

**PUBLIC PARTICIPATION GIS FOR CULTURAL
RESOURCES MAPPING AND MANAGEMENT IN
EMUHAYA CONSTITUENCY OF KENYA**

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(Geospatial Information Systems)**

**JOMO KENYATTA UNIVERSITY OF
AGRICULTURE AND TECHNOLOGY**

2019

**Public Participation GIS for Cultural Resources Mapping and
Management in Emuhaya Constituency of Kenya**

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**A thesis submitted in partial fulfilment for the degree of Doctor of
Philosophy in Geospatial Information Systems, in the Jomo Kenyatta
University of Agriculture and Technology**

2019

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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DEDICATION

I dedicate this thesis to my parents who encouraged me to pursue education, to my brother and sister who have always believed in me, to my wife and son for their patience and support through this journey and finally to the almighty God for giving me the strength and courage to pursue this program to completion.

ACKNOWLEDGEMENT

The successful completion of this research work has been made possible through the support of various individuals and institutions. First and foremost, I am thankful to God the almighty in whom I found my strength and peace during the duration of my study. I am also greatly thankful to Professor David N. Kuria and Dr. Moses M. Ngigi who graciously accepted to supervise and guide this work. They were always at hand to support me and they promptly reviewed my chapters and gave me useful suggestions and advice. I am grateful to them for their patience and willingness to share their immense knowledge and experience in GIS and Remote Sensing which contributed greatly to my success.

I am immensely indebted to the Chair and staff at the Geomatic Engineering and Geospatial Information Systems (GEGIS) department for their support and facilities utilised during the duration of my study. I also received immense support and guidance through the progress presentation sessions organised within the department. God bless your work.

I would also like to formally recognise the financial support I received from Jomo Kenyatta University of Agriculture and Technology (JKUAT) and the German Academic Exchange Services (DAAD) without which I would not have been able to pay for my fees and research costs. Thank you.

Last but not least I am greatly thankful to my fellow PhD candidates and family for their support and encouragement throughout this journey. I really benefited from the informal discussions and reviews with my colleagues. It was during these sessions that I discovered that we were all sharing similar challenges albeit in different areas and that the PhD journey is not for the faint-hearted. Thank you for the humour and motivation that kept me going even during the tough times. I will forever cherish the time we spent together during this program. To my wife and son, thank you for your patience and support. This PhD endeavour separated us in a way but I am thankful that you were always ready to

support me and provide me with the peace and comfort that I really needed. Most importantly I cherish the joy and love that you guys have brought into my life. God bless you.

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ABBREVIATIONS AND ACRONYMS

ACRI	African Cultural Regeneration Institute
ADMMC	Agile-based Development Methodology for Mobile Commerce applications
APK	Android application package
ASEAN	Association of Southeast Asian Nations
CPP	Cultural Planning Process
CMMI	Capability Maturity Model Integration
CRF	Cultural Resources Framework
CMPPP	Cultural Mapping, Planning and Policy Process
DBMS	Database Management System
GIS	Geographic Information Systems
GIT	Geographic Information Technologies
GPS	Global Positioning System
ICOMOS	International Council on Monuments and Sites
MDGs	Millennium Development Goals
OGC	Open Geospatial Consortium
PGIS	Participatory Geographic Information Systems

PLA	Participatory Learning and Action
PPGIS	Public Participation Geographic Information Systems
PRA	Participatory Rural Appraisal
SASI	South African San Institute
SDK	Software Development Kit
SEI	Software Engineering Institute
UAT	User Acceptance Test
UML	Unified Modelling Language
UNESCO	United Nations Educational, Scientific and Cultural Organization
VGI	Volunteered Geographic Information
WFS	Web Feature Service
WMS	Web Map Service
YWDM	Y-Model Web GIS Development Methodology

ABSTRACT

Culture is essential for human development as it promotes peace and stability while making development strategies relevant at the local level. These culture responsive development strategies empower and include the community in the development agenda. The problem noted for research in this thesis is the lack of formal documentation and visualization of culture information for sustainable development. The main goal of the research was to develop a participatory mapping model that conceptualizes and constructs a system that was used to create a digital culture repository for Emuhaya Constituency of Vihiga County, Kenya.

Literature review was conducted on modern participatory culture mapping approaches and the opportunities for applying internet and mobile technologies to these approaches. In this research both qualitative and quantitative data about culture and culture perceptions was collected through interviews and questionnaires. The quantitative analysis focused on descriptive and inferential statistics. Quantitative content analysis was used to code and extract the qualitative information obtained from the respondents. The data was then used to establish the functional and non-functional requirements of a participatory mapping model that was used to create a digital cultural repository for the study area. The model was then used to implement a mobile and web GIS component that facilitated public participation in the culture mapping process. The model was tested using several tests and the results recorded and presented in this thesis. The research also created a compact and suitably adapted software methodology for implementing the model. The software methodology was tested and validated during the development of the Emuhaya cultural resources portal.

The main achievement of the research is the implementation of a participatory culture mapping model that relies on indigenous culture information from non-technical users through familiar and readily available devices. The approach taken moves away from the

traditional field based participatory techniques and relies on technology to involve a wider stakeholder base while utilizing minimum resources. This is an advancement of the existing participatory mapping approaches. The findings have revealed that this application of technology can be ported to other participatory mapping domains/projects.

