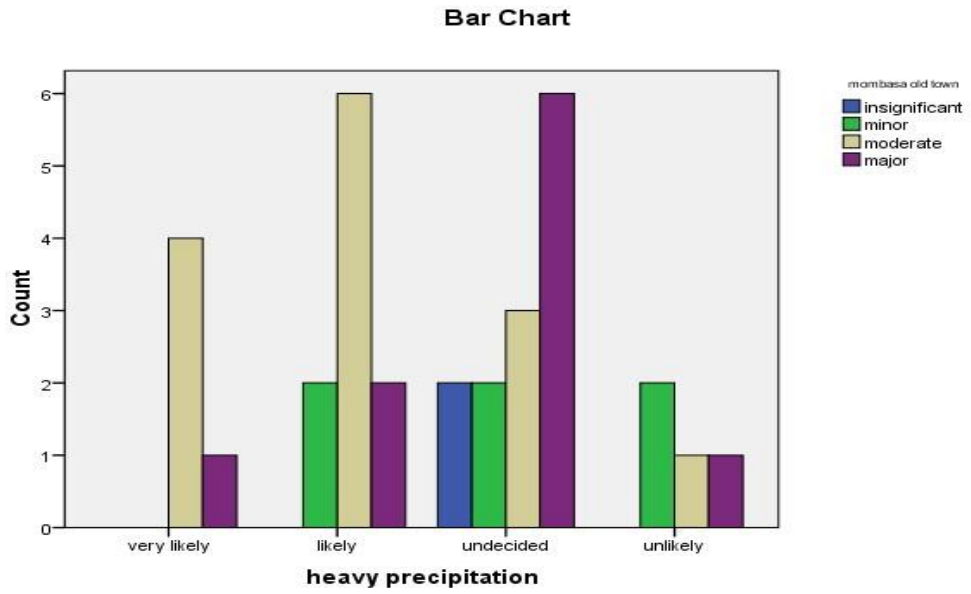


**Figure 4.16: Impacts of heavy precipitation on heritages**

**Mnarani Ruins**

Figure 4.17 indicates the impacts of heavy precipitation in Mnarani Ruins. Impact of heavy precipitation when it is very likely to occur in the area it is catastrophic, major and moderate. The site exhibited the presence of eroded basement due to flooding in the site when there is a heavy downpour. Site curator said that; "*The floor of the Ruins is completely washed and there is the presence of plant growth on the lower part due to the high level of dampness"*.

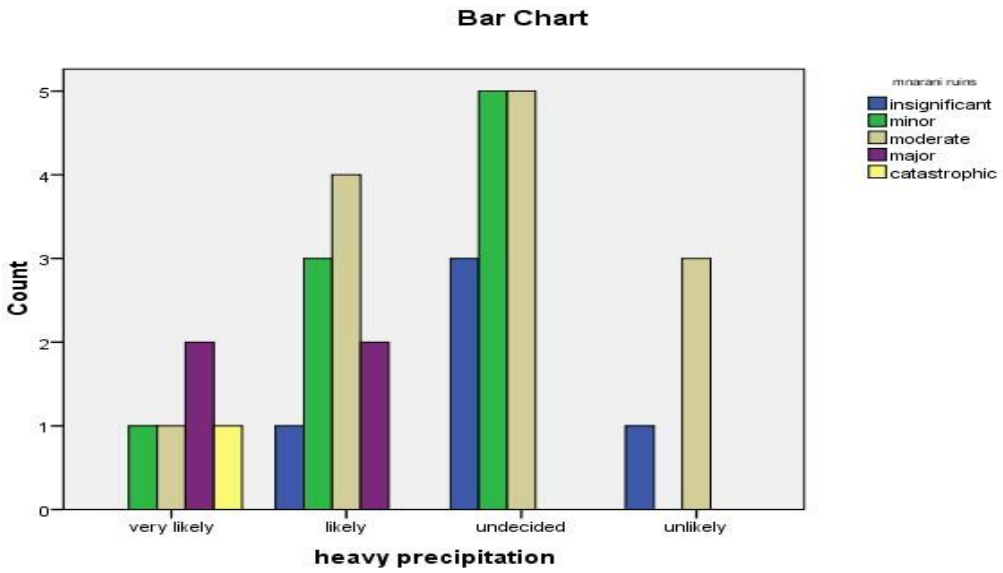


**Figure 4.17: Impact of heavy precipitation on heritages**

**Portuguese Chapel**

Heavy rains penetrated the grass thatched roof of the chapel resulting in rotting of the reeds and passage of water into the interior parts of the building. The lime paint on the walls had also been washed by water.

**Plate 4.5: Portuguese Chapel**

Despite this, precipitation for Mombasa is expected as projected below. Rainfall variability is very high and seasons have shifted.

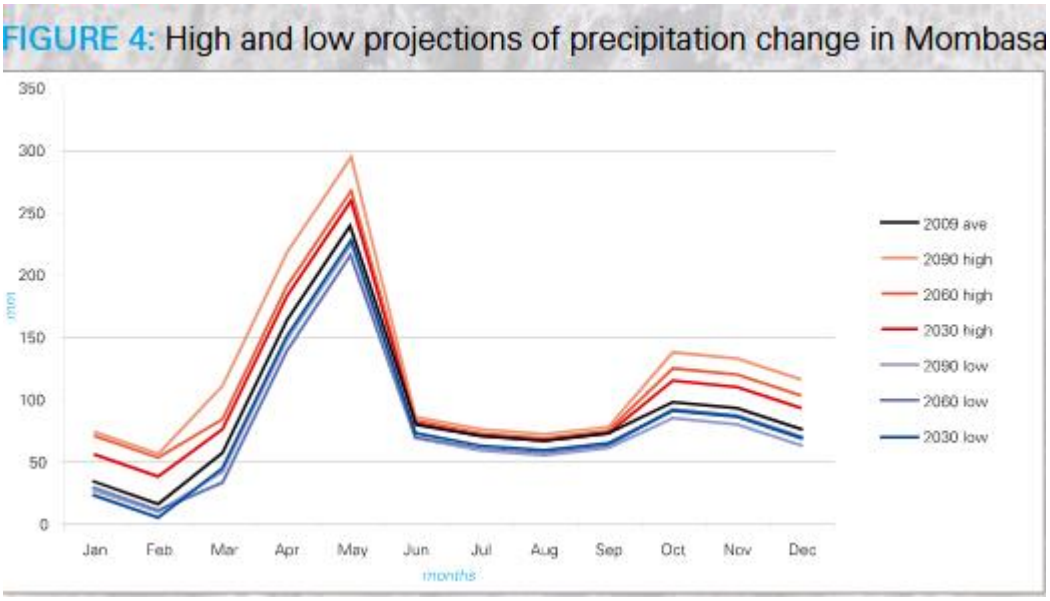


**Figure 4.18: Precipitation projection for Mombasa**

**Source: UNICEF (2010)**

### 4.4.7 Increase in Acidity Levels

Human activities such as the burning of fossil fuels emit harmful gases such as $CO_2$ into the atmosphere that causes climate change and global warming. Around a third of $CO_2$ released into the atmosphere is absorbed by the oceans. When carbon dioxide combines with water in the oceans it forms carbonic acids that make the oceans more acidic. Acidic nature of water causes corrosion and chemical reaction on the infrastructure when absorbed through capillarity. Many building materials are affected by acids, these materials include; limestone, aluminium, copper, zinc, sandstone and paper. The acid dissolves calcium carbonate in the stone forming a solution that evaporates forming crystals on the stone. Crystals grow with time causing the stones to break apart thus the building collapses. Acidic rain increases the corrosion rate on metallic materials by forming a layer of moisture and adding hydrogen and sulphate ions.

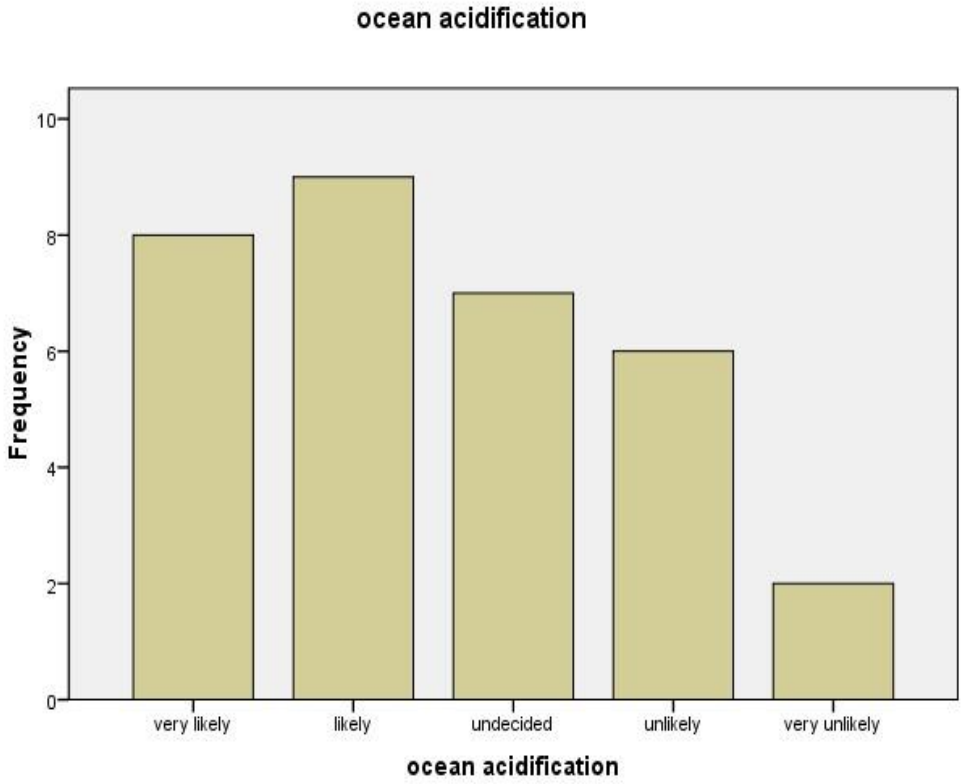


**Figure 4.19: The likelihood of an increase in acid levels in water**

When asked the likelihood of ocean acidification occurring, majority 28.1 % cited it as likely to happen which is more than 25 % who cited it as very likely to happen. On the other hand, 18.8 % indicated ocean acidification as unlikely to happen, 6.2 % very unlikely and 21.9 % were undecided.