CHAPTER

INTRODUCTION

1.1. Background

Culture is essential for human development as it promotes peace and stability while making development strategies relevant at the local level. These culture responsive strategies empower and include the community in the development agenda. Edigin (2010) observes that cultural forces drive national behaviours, international political affairs and relationships. Culture can further contribute to the Sustainable Development Goals (SDGs) by helping to build strong, self-reliant communities. Unfortunately local and indigenous knowledge is scattered between individuals and rarely formally documented or visualized. This has resulted in the rapid erosion of culture through the scramble to modernize and adopt newer technologies. Like many other countries in Africa, Kenya is experiencing rapid industrialization and increasing population density that is adversely affecting natural and cultural resources. It is therefore necessary to preserve culture by creating cultural inventories of cultural resources and assets.

The role of culture in sustainable development has increasingly been widely recognized even as evidenced in the 2030 Agenda for Sustainable Development adopted by the United Nations General Assembly in September 2015 (Fukuda-Parr, 2016). Osagie (1985) defines development as the qualitative and quantitative positive transformation of the lives of a community visibly improving their material and social well-being while at the same time raising their dignity level. Culture is being mentioned positively in the development discourse as policy makers begin to acknowledge that there is a strong correlation between a people's culture and their perspectives on life (Olasunkanmi, 2011). UNESCO (2001) recognizes culture and cultural diversity as vital to achieving economic and social development. Article 13 of the UNESCO Convention on the Protection of the Diversity of Cultural Expressions requires member states to integrate culture in their development

policies at all levels to foster sustainable development (Throsby, 2012). While examining sustainable development, Yencken et.al. (2000) identified the four pillars of sustainability as ecological, social, economic and cultural sustainability. It will appear that sustainable development is a delicate balance between these pillars and an omission of any may hinder the process (Gleeson and Low, 2000). However there now seems to be a general consensus that cultural diversity creates a rich and varied world making it the central pillar for sustainable development in communities and nations at large (UNESCO, 2005).

Culture mapping is one of the approaches used to document and preserve information about landscapes, sites, practices, beliefs and territories from the perspective of local and indigenous peoples. In the context of a communities' culture, culture mapping is a systematic approach to identifying, recording and classifying a community's cultural resources in order to describe and visualize them. The mapping is usually consultative and covers infrastructure, activities, histories, values, traditions, stories and other key cultural knowledge (Mercer, 1997). Culture mapping can also be defined as the process of collecting, recording, analysing and synthesizing information in order to describe the cultural resources, networks, links and patterns of usage of a given community. UNESCO (2001) cites cultural mapping as a realistic approach for studying and documenting a community's cultural and creative industries before making policy decisions. The consultative nature of the process has the added advantage of influencing the political sphere towards suitable public-policy making both locally and nationally (UNESCO, 2006).

UNESCO (2014) identifies culture mapping themes as being wide and varied with resources including: anthropological, sociological, archaeological, genealogical, linguistic, topographic, musicological and botanical. These themes broadly represent the different categories of cultural information that can be collected. Some of the benefits of using culture maps include; formal documentation of cultural resources, community empowerment through participation, effective cultural resource management, community economic development, preservation of local knowledge systems and promotion of inter-

cultural dialogue (UNESCO, 2014). The users of these maps include community-based organizations, local and national governments, NGOs and academic institutions. These maps visualize and georeference what was previously invisible thus serving as a bridge between the marginalized society and those in decision making positions locally and nationally.

Participatory mapping is an effective tool in cultural heritage management applications and it provides the community with a means to catalogue its heritage resources and determine their value (La Frenierre, 2008). Participatory mapping is a merger between Participatory Learning and Action (PLA) methods with Geographic Information Technologies (GIT). Local knowledge can be spatially represented in two or three dimensional maps to facilitate decision making as well as support community communication and advocacy (Rambaldi et al., 2006).

GIS is the technology behind participatory mapping. GIS is a powerful tool that utilizes computing resources to collect, store, manipulate, analyse and display spatially referenced information (Burrough and McDonnell, 1998). This information is useful in planning, data analysis and decision making. Unlike mapping software that is simply used for drawing maps, GIS can be used to make complex spatial analysis. GIS is a system that is made up of people, applications, data, hardware and core GIS software operating on an underlying network infrastructure (Harmon & Anderson, 2003). A different view of these components relies on the 3-tier perspective; a component to collect geographic data into the GIS either from remote sensing sources, field surveys, printed and digital maps; a database component that allows the storage and manipulation of spatial data and finally a presentation component that brings together themes or layers of data for a number of spatial analytical operations (Abbot et. al., 1998).

Over the years there have been several proposals to incorporate GIS into mainstream IT giving rise to Spatial IT (or Geo IT) which is intended to be broader than GIS. Tarle and Eng (2002) demonstrate that Spatial IT encompasses all the aspects of collection,

management, modelling, analysis and use of spatial information throughout the enterprise. Furthermore Spatial IT is not restricted to geographical information but can include drawings and any other spatial information about objects that can be captured and stored digitally. At the same time there has been a move towards the socially aware GIS that gives recognition and legitimacy to local and indigenous spatial knowledge (Dunn, 2007). This type of GIS is context and issue driven as opposed to the traditional GIS that is technologically driven. These newer approaches seek to encourage community involvement in the development and use of Geospatial information. This paradigm shift from expert GIS to community GIS has created an opportunity for the emergence of new instruments to support GIS; Public GIS and Public Participation GIS also referred to as PGIS and PPGIS respectively.

PPGIS is the use and application of geospatial information and GIS technology by members of the public, individually or in groups, for participation in public processes that affect their lives (encompassing data collection, mapping, analysis and decision making) (Tulloch & Shapiro ,2003). On the other hand PGIS is envisioned as a form of participatory spatial planning (PSP) which relies on maps and GIS (McCall, 2003). The degree of public involvement in the two instruments differs in that PGIS is equated to technical GIS with some minimum degree of participation from the public. Sometimes the participation may only be during the data collection and presentation of outputs. This research has adopted the following view of PGIS and PPGIS; PGIS is a technical form of GIS with some degree of people participation where participation is minimal and could be limited to data collection or even simply in the choice of data inputs, analysis and presentation (McCall, 2003) while PPGIS is the application of geospatial information and GIS technology in public processes that affect the communities' livelihood. This may include data collection, mapping, analysis and/or decision-making. The usage is distributed across members of the public, individuals, grass roots groups and any other stakeholders (Figure 1.1). Various data collection techniques are used in PPGIS and they can be broadly classified into Participatory Rural Appraisal (PRA) techniques (oral

narrations, historical time lines, interviews, focus group discussions, community visioning and sketch mapping) and Geographic Information Technologies (scale mapping, GPS survey, Participatory 3-D Mapping (P3DM), Mobile GIS/GPS, satellite and imagery).

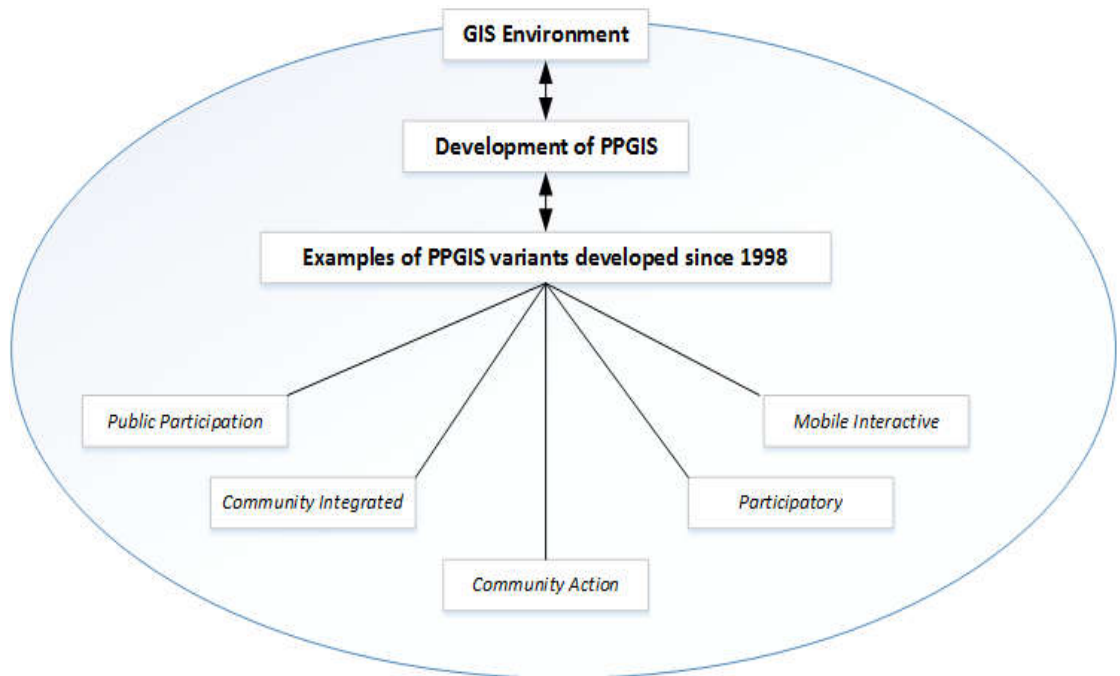


Figure 1.1: Examples of PPGIS

Source: Stewart et al. (2008)

Table 1.1: Characteristics of GIS and PPGIS

<i>GIS</i>	<i>Dimension</i>	<i>PPGIS</i>
Technology	Focus	People and technology
Facilitate official policy making	Goal	Empower communities
Supply driven; technological push	Adoption	Demand and need driven
Rigid, hierarchical & bureaucratic	Org. Structure	Flexible and open
Because it is possible	Why use it?	Because it is needed
Specified by technologists	Details	Specified by users / focus groups
Led by independent specialists	Application	Led by facilitators/group leaders
General/multi purpose applications	Function	Specific, project level activities
Urban-based	Location	Rural-based
Top down	Approach	Bottom up
Capital intensive	Cost	Low cost

Source: Kyem (2000)

PPGIS has the potential to visualize spatial interests, potentials, needs and information of communities through involvement and inclusion of the marginalized (Table 1.1). Goodchild (2000) refers to the geospatial information obtained and disseminated through community driven participatory initiatives as Volunteered Geographic Information (VGI). Participation creates a sense of ownership which is a critical success factor in the community mapping initiatives. McCall (2003) observes that such approaches can thus contribute to good governance because they minimize conflicts of interest between the 'governed' and the 'governing'.