**Fort Jesus**

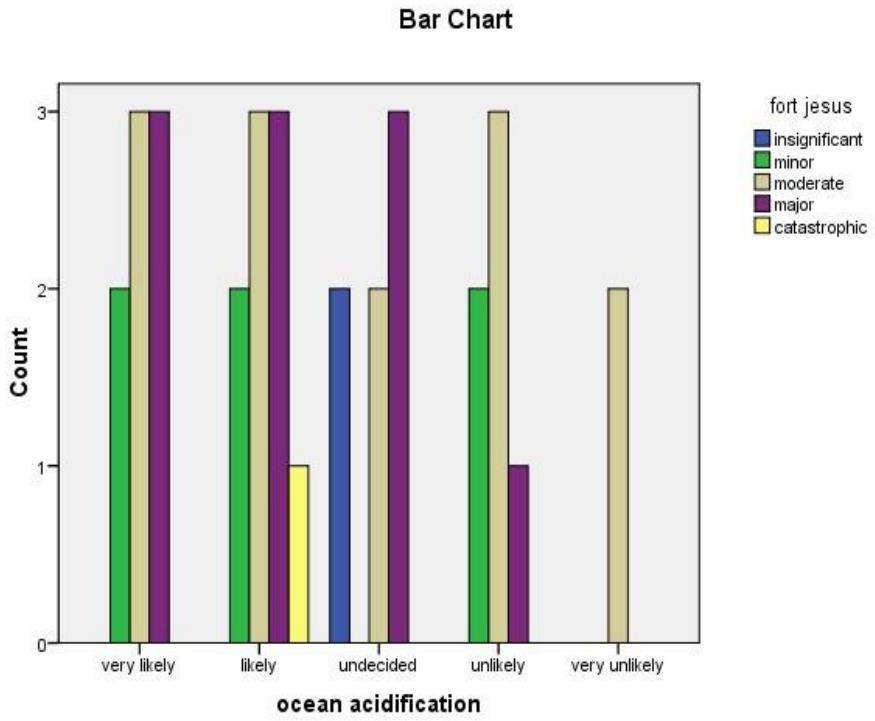


**Figure 4.20: Impact of ocean acidification on heritages**

Figure 4.20 indicates that Fort Jesus is very likely to get a major and moderate level of damage from the increase in acidity levels. The Fort is located on the shore and its basement is in contact with ocean water. When the level of acids in the water increases the rate of reaction with the limestone will be high therefore the loss of parts of the site.

**Vasco da Gama Pillar**

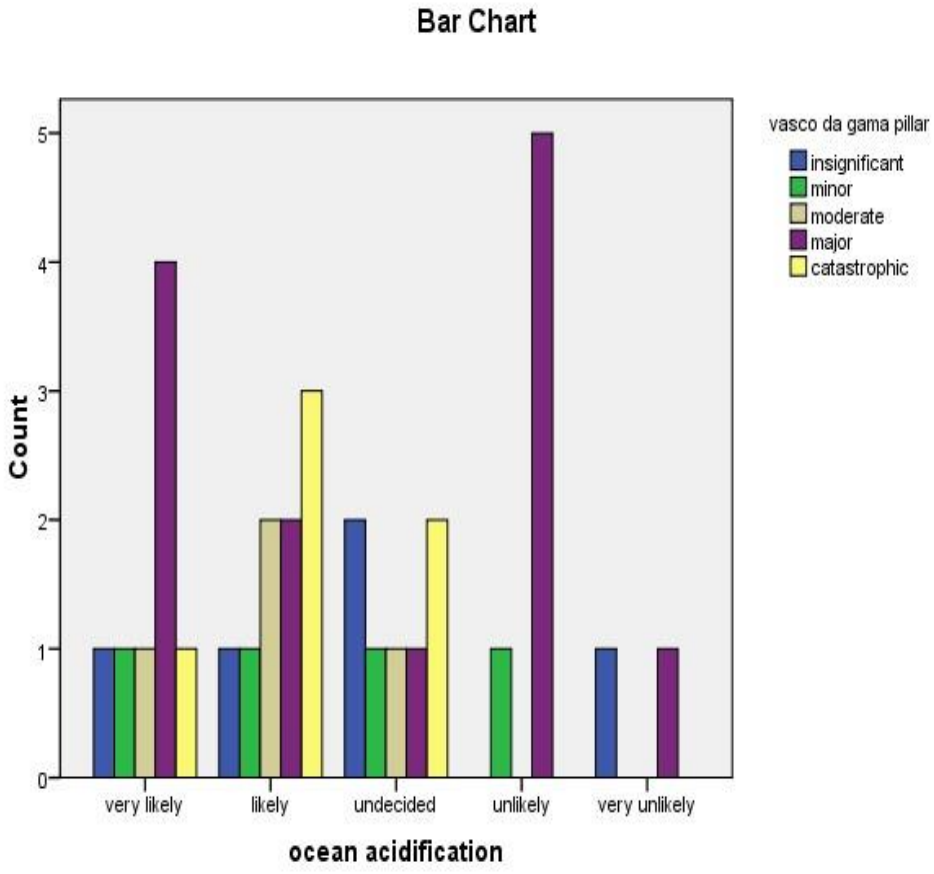


**Figure 4.21: Impact of ocean acidification on the heritage**

Figure 4.21 indicates that the level of damage on the Pillar when the increase in acidity levels is very likely to occur is catastrophic, major and moderate. The basement of the Pillar has already been lost due to chemical reaction of the building materials and the acidity in the water.

**Jumba la Mtwana**

Figure 4.22 indicates that when the acidity level is very likely to occur, the level of damage it causes on Jumba la Mtwana is moderate. This explains why the part of Ruins at the shoreline has been completely eroded and lost. The remaining part is the section away from the ocean.

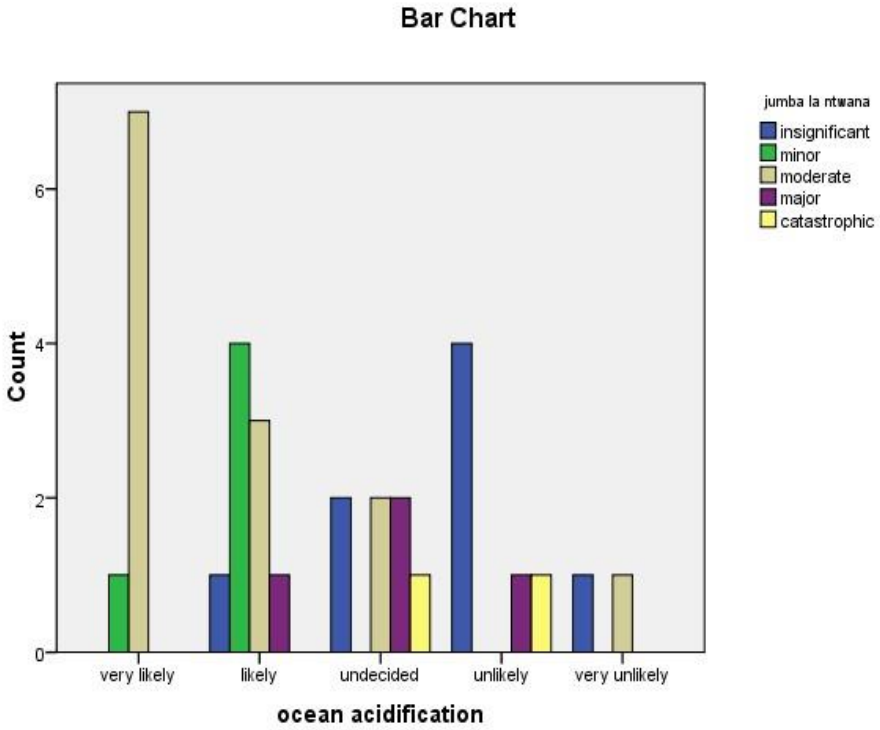


**Figure 4.22: Impact of ocean acidification on heritage**

### 4.4.8 Other Hazards

When asked to list other hazards apart from climate change being a major threat to the immovable cultural heritage. Other hazards include all other factors that are not climate change related but contribute to deterioration of cultural heritage sites such as human activities and old age. Respondents noted that the sites are also deteriorating due to several other factors that contribute to their loss if not protected. Cultural heritage has been destroyed by many factors using intentionally, conflicts, natural disasters, negligence or being forgotten (Gamboni, 2005).

The experts interviewed said that apart from climate change; "*All the immovable cultural heritage sites are also being lost due to old age since the sites were set up in the between the 12$^{th}$ and 16$^{th}$ century. Human encroachment is also another factor, locals are destroying the structures and clearing the land to use for farming activities"*. Human activities in response to climate change destruction such as an

attempt to move and fill land where erosion and rise in sea level have resulted to loss of heritage (Howard, Challis, Holden, Kincey & Passmore, 2008). *Development of new structures is another factor since people are adopting the new building designs hence destroying the old structures. Vandalism is another factor that has seen most of the old structures in the coast region forgotten and unprotected. Mnarani Ruins being a mixed heritage also experience other factors like cutting down of trees, destruction of Ruins by locals and land grabbing. Portuguese chapel and Jumba la Mtwana are also affected by plant roots that spread underground causing cracks on the Ruins".*

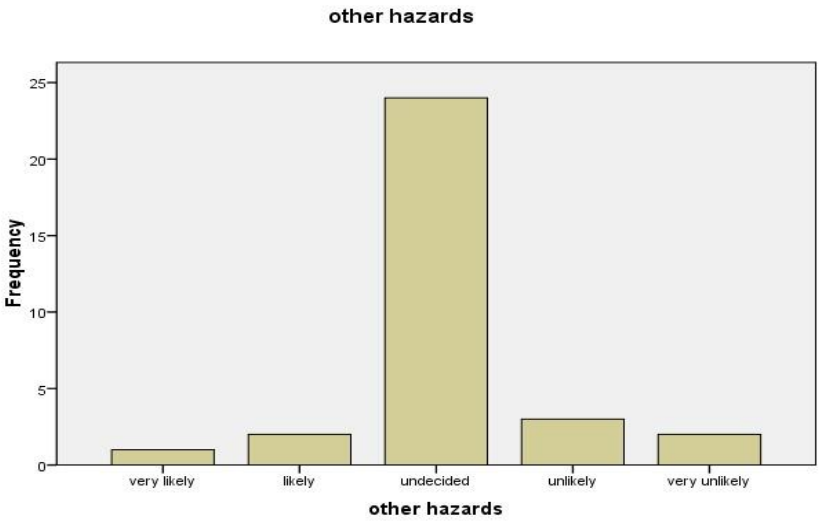


**Figure 4.23: Likelihood of other hazards occurring**

When asked the likelihood of occurrence of other hazards, a majority (75 %) of the respondents were undecided, (10 %) said it's unlikely to occur, (6 %) very unlikely, (6 %) likely to occur and (3 %) very likely. Therefore, the chances of other hazards such as human activities and old age contributing to the deterioration of the immovable cultural heritage are very low.