PPGIS provides a unique opportunity for public participation in culture mapping and cultural resource management. The public is continuously engaged through the technique's goals of; incorporating local knowledge, integrating and contextualizing complex spatial information, allowing participants to dynamically interact with inputs, analysing alternatives, and empowering individuals and groups. The technique also utilizes a range of geospatial information management tools and methods to represent community spatial knowledge in the form of maps that can be used for information exchange, discussions, analysis and decision-making (Rambaldi, 2006). An added advantage is that web and mobile based PPGIS applications of culture mapping are highly

interactive and multimedia driven making them easy to use even for the inexperienced user, an important aspect in community driven spatial planning.

1.2 Problem statement

The Kenyan national policy on culture and heritage (Ministry of State for National Heritage and Culture, 2009) was developed as a benchmark for main streaming culture and heritage into development plans. It sets out to raise awareness and capacity building necessary for integrating culture and heritage into public policy and human development. Within the policy, major components of the Kenyan culture are identified including the necessary creative industries at various levels that will spearhead practices necessary for the rejuvenation of local culture and the preservation of national heritage. Despite of this efforts, Kenya has continued to witness a breakdown in traditional lifestyles and a general decline in cultural distinctions under the influence of a dominant global culture (Njuguna and Deisser, 2016).

Various specific factors have contributed to a decline in the cultural heritage of the study area including Africa as a continent. These factors include but are not limited to; development pressures such as housing, industry and disturbances such as farming, mining; climate change and other climate variables resulting in droughts, floods, change in sea levels among others; theft of portable heritage like artworks; globalization and economic development leading to loss of traditions and indigenous knowledge; cultural disasters such as wars and civil unrest; and natural disasters like earthquakes destroying shrines (Bradshaw et. al., 2011). It is important to note that these threats vary in impact from one cultural landscape to another and while some can be mitigated others we have no control over. It is therefore important to document community cultural information at the earliest opportunity available.

The dawn of PPGIS presented researchers with the promise of better visualization of spatial interests, potentials, needs and community information through involvement and

inclusion of all stakeholders. However more than a decade since its inception, the full potential of PPGIS is yet to be realised. In fact Abbot et al. (1998), state that the participation component is the least understood component of PPGIS. Martin et al. (2012) identifies four main constraints that have hindered the success of PPGIS: technological inaccessibility; hardware, software and training costs; access to accurate and meaningful base-layer data; and representational exclusivity (point, line, and polygon). Within the context of local PPGIS initiatives, the degree of participation has been limited and only relies on the traditional field work based techniques such as sketch and participatory 3-Dimension (P3D) model mapping. Martin et al. (2012) further argue that participatory ideals and mechanisms traditionally “reject techniques or technologies which are complex, expensive or time-consuming.” Despite these arguments, Abbot et al. (1998) demonstrate how and why technologies have the potential to complement these participatory mechanisms.

There is a need for a participatory mapping model that utilizes the modern mobile and web technologies to conceptualize a system that will solicit indigenous culture information from non-technical users through familiar and readily available devices. This move from the traditional field based participatory techniques will include a wider stakeholder base while utilizing minimum resources. Such a model will be an advancement of existing participatory mapping approaches used in culture mapping.

1.3 Justification

Modern web and mobile technologies provide researchers with an opportunity to transcend physical barriers that make GIS data collection quite complex and time consuming. Over the past few years, Kenya has witnessed a significant increase in the uptake and use of modern web and mobile technologies. Some of the relevant technology statistics in Kenya include (Communications Authority of Kenya, 2016):

- a) 39.7 million People in Kenya have subscribed to a mobile service provider. This represents a penetration rate of roughly above 91%.
- b) 37.7 million People in Kenya have internet subscriptions and are internet users. This represents an 85.3% penetration rate. It is important to note that in this context the total number of Internet users = $(1MD+10TW+100FFOS)$ where MD is the number of mobile data/internet subscriptions; TW is the terrestrial wireless subscriptions; and FFOS by 100 is fixed DSL, Fibre optic and satellite subscriptions. This is based on the ITU recommendation.

These statistics point to the fact that mobile and web technologies in Kenya have come of age and a significant proportion of the population is familiar with these technologies. This fact presents GIS researchers with the opportunity to tap into this huge user base to foster participative mapping approaches in PPGIS. The study utilizes modern web and mobile technologies in a participatory mapping project aimed at crowdsourcing geographical data from local non-technical GIS users. The developed tool relies on the local participants as the primary source of the required raw volunteered geographical data. Pivoting on modern technology provides a wider and cost-effective means for community participation in participatory mapping as compared to the traditional Participatory Rural Appraisal (PRA) methods. The tool, enabled the researcher to collect more geographical data from a much wider source with relative ease. The tool is freely available and can be adopted to support the collection of any geographical data to be sourced through community participation.

Furthermore for the Abanyole community of Emuhaya, the research has yielded a geodatabase that will serve a culture repository for generations to come. The repository is freely accessible and with proper maintenance and upgrading the culture database can be used to support sustainable development and cultural tourism in the area. The system model serves as a pilot for similar culture mapping approaches in other areas of Kenya as well as other administrative units in other jurisdictions of the world.