**Comparison of the Mean Impact of Climate Change Elements on Cultural Heritages**

The Figure 4.24 indicates the mean impact of climate change elements on the immovable cultural heritage. Referring to the Likert scale where 1=insignificant, 2=minor, 3=moderate, 4=major and 5=catastrophic. The level of impact of other hazards on the immovable cultural heritage is below 1 which means that there is no damage on the structures as a result of other factors that are not climate-related. Increase in precipitation causes a minor impact on the cultural heritage with its mean impact at 2. Temperature rise, coastal flooding, coastal erosion, sea level rise, frequent strong winds and increase in acidity levels have a mean impact of more than 3 which means it causes a moderate impact on the structures. In circumstances where the occurrence of hazards is frequent the impact is very likely to increase hence become major and catastrophic.

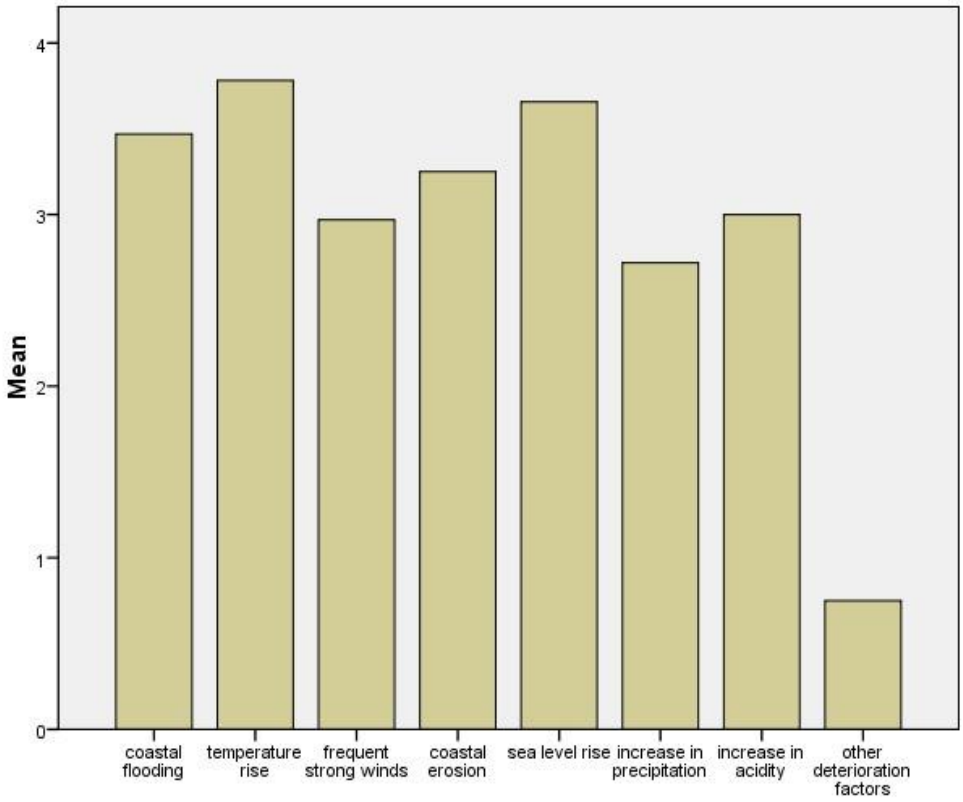


**Figure 4.24: Mean impact of climate change elements on the heritage**

**Comparison of the impact of the mean likelihood of environmental hazards occurring**

Figure 4.25 indicates the impact of the mean likelihood of a hazard occurring. Referring to the Likert scale 1=very likely, 2=likely, 3=neutral, 4=unlikely and 5=very unlikely. Coastal floods, heavy precipitation, increase in temperature, coastal erosion, strong winds and ocean acidification fall within a mean of 2 which means they are likely to occur while other hazards have a mean of 3 which means neutral.

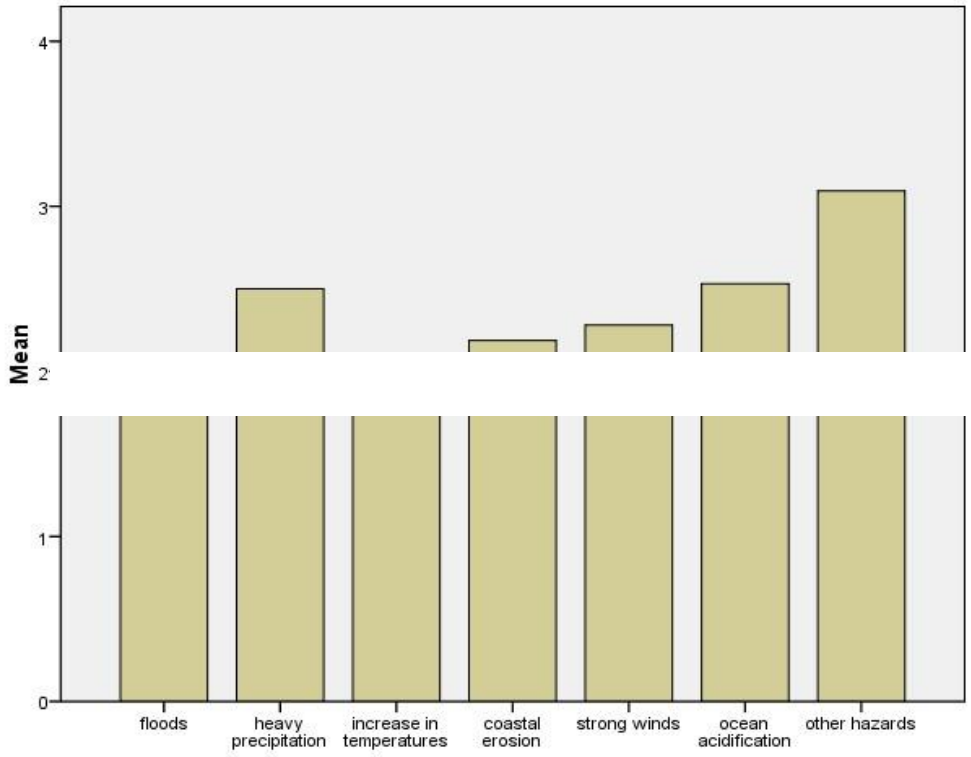


**Figure 4.25: Impact of the mean likelihood of a hazard occurring**

### 4.5 Assessment of the Vulnerability of Immovable Cultural Heritages

The study sought to assess the vulnerability of immovable cultural heritage to climate change. Extreme events have been projected to occur and may affect many areas therefore vulnerability assessment framework for cultural heritage should be made available based on their geographical locations (Jigyasu et al., 2010). Concept of vulnerability assessment was first raised by Asley-Smith (1999) in his framework based on assessing the probability of occurrence of a hazard, percentage of the collection or the expected loss of collection. However, the methodology did not gain acceptance since it became difficult to obtain data on the required fundamentals. The most commonly used and recognized methodologies were developed by Waller (2013), Michalski (2007) and Romaoa et al. (2016). The framework is oversimplified and assesses vulnerability based on the likelihood of occurrence of the hazard, level of damage of the hazard on the heritage. The framework doesn't involve assessment of construction materials used which is often difficult to obtain because it involves working with engineers. Later on, a vulnerability assessment framework for different seismic hazard under a multidisciplinary approach was developed by Pauperio et al. (2013) for a specific church in Pico Island, Azores.

Based on their argument the framework required multidisciplinary approach since its assessment involves a combination of the following data: data about the buildings, data about the collection and data about the building surroundings and access routes (Pauperio et al., 2013). Combined efforts of engineering, conservation and urbanism expertise were required during the development of the framework.

Since the study is among one of the first in the region, the study adopted the oversimplified framework because of the following factors:

a. The project was an individual work not a multidisciplinary
b. Inadequate data about the buildings
c. Inadequate data about the heritages within the region on risk assessment methods
d. The methodology allowed assessment of the vulnerability of a large number of immovable cultural heritages within a short period.
e. Vulnerability assessments of the immovable cultural heritages in Mombasa and Kilifi counties were based on the following:
    a. Level of damage on the site
    b. Possibility of restoration of damaged parts
    c. Likelihood of occurrence of the hazard

The level of damage on the sites was categorized into insignificant, minor, moderate, major and catastrophic. It is observed that all deterioration factors were directly or indirectly related to climatic conditions. Indirect climatic conditions provide a conducive environment for plants and insects to thrive and survive on the immovable cultural heritage. Parasitic plants were found to grow on the immovable cultural heritages for nutrients and support. Further climate change will increase the vulnerability of the sites to other stressors such as development which will create more preservation challenges (UNEP et al., 2016).