1.4 Research objectives

1.4.1 Main objective

The main goal of the research was to develop a participatory mapping model that conceptualizes and constructs a system that can be used to create a digital culture repository for Emuhaya Constituency of Vihiga County, Kenya.

1.4.2 Specific objectives

To achieve the main objective, the following specific objectives guided the study;

- i. To review cultural resources mapping and develop an appropriate culture classification scheme.
- ii. To analyse culture and cultural perceptions in Emuhaya.
- iii. To develop a participatory mapping model to be used to create a digital culture repository for Emuhaya.
- iv. To propose a software development methodology suitably adapted for public participation GIS applications.

1.5 Research questions

- i. How can the current Emuhaya cultural resources be classified for the purpose of georeferencing and visualization using maps?
- ii. What are the perceptions of culture and cultural resources in Emuhaya?
- iii. How can the existing participatory mapping models be improved to support culture mapping through digital culture repositories?
- iv. How can the existing software development methodologies be enhanced to better meet the needs of participatory mapping applications?

1.6 The study area

Emuhaya sub-county is located in Vihiga County of western Kenya (county code 38). The sub-county is bordered by Vihiga sub-county to the south and Sabatia sub-county to the east (Figure 1.2). A sub-county is a geopolitical area that is represented in the National Assembly by an elected representative; a Member of Parliament (MP). Emuhaya sub-county formerly Emuhaya constituency, was previously identified by the constituency code 164 before being split after a boundaries review in 2010 (Independent Electoral and Boundaries Commission, 2012). According to the 2009 national census, the constituency had a total estimated population of 185,069; male being 87,136 and female 97,933 (Kenya National Bureau of Statistics, 2010).

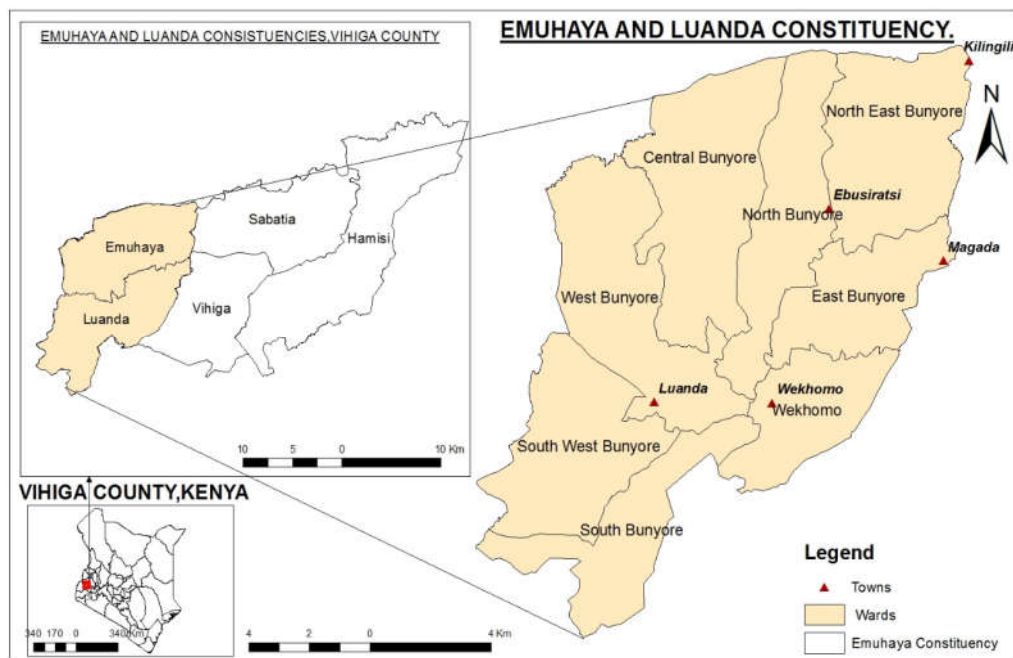


Figure 1.2: Study Area: Emuhaya Constituency, Vihiga County, Kenya

The total number of households are 43,030 with an average household size of 4.5 persons. The combined area covers 173.46 square kilometres with a population density of 1,126.54 people per square kilometre (Estambale et al., 2008). In 2010, Kenya promulgated a new constitution that redefined constituency boundaries and increased constituencies from 210 to the current 290. Emuhaya constituency was split into 2 sub-counties namely; Emuhaya (code 215) and Luanda (code 214) sub-counties. Emuhaya and Luanda sub-counties are predominantly inhabited by the culturally rich Luhya community from the Abanyole sub-tribe. The Abanyole sub-tribe has a total of 22 clans residing in the study area. The clans are culturally rich with variations in material and non-material culture.

1.7 Why culture mapping in Emuhaya Constituency

The study focuses on the Luhya community that is coincidentally the oldest tribe in settlement history having migrated from Congo, then into Uganda and finally settling in the Western part of Kenya and as far as the shores of Lake Victoria in Kisumu over one thousand years ago (Ipara, 2000). The community is the second most populous tribe in Kenya (Kenya National Bureau of Statistics, 2010) with a total of 18 sub-tribes; Abakhaayo (Khayo), Abanyala (Banyala or Nyala), Abanyala be Naomi, Abanyole (Banyore), Abakabras (Kabras), Abashisa (Kisa), Abamarach (Marach), Avalogooli (Maragoli), Abamarama (Marama), Abasamia (Samia), Abatachoni (Tachoni), Abatiriki (Tiriki), Abisukha (Isukha), Abidakho (Idakho), Abatsotso (Batsotso or Tsotso), Ababukusu (Bukusu), Abawanga (Wanga) and Abasonga (Songa).