### 4.5.1 Level of damage on the immovable cultural heritage

**Ruins**

The Ruins of Mnarani, Gede and Jumba la Mtwana are some of the historic sites built by early visitors who were Portuguese, British, Arabs, explorers and missionaries along the Kenyan coast. Ruins include mosques and residential homes. The Ruins were built from coral stones that were obtained from dead coral reefs and mixed with lime mortar. Most of these Ruins are not roofed hence very fragile to climate change that speeds up the rate of weathering. It was observed that all the Ruins had cracks on the walls, fallen parts, plaster on the walls have peeled off and presence of plants on the walls.

**Historical Buildings**

The Mombasa old Town consists of residential houses, administrative offices and government buildings made with the unique architectural design of both Islamic and foreign influence. Most of the buildings are in bad condition due to climatic conditions. Roofs of the buildings are highly corroded due to salt and high humidity. The corroded iron sheet allows penetration of rainwater into the structure increasing the level of dampness that affects the building materials. Fungi growth is also visible on the doors, windows, rafters and other wooden parts. Some of the walls have disintegrated, cracks are also visible and plaster has peeled off in some buildings. Furthermore, there is the presence of termites and other insects' infestation on the walls, windows and doors evidenced by the presence of the off brown mud-like materials on the buildings. There is also the presence of faded lime especially in the Portuguese chapel due to direct sunlight and rainfall.

**Pillars**

Research was also carried out on the Vasco da Gama Pillar. It was observed that the Pillar is in bad condition. Initially built on a cliff the basement of the Pillar is being eroded by coastal erosion and sea-level rise. Plants have grown on the

basement and there are visible cracks on the Pillar. Lime used on the Pillar has also faded due to direct sunlight and heavy rainfall.

When asked on the level of damage on the immovable cultural heritages, respondents' opinions were summarized in Table 4.2.

**Table 4.2: Summary of the level of damage by the impacts of climate change per the cultural heritage site**

| **Immovable cultural site** | **amage** | **Percentage (%)** |
|---|---|---|
| Fort Jesus | Moderate | 40.6 % |
| Mombasa old Town | Moderate | 43.8 % |
| Gede Ruins | Minor | 36.2 % |
| Vasco da Gama | Major | 56.2 % |
| Jumba la mtwana | Moderate | 40.6 % |
| Mnarani Ruins | Moderate | 40.6 % |
| Portuguese chapel | Minor | 31.2 % |
| Watamu Monument | Minor | 34.4 % |

Referring to the proposed vulnerability assessment methodology, the level of damages can be classified into three based on structural and non -structural damages (Romaoa et al., 2016). Light damage refers to cases where the damages don't affect the overall stability of the cultural heritage. The damages can be insignificant or minor. Watamu Monument and Gede Ruins exhibited minor damages such as the

growth of plants on the Ruins while the Portuguese chapel exhibited slight damages such as fading of the lime on the walls and infestation of insects on the wooden parts. The two sites did not exhibit any structural damage therefore the function of the cultural heritage can easily be restored through the removal of plants and spraying of insecticides on the wooden parts.

Medium damage refers to cases where the site has many non -structural damages and moderate structural damages. The damages can be moderate or major. Jumba la Mtwana, Mnarani Ruins, Fort Jesus and Mombasa old Town exhibited growth of plants on the walls, infestation of insects on the wooden parts, corrosion of metallic parts and faded paints. Moderate structural damages witnessed were cracks on the walls, corroded basements, rusted roofs, split walls and fallen parts which affected the overall stability of the sites. Level of damage in Fort Jesus has been reduced from major to moderate through the construction of the sea wall which has minimized the rate of deterioration of the world heritage. Vasco da Gama Pillar is the only site that exhibited a major level of the damage attributed by the major structural damage on the Pillar. More than half of the basement supporting the Pillar has been badly eroded by the ocean, grown vegetation on the walls and formation of cracks on the Pillar. Since none of the sites exhibited a heavy level of damage which is catastrophic, hence the function of the cultural heritage sites can still be restored if the management puts the adaptation strategies in place.

Assessment of vulnerability level of the immovable cultural heritage depends on the level of damage and whether the damages can be repaired. The site with major levels of damage that is Vasco da Gama Pillar is very vulnerable to climate change since the site exhibited major damages related to impacts of extreme weather events. Restoring the Pillar requires a lot of resources which makes it difficult to

repair the entire damages while Gedi Ruins, Portuguese chapel and Watamu Monument are less vulnerable to the changing climate. The damages on the sites are minor and can easily be repaired without much resources being needed.

**Mean Level of Damage Per Cultural Heritage Site**

Figure 4.26 indicates the mean level of damage per immovable cultural heritage. Vasco da Gama is the most damaged site followed by Fort Jesus and Mombasa old Town. Watamu Monument is the least damaged cultural heritage.

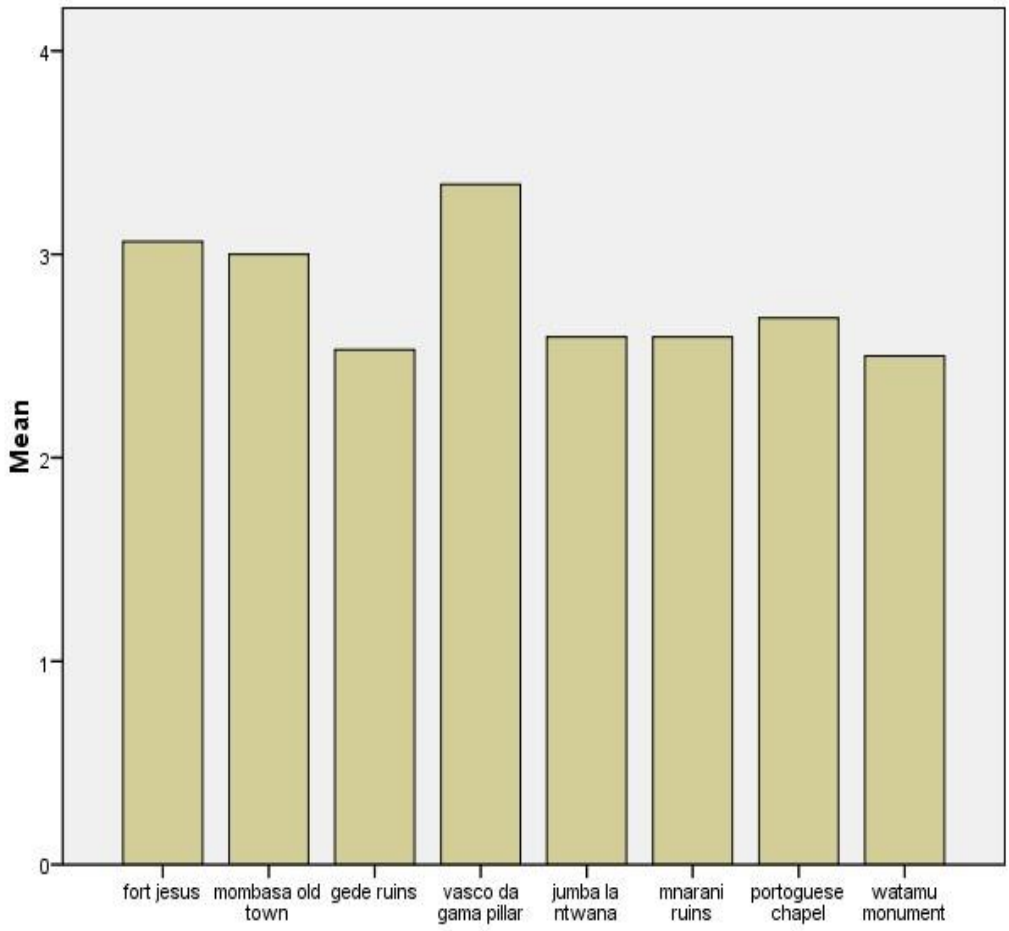


**Figure 4.26: Mean level of damage per cultural heritage**

### 4.5.2 Status of the Immovable Cultural Heritage Sites, Type of Deterioration and Possible Causes

All the immovable cultural heritages exhibited different types of deterioration due to their different localities except for few similar form of degradation that resulted from a common factor such as the growth of plants and formation of cracks on the walls. The possible cause of deterioration for all the heritages were almost similar and the major cause being climate change related conditions. The speed of deterioration and the level of damage in each cultural heritage site depended on the building materials and the management response rate to such damages as they occur. Table 4.3 gives a clear condition of individual cultural heritage site.

**Table 4.3: Impact of climate change on individual site**

| | | |
|---|---|---|
| **Fort Jesus** | ✓ cracks, splitting and peeling off of plastered walls and paints<br>✓ abrasion, peeling off of wall plaster and collapse of some parts<br>✓ growth of plants (algae, lichens and mosses)<br>✓ corrosion of the walls<br>✓ rusting of metallic parts<br>✓ rotting of wooden parts and insect infestation | ✓ expansion and contraction of walls due to high temperatures from direct sunlight, high humidity from direct rainfall and acid rainfall<br>✓ wind and rainfall<br>✓ high humidity, rainfall and warm temperatures<br>✓ sea-level rise and acidity<br>✓ wind with salt content, acidic rainfall<br>✓ heavy rainfall, conducive temperatures and humidity |
| **Mombasa Old Town** | ✓ cracks, splitting and peeling off of plastered walls and paints<br>✓ growth of plants on the walls and roofs<br>✓ corrosion of iron sheets<br>✓ infestation of wooden parts<br>✓ abrasion on plastered walls | ✓ expansion and contraction of walls due to high temperature from direct sunlight, direct rainfall or acid rainfall and high humidity<br>✓ conducive temperature, rainfall and humidity<br>✓ acidic rainfall<br>✓ conducive temperatures, high humidity and rainfall<br>✓ winds and rainfall |
| **Gede Ruins** | ✓ cracks and splitting<br>✓ fallen parts of Ruins and Pillars<br>✓ mosses and lichens on the walls<br>✓ growth of vegetation on walls | ✓ expansion and contraction of the walls due to high temperature from direct sunlight, direct rainfall, acidic rainfall and high humidity<br>✓ wind, rainfall<br>✓ conducive temperatures, high humidity, rainfall<br>✓ conducive environment with warm temperatures, high humidity and rainfall |
| **Jumba la Mtwana** | ✓ cracking and splitting of walls<br>✓ growth of plants | ✓ constant coastal erosion<br>✓ expansion and contraction of walls due to high temperatures, direct rainfall, acidic rainfall and high humidity<br>✓ conducive environment with warm temperatures, high humidity and rainfall |
| **Mnarani Ruins** | ✓ cracking and splitting of the walls<br>✓ Vegetation growth and spread of roots<br>✓ Corrosion of the foundation | ✓ expansion and contraction of walls due to high temperatures, direct rainfall, acidic rainfall and high humidity |

| | | |
|---|---|---|
| | | ✓ conducive environment with warm temperatures, high humidity and rainfall<br>✓ flooding due to heavy rains |
| **Vasco da Gama Pillar** | ✓ formation of cracks on the Pillar<br>✓ fading of the color<br>✓ corrosion of the basement<br>✓ growth of vegetation on the basement Pillars | ✓ expansion and contraction due to high temperature, direct rainfall, acidic rainfall and high humidity<br>✓ rainfall, wind with salt content<br>✓ coastal erosion, sea-level rise, increase in acidity of ocean water<br>✓ conducive environment with warm temperatures and high humidity |
| **Portuguese Chapel** | ✓ washing away of lime<br>✓ Growth of plants | ✓ direct rainfall<br>✓ Conducive environment with warm temperatures, high humidity |
| **Watamu Monument** | ✓ cracking and splitting of the walls<br>✓ Vegetation growth and spread of roots<br>✓ Corrosion of the foundation | ✓ expansion and contraction of walls due to high temperatures, direct rainfall, acidic rainfall and high humidity<br>✓ conducive environment with warm temperatures, high humidity and rainfall<br>✓ flooding due to heavy rains |

### 4.6 Strategies for Adapting Immovable Cultural Heritage to Climate Change

The study sought to identify adaptation strategies by different stakeholders in the immovable cultural heritage. Every culture has a heritage and therefore there is a need to protect these heritages irrespective of their original culture. To preserve and protect the site from all aspects of danger conservation goals must be a priority over its economic value. It's our mandate as humans to conserve them since we have to grow with them. Majority (93.8 %) of the respondents agreed that the deterioration of cultural heritage will affect negatively the tourism industry. This is because 50 % of tourism is driven by cultural heritage (O'Brien et al., 2015).

Heritage provides employment and has economic value that drives the tourism industry, therefore, should be preserved for future generation to get the same economic benefit (Philip, 2015). Therefore, the loss of heritage is a threat to tourism and also a source of income (Harvey, 2016). In relation to this 84.4 % of the respondent indicated that it is possible to protect the immovable cultural heritage from climate change. Adaptation strategies have already begun in some of the sites. Cultural heritage adaptation may be in two forms, first, is a change in policies and guidelines that oversee monitoring and maintenance. Second, is a physical adjustment in the original state of the heritage by either changing construction materials or building barriers (UNESCO, 2015). The strategies were classified into structural adaptations and managerial and policy adaptations. Structural adaptation involves changes in the structural appearance of the immovable cultural heritage. Changes may involve the construction of buffer zones or practical change in the physical appearance of the structure. The following adaptation strategies were identified during the study.

### 4.6.1 Structural Adaptation

#### i Construction of a Sea Wall

The interviewed experts noted the following adaptation strategies in the cultural heritage sites along the Kenya coastline "*Fort Jesus is the only immovable cultural heritage that has begun the construction of a sea wall apart from Vasco da Gama Pillar and Jumba la Mtwana which have the same plans in place. These three sites are located along the seashore hence are affected by sea-level rise, coastal erosion and silts deposits. Due to erosion of the Fort basement two hectares of land were reclaimed from the sea where the wall was constructed. The wall is yet to be*

*completed. Fort Jesus being a world heritage, it took the efforts of both local government, national government, UNESCO and other European sponsors to have the wall constructed to save the heritage. The wall act as a barrier to protect the Fort from not being in direct contact with the ocean water thus cases of erosion will be minimized. Materials used in the construction are marine friendly hence the strategy is believed to be very effective. The sea barrier will counteract water waves, silts and water speed that would cause damage to the Fort".*

**Plate 4.6: Construction of sea wall at Fort Jesus**

### ii Painting of Buildings

Painting is one of the maintenance activities done on a regular basis to enhance the physical appearance of the buildings. Site curators stated that; "*Heavy precipitation and direct sunlight cause the fading of wall paints, therefore, speeding the rate of deterioration of building materials. Complete buildings such as Fort Jesus, Portuguese chapel and Mombasa old Town have the structures painted to maintain the authenticity of the structures".*

### iii Restoration of Fallen Walls

In Mnarani and Gede Ruins, fallen parts of the important sections have been repaired as explained by the Gedi Ruin site curator that; *"Ruins are being repaired*

*with coral rocks and lime, repairs are done on a frequent basis and are only repaired to their original position".*

**Plate 4.7: Restoration of a fallen wall at Gede Ruins**

**iv Renovation of Some Structures**

Some parts of Fort Jesus and Mombasa old Town have been renovated. Renovation is the change of the entire materials to replace with new ones that are resistant to the hostile environment. Renovation prolongs the life of a building therefore it is preserved.

**v Placement of Blocks to Reduce Water Speed**

Massive blocks have been placed near Vasco da Gama Pillar to counteract the effects of waves. This is one of the strategies in place to protect the Pillar from coastal erosion that has seen the loose of the basement.

**Plate 4.8: Massive blocks at Vasco da Gama Pillar**

**vi Creation of Drainage Systems**

Drainage systems have been opened up in the immovable cultural heritage sites to allow easy flow of water. Availability of good drainage systems reduces water blockage that could increase dampness in the structures increasing the rate of deterioration. Site curators said that; *"Drainage has been enlarged to cope with increased rainfall and gutters have been enacted to collect water into a designated storage area"*.

### 4.6.2 Managerial and Policy Adaptation

**i. Involvement of Local Community**

Local community need to be involved in the decision-making process on the adaptation strategies that are to be put place in the site. Fort Jesus education officer stated that, *"Local communities through the barazas are made aware of what to expect and the proposed plans in place. Locals have participated in beach cleaning exercises and trees planting within the site"*.

### ii. Regular Maintenance

Monitoring on the areas where the impacts are severe and maintaining the surrounding environment. *"Activities such as cutting of long grass in the sites, uprooting of grown weeds and plants on the structures and cleaning the sites through sweeping maintain the overall appearance of the cultural heritage are the continuous activities in all the heritages"* as stated by the curators. Growth of plant and other materials on the structures act as agents of deterioration.

### iii. Education

Respondents indicated that, '*Information has been disseminated among the staff and management to be prepared on the climate changes and have response strategies in place'*. This indicates that the sites have just initiated the first step of protecting the heritages from climate change impacts.

### iv. Inclusion of Climate Change in the Management Plans

Since the beginning of the 21st century when the adverse impacts of climate change begun being felt, the majority of the sites curators said, *"The sites have included climate change in their management plans and policies exist but their implementation is a problem due to barriers such as inadequate resources".* Management needs to make changes to the plans and work on those that require urgent attention.

### v. Enactment of Policies to Protect the Sites

Rigid policies need to be enacted to protect the sites from both natural and human factors. Some sites such as the Ruins have enacted policies such as those cited by Gede Ruins curator, *"policies exist in place that prohibit visitors from stepping on*

*the Ruins. This policy helps in maintaining the Ruins as they are without losing other important parts"*.

**vi. Mitigation Strategies**

Immovable cultural heritage also supports the protection of the natural environment. Site curators also stated that, *"Staff at the sites participates in tree planting activities within the site which act as windbreakers"*. Trees also help the sites indirectly in regulating gases in the atmosphere that causes global warming.

### 4.6.3 Proposed Ways to Protect and Conserve the Immovable Cultural Heritage

The respondents listed the following ways that need to be done in order to protect the immovable cultural heritages.

*a)'More research needs to be done on the individual sites*

*b)Public participation forums to be regularly organized to highlight the importance of the sites*

*c)Involvement of local community*

*d)Making efforts to regularly clean the site*

*e)Training enough personnel for conservation work*

*f)Planting trees around the immovable cultural heritage sites to act as windbreakers*

*g)Government and other stakeholders to work closely to develop robust and sustainable cultural heritage tourism*

*h)Information and knowledge sharing among stakeholders need to be practiced*

*i)Implementation of by-laws on the protection of immovable cultural heritages*

*j)Sourcing funding from potential sponsors and donors to facilitate the implementation of adaptation strategies*

*k)Putting up measures on the preservation of the environment'.*

### 4.7 Barriers to Adapting to Climate Change

Barrier refers to factors that hinder the achievement of a successful adaptation. Despite the increasing need to adapt to the changing environment, efforts to achieve successful implementation are often faced with some limitations. Barriers such as lack of inclusion of citizens, inadequate finances, lack of awareness among the locals may prevent public participation in the policymaking, policy implementation and uptake of a new framework within the site. Successful implementation of the adaptation strategies has been affected by some of the listed factors. Each immovable cultural heritage faces different barriers that were outlined by the curators during the field study. The findings are in agreement with Fatoric and Seekamp (2017) listed three categories of barriers to the adaptation of cultural heritage to climate change: institutional barriers, technical barriers and financial barriers. Barriers related to governance and compatibility with current management framework in Australia was identified (Carmichael et al., 2017). Inadequate funds, inadequate resources, inadequate management plans and issues with the legal framework can be barriers to protection and management of the heritages (UNEP et al., 2016). Amar (2017) also identified the following barriers to the conservation of built heritage in Australia and Tanzania; value assessment in a laissez-faire society, private ownership of cultural heritages, legislative frameworks are silent, political influence and negligence, lack of stakeholder involvement, poor management of heritage inventories, inadequate education and training and modern technologies and materials.