A study conducted by Ipara (2000) revealed that the Luhya cultural resource base is rich and diverse with a detailed history spanning hundreds of years. The data used in the study was collected through field surveys, formal/informal discussions and observations. Table 1.2 lists the generic cultural resources of the Luhya community common to all the sub-tribes. The resources are then further classified into material (tangible) and non-material (intangible) resources.

Cultural heritage preservation efforts will increase the opportunities for cultural tourism in Emuhaya and Western Kenya as a whole. The region is rich in geographic, cultural and natural diversity that can be exploited for economic gain through targeted tourism initiatives. The region has been designated as a tourism circuit which covers the Lake Victoria basin which includes the entire tourism activities inside and around Lake Victoria in Kenya. The circuit offers the cultural tourist visits and experiences to some of the following events/activities/places; markets, traditional foods, factories & plantations, traditional fishing, bird watching, boda boda (bicycle) rides, forest visits, circumcision ceremonies, religious ceremonies such as prayers, rituals and dances, medicine men, rain makers, traditional farming practices, community/village meetings and other formal events with a traditional inclination. This cultural phenomena and indigenous knowledge can be used as leverage to create unique experiences and cultural attractions for the modern tourist.

Table 1.2: Luhya Cultural Resources

Material Culture	Non-material Culture
Cultural heritage sites (sacred graves, caves, granite rocks, waterfalls)	Traditional ceremonies and festivals (initiation, bull fighting, and marriage.)
Historic ruins and landscapes (Gold mine ruins)	Folk media (songs, music, dances, myths, folk tales)
Sites associated with historic events and people (hills, rocks, caves)	Traditional farming practices (Agro forestry, mixed cropping)
Musical instruments (drums, horns, flutes)	Traditional food processing and storage techniques (smoking, salting, drying)
Traditional arts and crafts (baskets, mortars, pestles, mats)	Herbalism and herbal practice
Traditional regalia (Ceremonial robes, hoods fly whisks, traditional stool, spear, shield)	
Traditional cooking stoves	
Traditional huts	
Indigenous wildlife (frogs, leopards)	
Traditional medicine	
Traditional utensils (earthenware, wooden utensils)	

Source: Ipara (2000)

1.8 Scope

The study focused on the application of a participatory approach to mapping of tangible and intangible culture of the Abanyore community in Emuhaya Constituency of Western Kenya. The entire study period lasted between the years 2012 and 2016. A detailed literature review was undertaken to establish current approaches in participatory culture mapping and any opportunities arising for technology driven participatory approaches. The research further collected data on culture and culture perceptions from respondents in the study area. This data was collected between July and August of the year 2015.

The research yielded a participatory mapping model that utilizes mobile and web technologies to implement a digital culture repository for the study area. The platform relies on information that is crowdsourced from respondents in the study area. User participation on the platform is purely voluntary, however all the information is disseminated freely. In addition, the research also presents a software development methodology suitably adapted to the development of GIS public participation portals similar to the Emuhaya culture mapping portal.

1.9 Limitations

The study focused on an area of study that is quite small in relation to the entire country and context of a digital cultural repository. The selection of the area was guided by the resources available for the study and proximity of the area to the researcher. During the culture survey, mistrust from the respondents hampered detailed engagements and discussions. The mistrust arose due to the approaching national elections that were held in August 2017, a few months after the fieldwork.

Inadequate reference material on participatory models for culture mapping locally in books, online repositories and journals also limited the research. Most of the local culture

mapping exercises have been executed as projects focusing on specific interests of the funder and not as scientific studies whose results are widely disseminated. Finally deep knowledge of GIS and remote sensing was fundamental for the project but the researcher had an IT background at both undergraduate and graduate levels. This resulted in much time being spent on fundamentals of GIS and literature review which ultimately delayed the overall completion of this work.

CHAPTER

LITERATURE REVIEW

2.1 Introduction

Culture can be better examined through two inter-related perspectives; the psychological and physical perspectives (Kessing and Kessing, 1971). The psychological perspective is concerned with what people think. Attitudes, beliefs, values and ideas are examples of concepts under this perspective. The physical perspective highlights what people do. Cultural industries, artworks, ways of life and products are some of the concepts covered within the psychological perspective. The psychological aspects inform and formulate the physical actions of culture.

The UNESCO Framework for Cultural Statistics provides an alternative view of culture. It defines culture by identifying and measuring the behaviors and practices resulting from the belief and value systems within the community. The framework further examines culture through cultural domains and identifies the core set of cultural domains for which data should be collected. The framework identifies the following key domains: cultural and natural heritage, performance and celebration, visual arts and crafts, books and press, audio-visual and interactive media, and design and Creative services. This framework provides a uniform tool for organizing cultural statistics nationally and internationally (UNESCO, 2009a).

Another perspective of representing a community's tangible and intangible cultural assets is provided by The Cultural Resources Framework (CRF). The framework identifies cultural resources by classifying them into eight broad categories; Cultural Industries, Cultural Occupations, Community Cultural Organizations, Cultural Facilities and Spaces, Natural Heritage, Cultural Heritage, Cultural Events and Festivals and Intangible Culture (Evenson & Tilden, 2010). These categories are not considered as a comprehensive list

but as a check list of items that may be used or omitted depending on objectives of culture documentation in a community. The Association of Southeast Asian Nations (ASEAN) declaration on cultural heritage also uses a check list to categorize cultural resources (ASEAN, 2010). Though the declaration was signed by member states, it provides a generic check list that can be applied in any context. The declaration outlines cultural heritage as follows; significant cultural values and concepts, structures and artefacts, sites and human habitats, oral or folk heritage and popular cultural heritage. Similarly, the extent of information in each category is influenced by the cultural richness of the community.

While totally applicable in categorizing cultural resources, the mentioned frameworks appear to be more rigid and structured. Bradshaw et.al. (2011) provide a different view of cultural resources classification. In their publication the authors postulate that cultural heritage should be examined from three perspectives; cultural heritage places; cultural heritage objects, and cultural practices. Theirs is an attempt to split cultural information into fewer categories but in essence still retain as much detail as seen in the previous frameworks. This view of culture has greatly influenced this research as it provides a simple and non-technical view of culture and cultural resources that can be easily understood and used at the community level.

2.2 The theoretical framework

Is there a difference between cultural and natural heritage? In most cases the term natural resources is used in a broader context and is often associated with the environment. These resources contribute directly to the ecological processes and are mostly appreciated for their role in influencing the quality of life in their surroundings. Cultural heritage on the other hand is the result of human use and influence of the natural resources. It has proven to be difficult to explicitly distinguish between the two. Some natural resources like landscapes are significant to cultural groups, some plants are part of important cultural practices like traditional medicine while some resources are critical ingredients in cultural

practices and knowledge systems (Bradshaw et al., 2011). This study has contextualized natural environments and cultural environments as one and the same thing.

Cultural heritage needs to be preserved as it is constantly under threat. Some of the factors that contribute to loss of cultural heritage as identified by Bradshaw et.al (2011) include but are not limited to;

- i. development pressures such as housing, industry and disturbances such as farming, and mining;
- ii. climate change and other climate variables resulting in droughts, floods, change in sea levels among others;
- iii. theft of portable heritage like artworks; globalization and economic development leading to loss of traditions and indigenous knowledge;
- iv. cultural disasters such as wars and civil unrest;
- v. Natural disasters like earthquakes destroying shrines.

It is important to note that these threats vary in impact from one cultural landscape to another and while some can be mitigated, others we cannot control. This therefore provides the justification for documenting cultural information at the earliest opportunity available. However local knowledge is mostly scattered among a few individuals in the community. Rarely is this information collated, georeferenced or visualized using maps. Maps are a fundamental way for displaying and communicating spatial information. UNESCO's Universal Declaration on Cultural Diversity (Torres, 2002) advocates for maps as the preferred approach for representing and studying the cultural and creative industry before policy decisions. Furthermore, maps provide an opportunity for stakeholder participation during the mapping process and can be used to raise awareness about cultural boundaries.

2.2.1 Culture mapping

Culture mapping is a systematic approach to identifying, recording and classifying a community's cultural resources in order to describe and visualize these resources (Evenson & Tilden, 2010). The continued lack of a unified approach when collecting culture information has greatly resulted in duplicated efforts as the same information is collected by different agencies for different purposes. It has therefore become necessary to code this information into an agreed upon framework.

Broadly there are two kinds of cultural resources to be mapped: tangible and intangible cultural assets. Tangible assets are physical in nature and GIS tools and platforms can be used to record them. Intangible assets are the stories and traditions that contribute to the unique identity of the community. A more refined explanation has been offered by Baeker and Brown (2010) where they assert that culture mapping has two dimensions: resource mapping and community identity mapping. Resource mapping involves identifying and recording tangible cultural resources usually making use of GIS tools and platforms while community identity mapping involves exploring the unique stories and traditions that define a community's identity and sense of place (intangible cultural resources). Evenson and Tilden (2010) provide a more detailed list of cultural resources to look out for during a culture mapping exercise (Table 2.1).

Table 2.1: Cultural resources

Cultural resource	Examples
i.) <i>Intangible Heritage-</i>	<ul style="list-style-type: none"> • <i>Oral Traditions, Folklore, Customs and ceremonies</i> • <i>Local Health Traditions</i> • <i>Festivals and Fairs</i> • <i>Social and Religious Practices</i> • <i>Skills and Craftsmanship associated with cultural occupations and creative cultural industries</i>
ii.) <i>Cultural Occupations and Industries</i>	<ul style="list-style-type: none"> • <i>Dance</i> • <i>Dance-drama</i> • <i>Music</i> • <i>Singing</i> • <i>Arts and Crafts (Painting, Pottery, Metal Craft, Carving, Textiles, Organic Food products, Bamboo, Jewellery)</i>
iii.) <i>Built and Natural Heritage</i>	<ul style="list-style-type: none"> • <i>Local monuments or sites</i> • <i>Forests, River, Lakes, Sacred Groves, Orchards</i>
iv.) <i>Organizations & Spaces</i>	<ul style="list-style-type: none"> • <i>Associated Organizations (Government agencies, NGOs, University, Zonal Cultural Centres)</i> • <i>Associated Spaces (Village centre, schools)</i>

Source: Adapted from Evenson and Tilden (2010)

A culture mapping exercise results in the development of a community cultural knowledge base which is important for the following reasons (Baeker, 2009):

- i. To inform planning and policy decisions in cultural development.
- ii. To market and promote local assets to potential visitors thus supporting economic development.
- iii. To widen stakeholder participation in cultural development through dynamic approaches possible in web-based maps
- iv. GIS based culture mapping makes it possible to integrate culture into other planning issues such as land use planning and social planning.