Some barriers such as those of finances, institutional, managerial and technical can be overcome while others such as natural hazards like climate change, hurricanes, tornados, wars or conflicts are a times beyond control. Policy changes and financial investments are needed for effective adaptation while financial situation depends on the country`s ability to prepare for natural disasters (UNEP et al., 2016). Therefore, government and stakeholders should address to overcome these barriers. The interviewed experts and other respondents expressed their different barriers to successful implementation of adaptation strategy to changing climate to include the following;

i. **Inadequate resources**

"*Carrying out a vulnerability assessment of the immovable cultural heritage is a complex task that requires a lot of finances and skilled personnel. Hiring and training the personnel to handle the challenges facing the sites due to changing climate requires finances and improved technology"*. Implementation of the adaptation strategies both managerial and structural requires finances. Majority of the sites lacked enough personnel to do continuous monitoring and evaluation of the changes in the structures. There are inadequate experts in the field of climate change and cultural heritage to advise the management on how to protect the sites.

**ii. Climate Change has not been included in the Management Plans**

"*Climate change has not been included in majority of the management plans which makes it difficult to plan on emergency measures and adaptation strategies. Conservation plans are also lacking in most of the sites"*.

This is in agreement with a study by ICOMOS in 14 industrialized countries that showed that natural hazard risk analysis is not included in the cultural heritage

management plan meaning that even the developing countries lack the plans in place (Taboroff, 2003). In the wake of UNESCO 2016 report, world heritage and climate change issues have received news coverage (Abel, 2017; Davidson, 2016; Guarino, 2016; Harvey, 2016). Therefore, there is a call for more research and informed decision-making on management, adaptation and protection of cultural heritage sites due to climate change (Grossi et al., 2007; Howard, 2013; Marzeion & Levermann, 2014; UNESCO World Heritage Centre, 2007, 2008).

### iii. Interference of Marine Life

"*Implementation of adaptation strategies in some of the sites interfere the marine life. Plans to construct a sea wall in Jumba la Mtwana are still under negotiations due to impact the sea wall will have on the marine life. The shoreline of Jumba la Mtwana is a breeding ground for the turtles hence constructing a sea wall to save the Ruins means loss of a large family of turtle who often move from other countries to breed"*.

### iv. Overdependence on Cultural Heritage in Coastal areas for Tourism Purposes

"*Cultural tourism is one of the major forms of tourism along the coast, hence the closure of some of the sites for renovation results to loss of tourists"*.

Research and maintenance should be a continuous process so that once a threat is detected the management quickly respond before major damage is done on the site.

### v. Lack of Awareness

"*It is difficult for the local community to embrace changes as a result of adaptation when they lack knowledge on the importance of the sites"*. Lack of respect from the

local community towards cultural heritages often makes them rebel conservation efforts.

Management needs to work closely with local communities and leverage citizen scientist program to gain public support, complete assessment and implement management plans at the site level (Harvey & Perry, 2015).

**vi. Natural occurrences hinder Adaptation Process from being successful**

"*The continuous occurrence of extreme weather events such as flooding, hurricanes and tornados affects the achievement of a successful implementation process. Future climate is projected to be extreme from the current situation, therefore, makes the achievement of conservation unsuccessful"*.

To understand the factors, management should adopt the proposed frameworks for assessing vulnerability and decision-making processes to overcome these barriers (Shi et al., 2012; Hujbregts et al., 2012; Nettley et al., 2014; O'Brien et al., 2015; Philips, 2015; UNESCO World Heritage Centre, 2007).

**vii. Emergences of new Developments**

Emergence of new development is the construction of new buildings and expansion of the existing infrastructural projects and buildings. A local Town or Centre may be expanding due to increase of population and also adoption of new design structures in the area thus the old structures are demolished to give room for new ones. "*Industrial and infrastructural developments threaten the conservation of the cultural sites. Locals are getting rid of old structures and embracing the new structures with new designs hence the immovable cultural heritage cannot be protected. Mombasa old Town is facing extinction from the development of new buildings and structures hence locals get rid of the old structures"*.

The buildings that make up the Mombasa old Town have been painted with the same colour that is cream-yellow to identify them from the buildings that were set up later which have been painted white and blue. Management should involve support from the public and politicians in research and management of the individual site (Cassar, 2005; UNESCO World Heritage Centre, 2008).

### viii. Construction of Sea Wall may be an Intrusion to the Authenticity of the Site

"*Embracing conservation in the immovable cultural heritage sites interferes with the authenticity of the structures. This makes it difficult to choose between the conservation and preservation of the originality"*.

Site level assessment is an important aspect that should be researched with the impacts the adaptation will have on the heritage before implementing any strategy.

### ix. Vandalism of Cultural Heritage Sites

"*Most of the immovable cultural heritages were constructed by early visitors. After early inhabitants left most of the sites were vandalized. Muiwa kai and Mambrui Ruins in Kilifi county is an example of a vandalized heritage and therefore it's not open to the public"*.

Legal action can be taken to protect heritage from natural processes (Harvey & Perry, 2015) however management needs to involve local community due to diversity of threat (Cassar, 2005; UNESCO World Heritage Centre, 2007).

### x. Lack of Cooperation from the Stakeholders

"*Achievement of a successful implementation of adaptation strategies is a continuous process which requires the efforts of all stakeholders"*.

For successful incorporation of adaptation and mitigation strategies, government agencies, cultural heritage and disaster management professionals need to work together (Taboroff, 2003). Protecting the cultural heritages from climate change threats require both national and local level responses with also international conventions providing recommendations and education advises (UNESCO World Heritage Centre, 2007).

### xi. Loss and Obsolescence

"*Some of the immovable cultural heritage sites have already been lost due to climate change"*.

Watamu Monument is among the neglected heritage, the Ruins are not maintained. Most of the parts have been enclosed in overgrown trees and plants. Management needs to assess the potential economic loss from a site with its impact on society through research to understand the heritage value (UNESCO World Heritage Centre, 2008).

## 4.7 Maximizing opportunities arising from Adapting to Climate Change

Adapting to climate change may create some opportunities that benefit both the site and the local community. The opportunities that arise in adapting the immovable cultural heritage to climate change were beneficial to the locals, visitors and the management. The respondents both interviewed and those who filled the questionnaires cited the following opportunities.

### I. Creation of an Extra Space

"*Construction of barriers in Fort Jesus provide a good fishing ground for the locals. The reclaimed land may be used to host events, playground and also provide*

*ground for the locals to do their businesses. Establishment of a sea wall in Vasco da Gama Pillar will create more space that can accommodate a large number of visitors at a time".* The creation of extra space in both the immovable heritage allowed accommodation of large number of people within the site and also the locals can use the space in doing businesses that provides goods and services to visitors visiting the sites.

### II. Studies done on the Site provide Scientific Solutions

Carrying out continuous research on individual sites provide solutions to the management on how to protect the sites. Consistent and continuous research on the cultural heritage sites allows the management to prevent and adapt to the deteriorating factors as they occur. Planning is also reactive rather than proactive hence conservation plans and budgets are adjustable to a threat immediately it is detected.

### III. Preservation of the Heritages

"*Adaptation leads to the preservation of the cultural heritage site. Removal of vegetation from the walls helps in reducing cracks in the structures".* Sea wall help in reducing water pressure and speed that would minimize coastal erosion on the beaches. Preservation and conservation of the cultural heritage sites contributes to the overall sustainability of the internal and external environment.

### IV. Involvement of all Stakeholders

Implementation of adaptation strategies requires the consent of all stakeholders. Selecting the best adaptation measure, therefore, brings together all the stakeholders

for their input in the process. In order for a cultural heritage site to have an adaptation strategy in place awareness needs to be created among the locals, host country and the management, public participation is also required hence brings together all the stakeholders and investors on board. Decision and guidance can also be sought from the global bodies and international community therefore promotes national and cultural cohesion.

### V. Continuous Monitoring and Evaluation of the Sites

"*Monitoring and maintenance become a continuous process in the site before implementing any adaptation measure".* After a successful implementation of an adaption strategy the management will also be required to do a day to day checks of how the new adjustment or policies are on the site.

### VI. Implementation of Adaptation Strategies

Every immovable cultural heritage site adopts an adaptation measure that protects the sites for future generations. All the immovable cultural heritage sites are in the long run protected against the adverse impacts of a changing climate, natural hazards and manmade factors.

### VII. Community Involvement in Conservation Efforts

Local community support the conservation effort in the sites since they benefit from the strategies adopted. "*Creation of space for the community to do their business as a result of the implementation of an adaptation measure promotes cultural cohesion".*

## 4.9 Summary

In this chapter, the findings have been discussed in the form of themes and presented through charts, graphs, photographs and tables. Data collected through questionnaires and interviews was analyzed and discussed in this chapter.

# CHAPTER FIVE

# SUMMARY, CONCLUSION AND RECOMMENDATIONS

## 5.1 Summary

The study sought to assess climate change impacts and the vulnerability of the immovable cultural heritage sites, a case study of Kenyan coastline. The study was guided by the following objectives; to analyze impacts of climate change on the immovable cultural heritage; to assess the vulnerability of immovable cultural heritage to climate change; to identify adaptation strategies in the immovable cultural heritage; to determine response to barriers in adapting immovable cultural heritage to climate change; to identify how stakeholders maximize opportunities that arise in adapting to climate change.

The study employed a qualitative case study research design. Structured questionnaires with both open and closed-ended questions were issued to respondents in the cultural heritage site chosen through convenience sampling. Interviews were also conducted with experts. Questionnaires were dropped and picked after being filled. Data collected through questionnaires was analyzed using descriptive statistics while data collected through interviews was analyzed into themes. SPSS version 16 was used in data analysis and the results presented in tables and charts.

### 5.1.1 Climate Change Elements

Findings indicated that sea-level rise, temperature increase, coastal erosion, strong winds, heavy precipitation, coastal flooding and increase in acidity levels are the major causes of cultural heritage deterioration. Furthermore, the most affected cultural heritages are Fort Jesus, Vasco da Gama Pillar and Jumba la Mtwana. Climate change impacts have become extreme since the beginning of the 21st century. Results revealed that climate change is indeed the major cause of cultural heritage deterioration with other factors being secondary causes.

### 5.1.2 Physical Evidence on the Immovable Cultural Heritage

The study showed that all the cultural heritages used in the research exhibited changes in the overall appearance of the structure. Some structures had visible cracks, fallen parts, presence of plant growth, insect and pest infestation and rotten wooden parts. Results revealed that the level of damage in the immovable cultural heritages ranged from minor, moderate and major. Level of damage depended on the vulnerability of the site to climate change.

### 5.1.3 Adaptation Strategies

Findings indicated that the majority of the affected immovable cultural heritages have not developed any adaptation strategies. The findings further indicated that Fort Jesus is the only heritage that has initiated the implementation of adaptation measure. Sea wall construction is in its last phase in Fort Jesus while the other sites have enacted the monitoring and maintenance policy. Results revealed that lack of adaptation strategies in the immovable cultural heritage is due to lack of finances and resources to facilitate its implementation.

### 5.1.4 Response to Barriers

Findings indicated that most of the sites face different factors that hinder the successful implementation of the adaptation measures. Most of the sites listed finance as a major barrier to adaptation since adaptation itself is expensive. Majority of the sites had requested for funding from the national government and other willing sponsors. Results revealed that barriers can be overcome if the management involved all the stakeholders in the decision-making process up to the implementation of the strategy.

### 5.1.5 Maximizing Opportunities

Findings indicated the creation of extra space for doing business and relaxation area for the visitors and local communities are some of the opportunities that resulted in the construction of the sea wall. The locals, visitors and management maximize the opportunities in creation of employment, increase on source of income, protection of the natural environment, having more visitors at a time on the site and creation of harmonious existence among the locals and visitors.

Results revealed that implementing adaptation strategies not only preserve and protect the sites but also, it's one way of achieving sustainability.

## 5.2 Conclusions

The study concluded that, the main cause of immovable cultural heritage deterioration along the Kenyan coastline is climate change. Historic buildings have been subjected to several threats such as sea-level rise, heavy precipitation, high temperatures, frequent strong winds, coastal flooding, increase in acidity levels, coastal erosion, ocean currents and changes in seasonality. Immovable cultural heritage sites are exposed to different environmental factors depending on their

locality. The rate of deterioration on the immovable cultural heritage depends on the materials used in construction.

The study explored the assessment of climate change impacts and vulnerability assessment on the immovable cultural heritage in Mombasa and Kilifi counties. The historic buildings included Fort Jesus, Mombasa old Town, Gede Ruins, Mnarani Ruins, Vasco da Gama Pillar, Jumba la Mtwana, Portuguese chapel and Watamu Monument. The sites faced direct deterioration from climate change through splitting, the formation of cracks, peeling off of paints and walls and erosion of the basement. While on the other hand climatic factors may indirectly contribute to the deterioration of the immovable cultural heritage through the provision of a conducive environment for the growth of plants and infestation of insects.

Apart from climate change being a major factor in the deterioration of the immovable cultural heritage, other factors include old age and human factors. Majority of the historic buildings were constructed between the $12^{th}$ and the $16^{th}$ century. Materials used for construction can no longer withstand the harsh environmental conditions. The immovable cultural heritage sites require renovation and refurbishment of the materials. Some of the sites especially the mixed cultural heritages like Mnarani Ruins, Gede Ruins and Jumba la Mtwana are also threatened by human factors. These factors include vandalism and local community cutting down trees within the site which in turn fall on the Ruins causing the collapse of some walls. Adaptation for immovable cultural heritage is possible and the future for our heritages is bright if adaptation is embraced within individual sites.

## 5.3 Recommendations

The following are the recommendations made from the study:

### 1. Cooperation among Stakeholders

In Kenya, the immovable cultural heritage sites are under the management and control of the national museums of Kenya. Any decision on the sites is done by the national museums. There is a need for cross-disciplinary participation in handling serious issues such as climate change to achieve protection of the overall natural environment. Coordination of all stakeholders in the management and conservation of the immovable cultural heritage sites will enable the achievement of adaptation and protection strategies on the sites. It will also be easier in sourcing funding for maintenance of the heritages.

### 2. Short-term Planning Scale

National museums of Kenya management often make long-term plans for the cultural heritage this makes it difficult to convince the policymakers to include climate change impacts when it occurs. Initially, climate change was not a threat to the built heritage as it is in the 21$^{st}$ century. Climate change needs to be included directly in conservation plans of an individual site to provide quicker responses to impacts before they become major.

### 3. Development of Garbage Management Plans

There is a need to develop a garbage management plan for heritage like Mombasa old Town. There is a lot of litter disposed everywhere within the old Town. Having a plan in place will help in getting rid of waste within the Town to maintain the authentic value of the site.

### 4. Local Community Awareness

There is a need to involve the local community in conservation plans since the sites mean a lot to local people and their culture. Majority of the sites have not done awareness on the importance of the immovable cultural heritage to the local people so that they can support their protection.

**5. Regular Monitoring and Maintenance**

Most of the immovable cultural heritages along Kenyan coastline have existed as early as the 12$^{th}$ century hence requires regular maintenance to maintain their authenticity. The sites are exposed to different environmental and human factors over time; therefore, the sites should be monitored regularly to preserve and maintain the heritage value.

Regular maintenance such as cutting down of grass, painting of the structures, removal of grown plants within the site and creation of proper drainage systems helps maintain the structures. Renovation and refurbishment of the structures should be done regularly.

### 5.4 Further Research work

Inadequate data exist on climate change impacts on the immovable cultural heritage. The different building materials used in construction of cultural heritages react differently to extreme weather conditions, this makes it difficult in choosing the adaptation strategies for the sites. More research needs to be carried out on related topics to provide the management with the sustainable conservation and adaptation strategies. There is a need for future researchers to focus on the economic loss that would occur when these parts of cultural heritage are lost. Future research is also needed to focus on the specific building materials used in the construction of individual immovable cultural heritage so that it will be easier to

identify the needed adaptation strategies. There is also need for future research to focus on how individual climate change factors affect and deteriorate the specific construction materials and give solutions that are resistant to extreme environmental conditions.

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# APPENDICES

## APPENDIX 1:

## INTRODUCTION LETTER

**MURANG'A UNIVERSITY OF TECHNOLOGY**

Dear Respondent,

I am a student at Murang'a University of Technology pursuing a master of science in tourism and hospitality management. I am currently in the field work conducting a research on 'ASSESSMENT OF CLIMATE CHANGE IMPACT AND VULNERABILITY OF IMMOVABLE CULTURAL HERITAGE SITES: A CASE STUDY OF KENYA`S COASTLINE'. Your opinions and suggestions will be of great help in the development of the study which seeks to advocate protection and conservation of heritage sites from any threat. The purpose of the study is purely for academic purpose and any information received will be treated very confidential.

## APPENDIX 2:

## QUESTIONNAIRE FOR RESPONDENTS

PART ONE: BACKGROUND INFORMATION.

Please tick where appropriate.

Please provide answers to all the questions in the sections.

1. AGE

[5] 18 to below25yrs [2]25 to below35yrs [3]35 to below45yrs [4] 45 to below 55yrs and [5] 55 and above

2. SEX

[01] Male [02] Female

3. LEVEL OF EDUCATION:

[1] Primary certificate [02] Secondary certificate [03] College certificate

[4] Diploma [05] Undergraduate degree [06] Postgraduate diploma [07] other

4.WHERE IS YOUR PLACE OF RESIDENCE?

[1] Mombasa county [2] Kilifi County [3] other

5.HOW MANY YEARS HAVE YOU STAYED IN THE AREA?

i. Less than a year

ii. 2-5yrs

iii. 6-10yrs

iv.11-15yrs

v.16-20yrs

vi.21-25yrs

vii.26-30yrs

viii. 0ver 30yrs

6.WHAT IS YOUR OCCUPATIONAL STATUS?

[1] Employed

[2] Unemployed

[3] Self-employed

PART 2: GENERAL INFORMATION

Please provide answers on the space provided and tick where appropriate.

1. For the period you have stayed here, have you seen any changes in your environment? Yes ()

No ()

Not sure ()

If yes which ones?

_____

_____

_____

_____

2. What do you understand by cultural heritage?

_____

_____

_____

_____

3. Which cultural heritage do you know along the Kenyan coastline?

_____

_____

_____

_____

_____

4. Do you think the cultural heritages within the coastal region are of any importance or benefit? Yes ( )

No ( )

Not sure ( )

If yes (please explain)

_____

_____

_____

5(a) Do you think that climate change is the major threat to the cultural heritages in the coast region?

1-Strongly disagree

2-Disagree

3-Moderate

4-Agree

5-Strongly agree

(b) If your answer above is moderate, agree and strongly agree. Please specify these major threats

_____
_____
_____

6(a) Rate the following causes of cultural heritage deterioration from the one with very high impact to the one with very low impact? Likert scale represents very high=5(81-100%), high=4 (61-80%), medium=3(41-60%), low=2(21-40%), very low=1(0-20%).

| Causes of heritage deterioration | very high | high | medium | low | Very low |
|---|---|---|---|---|---|
| Coastal flooding | | | | | |
| Temperature rise | | | | | |
| Frequent strong winds | | | | | |
| Coastal erosion | | | | | |
| sea level rise | | | | | |
| Increase in precipitation | | | | | |
| Increase in acidity | | | | | |
| Any other | | | | | |

(b). According to your answer above, what is the likelihood of the hazard occurring?

| Climate change event | Very likely | Likely | neutral | unlikely | Very unlikely |
|---|---|---|---|---|---|
| Floods | | | | | |
| Heavy precipitation | | | | | |
| Increase in temperatures | | | | | |
| Coastal erosion | | | | | |
| Strong winds | | | | | |
| Ocean acidification | | | | | |
| Any other | | | | | |

7. List any cultural heritage threatened by changes in climate within the region?

_____

_____

_____

8. What is the level of damage on the immovable cultural heritage sites?

| Level of damage | Insignificant | Minor | moderate | major | Catastrophic |
|---|---|---|---|---|---|
| Fort Jesus | | | | | |
| Mombasa old Town | | | | | |
| Gede Ruins | | | | | |
| Vasco da Gama Pillar | | | | | |
| Jumba la Mtwara | | | | | |
| Mnarani Ruins | | | | | |
| Portuguese chapel | | | | | |
| Watamu Monument | | | | | |

9 (a) Is there any action that has been taken to protect these heritages?