Modern development approaches perceive culture and creativity as the new economic drivers. Culture mapping will support local communities visualize all aspects of their culture including those that often go unnoticed (Baeker and Hanna, 2009; Baeker (2008)).

The idea of incorporating culture and place in planning is not new. Chapin et.al. (2005) trace the origin of modern culture mapping to the Canadian and Alaskan Arctic from the late 1960s. Geographers and cartographers needed a common medium for expressing knowledge of natural resources and their cultural significance. Cartography proved to be the right medium that accommodated both interests. Most of the early mapping was done by anthropologists working with locals, and this led to the training of local cartographers (Crawhall, 2008).

Culture mapping is a critical early phase component of culture planning (Dreezen, 1997). Culture planning only begins when mapping is complete because the map serves as a tool for deepening understanding of local cultural systems while engaging communities in the process. Cultural planning attempts to identify opportunities to leverage resources for larger economic and community benefit and strengthen existing resources while addressing any gaps and deficiencies (Baeker, 2010). Therefore planners need to map before they start planning.

2.2.2 Cultural planning

Cultural planning is a place-based approach to local and regional cultural development (Stevenson, 2005). It is the strategic and integrated use of culture and cultural resources in national, regional and local development (Teaiwa and Mercer, 2011). The goal of the process is to identify and leverage the community's cultural resources, strengthen the management of these resources and integrate cultural resources in local planning and decision-making. Cultural planning has gained widespread attention because culture is now seen as a fourth pillar of sustainability and cultural governance (Hawkes, 2001), the other three pillars of sustainability being; economic prosperity, social equity and

environmental responsibility. It is important to clarify that cultural planning is not an attempt to plan culture but instead it is intended to nurture and cultivate cultural activity to promote sustainable development (Evans and Foord, 2008).

The emergence of cultural planning is as a result of a massive economic revolution shifting towards the creative economies that are rooted in culture and design. This revolution is as transformational as the information revolution that preceded it. Richard Florida is one of the scholars who have greatly contributed to the concept of creative economies. He observes that creativity and culture are the new economic drivers (Florida, 2002). Cultural planning is the least understood type of planning which is a product of the late 19th and early 20th century visionaries such as Patrick Geddes and Lewis Mumford. In their approaches, cities were considered to be cultural entities shaped by their natural and human heritage and a product of the values and beliefs of their citizens.

Geddes approached planning as a human science that required planners to have expertise in anthropology, economy and geography (Geddes, 1949). However in the 1950s and 1960s urban planning underwent professionalization and institutionalization as a function of the local government. This led to the erosion of this holistic approach to planning and instead focused on administration of land and service delivery. However a new breed of visionaries have been responsible for the reorientation of planning back to the holistic view shared by earlier scholars such as Geddes. Jane Jacobs is one such scholar who advocated for place-based and context specific models. Community engagement was also a cornerstone of her philosophy (Jacobs, 1961). Today towns are embracing the vision of cities and cultures envisioned by Geddes. In order to realize this vision, they are embracing an integrated cultural planning approach.

There are very many approaches to cultural planning. However this research takes note of one notable Canadian approach to culture planning that includes recommended time frames for each planning activity (Russo and Butler, 2007). The result is a culture planning model that is practical and well structured (Table 2.2). Implementing a culture plan using

this model should last between 13 to 20 months and the model recommends that any projects taking a longer duration risk losing momentum and those taking a shorter time might compromise on quality and reliability of the information used and also affect community and Government ownership of the final plan.

Table 2.2: Culture planning process

Action Sequence	Description	Duration
Step 1	Preparation	2-3 Months
Step 2	Information gathering and research	4-6 Months
Step 3	Assessment and analysis	2-3 Months
Step 4	Organization and consultation	Ongoing throughout the duration of the project
Step 5	Writing the plan	1-2 Months
Step 6	Public consultation	2-3 Months
Step 7	Finalizing and adoption	1-2 Months
Step 8	Launch	1 Month
Step 9	Implementation, monitoring and review	Ongoing until culture is integrated in all facets of planning and decision making

Source: Adapted from Russo and Butler (2007)

The model also recommends the documentation of the planning process in the published plan as this will serve as evidence that a structured and consultative process was followed as it is key to the successful adoption of the resultant plan.

Cultural planning at the community level may be faced with some barriers. Municipalities in Ontario Canada have had a wealth of experience in this planning process and through a participant survey during a discussion forum the following were identified (in order of priority) as barriers to advancing municipal cultural planning (Baeker, 2005);

- i. need for dedicated financial resources to support planning