Yes ( )

No ( )

Not sure ( )

If yes (please explain)

_____

_____

_____

10 (a) How is the local community`s support on conservation and protection of heritage sites?

0. None ☐ 1. Very weak ☐ 2. Weak ☐ 3. Neutral ☐

4. Strong ☐ 5. Very strong ☐

(b)If the answer in question (10a) is strong or very strong, kindly explain how they have contributed in the protection

_____

_____

_____

_____

_____

11. What is your opinion on how to protect and conserve the immovable cultural heritages?

_____

_____

_____

12. What are the challenges in conserving cultural heritages?

_____

_____

_____

_____

_____

13. Is there a future for Kenya`s cultural heritage with the change in climate?

Yes ( )

No ( )

Not sure ( )

14. What do you think should be done to curb climate change in Kenya?

_____

_____

15. Does the deterioration of cultural heritage affect tourism?

_____

_____

Thank you.

## APPENDIX 3:

## INTERVIEW SCHEDULE FOR SITE CURATORS

The study seeks to assess climate change impacts and vulnerability of the immovable cultural heritage in Mombasa and Kilifi counties. The information obtained is for academic purpose only and was kept confidential. Thank you for participating.

1) Self-introduction
2) Interviewee introduction
3) What are some of the evidence that climate is changing?
4) Which are the affected tourism resources in coast region?
5) How is the immovable cultural heritage sites affected?
6 a) Do you think climate change is the major threat to immovable cultural heritage?
1-Strongly disagree
2-Disagree
3-Moderate
4-Agree
5-Strongly agree

b.) If your answer above is moderate, agree and strongly agree, please specify these major threats to cultural heritage

1. Coastal floods
2. Temperature increase
3. Strong winds
4. Increase precipitation
5. Coastal erosion
6. Sea level rise
7. Increase in acidity
8. Any other

7) According to your answer above what is the likelihood of the hazard occurring?
1. Very high

2. High

3. Medium

4. Low

5. Very low

8.) What is the level of damage on the immovable cultural heritage?

1-insignificant

2-minor

3-moderate

4-major

5-catastrophic

9.) Can the function of the cultural heritage unit be easily restored?

Yes

No

10.) How are the levels of damages expected to be repairable?

1-partially

2-entirely

11.) What is the importance of the immovable cultural heritage existence?

i) Economic value

ii) Communal value

iii) Evidential value

iv)Historical value

v) Aesthetic value

12) Is the adaptation of cultural heritages to climate change possible?

13) List the current adaptation practices in place for the immovable cultural heritage?

14) What are the determinant factors in implementing adaptation of cultural heritage to climate change?

15) Name the barriers in adapting immovable cultural heritage to climate change and how do you minimize these barriers?

16) Are there opportunities in adapting cultural heritage to climate change and how do you make effective use of them?

17) What are the best practices examples in adapting cultural heritage to climate change?

18) Is climate change currently included in management of the heritage sites?

If yes…… how……..

19) How do you consider climate change with the preservation of cultural heritage?

20) Examples of methodologies to mitigate impacts of climate change on the cultural heritages?

21) What has NMK do in order to address these problems?

22) Identify the community`s effort on the protection of heritage?

23) What have you done to create awareness on the locals concerning the effects of climate change on tourism?

24) Considering human activities verses climate change which is the main cause of heritage deterioration?

25) From your own understanding do you think the constructed walls/barriers are effective in adapting to climate change?

26) What changes occur in the ecosystem due to climate change?

27) What policies are in place on the protection of cultural heritages from climate change?

28) How is the future of Kenya`s tourism in era of climate change?

Thank you.

## APPENDIX 4:

## INTERVIEW SCHEDULE FOR CLIMATE EXPERTS

Self-introduction

Interviewee introduction

1) What is your understanding about climate change?
2) What are the causes of climate change?
3) Is Kenya experiencing climate change?
4) What is the evidence of climate change in the coast region of Kenya?
5) What are some of the indicators of climate change?
6) Do you think coastal region of Kenya is at risk of climate change?
7) What are the climatic hazards affecting the coast region of Kenya?
8) What resources do you think have been affected by climate change in the coastal region?
9) Do you think cultural heritage is at risk? How and why?
10) What is your assessment of the risk of climate change on the cultural heritage?

a) Light
b) Medium
c) Heavy

11) Do you think it has an implication for tourism?
12) What are the some of the ways that cultural heritage stakeholders should do to limit the impact of climate change on the cultural heritage sites?
13) Are there available data on how the climate for Kenya`s coast region has been changing? Yes ( ) No ( )
14) What are the challenges in monitoring climate change?
15) Do you think that the climate will continue to change in the future or it has reached the limits?
16) Does climate change in Kenya have any difference from the global NASA readings?
17) What is your advice on the measures to be taken by the sectors mitigation or adaptation?
18) How do you communicate to the tourism sector to prepare for climate hazards?

Thank you

## APPENDIX 5:

## OBSERVATION CHECKLIST

Is the cultural heritage site facing any of the following risks?

| | |
|---|---|
| **a) Environmental factors-**<br>**natural disasters and climate change**<br>-earthquakes<br>-flooding<br>-wildfires<br>-pest and diseases<br>-sea level rise<br>-temperature increase<br>-heavy precipitation<br>-coastal erosion<br>-increase in acidity levels<br>-Growth of plants<br>**b) Socio-political factors**<br>-armed conflict<br>-vandalism<br>-lack of participation of local community<br>--negligence<br>**- Economic factors**<br>-mass tourism impacts<br>-illicit trafficking<br>-Development pressures<br>-technological pressures<br>**c) Physical factors**<br>-construction features<br>**2. physical signs of deterioration**<br>-cracking<br>-splitting<br>-rotting<br>-peeling off<br>-formation of flakes<br>-missing parts<br>-Growth of plants<br>-pest infestation<br>-Submergences of structures<br>-corrosion of roofs | |

## APPENDIX 6:

## RESEARCH AUTHORIZATION(MUT)

MURANG'A UNIVERSITY OF TECHNOLOGY (MUT)
Tel: +254-771463515
Fax:: 06030269
P.O.Box 75-10200
Murang'a
Kenya

**Email:** bps@mut.ac.ke
**Website:** www.mut.ac.ke
**DIRECTORATE OF POSTGRADUATE STUDIES**

**Ref: MUT/BPS/M/04** **Date:** 16th September 2020

Dear M/S Angelah Chemeli (HT400/5265/2017)

**RE: APPROVAL OF RESEARCH PROPOSAL AND SUPERVISORS**

I am pleased to inform you that the directorate of Postgraduate Studies on the 10th September 2020 considered and approved your MSc proposal entitled **"Assessment of climate change impact and vulnerability of immovable cultural heritage sites: A Case Study of Kenya's Coastline"** and appointed the following as supervisors:

1.Dr. Joseph Njoroge [School of Hospitality and Tourism Management]
2.Dr. Peace Agufana [School of Education]

You may now proceed with your data collection subject to obtaining research permit from NACOSTI, if required. You should also begin consulting your supervisors and submit through them quarterly progress reports to the Director Postgraduate Studies through your COD and School Dean. Progress Reports can be accessed in the University Website.

It is the policy and regulations of the University that you observe deadlines. The Guidelines on Postgraduate supervision can be accessed in the post graduate Handbook.

Your responsibilities as a student will include, among others;

I. Maintain regular consultation with your supervisor(s), at least once a month
II. Submit quarterly reports on time, through your supervisors, COD, Dean and to the Director of Postgraduate studies;
III. Ensure quality work all through;
IV. Present your research findings at 2 seminars/conferences prior to thesis examination.
V. Publish one article from your research findings in a refereed journal prior to thesis examination

For any further clarification, please contact the undersigned.

Yours Sincerely,

**Dr. Andrew Makori**
**Ag DIRECTOR OF POSTGRADUATE STUDIES**
**CC** Registrar- ASA

## APPENDIX 7:

## NACOSTI RESEARCH PERMIT

Permit No : NACOSTI/P/19/59890/31653
Date Of Issue : 20th August,2019
Fee Recieved :Ksh 1000

THIS IS TO CERTIFY THAT:
*MS. ANGELAH CHEMELI LAGAT*
of MURANGA UNIVERSITY OF TECHNOLOGY, 0-10200 Muranga,has been permitted to conduct research in *Kilifi , Kwale , Lamu , Mombasa Counties*

on the topic: *ASSESSMENT OF CLIMATE CHANGE IMPACTS AND VULNERABILITY OF IMMOVABLE CULTURAL HERITAGE SITES: CASE STUDY OF KENYA'S COASTLINE'*

for the period ending:
*19th August,2020*

*Applicant's Signature*

*Director General*
*National Commission for Science, Technology & Innovation*

## APPENDIX 8:

## RESEARCH PUBLICATIONS

1. **Chemeli, A.,** Njoroge, J.M., and Agufana P., (Forthcoming 2021), Climate change and immovable cultural heritage: impact and response strategies in Kenya Walter Leal Filho, W.L., Luetz, J.M, and Aya, D.Y, (EDs), Handbook of Climate Change Management. Springer. ISBN 978-3-030-57280-8
   https://www.springer.com/gp/book/9783030572808#:~:text=Book%20Title%20Handbook%20of%20Climate,Luetz
2. **Chemeli A.** and Njoroge, J.M., (Forthcoming 2022), 'Immovable cultural' in D. Buhalis (ed.), Encyclopedia of Tourism Management and Marketing, Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing.
3. Njoroge, J.M. and **Chemeli, A.,** (Forthcoming 2022), 'Maladaptation adaptation' in D. Buhalis (ed.), Encyclopedia of Tourism Management and Marketing, Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing.
4. Njoroge, J.M**.** and **Chemeli A.,** (Forthcoming 2022), 'Bleisure' in D. Buhalis (ed.), Encyclopedia of Tourism Management and Marketing, Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing.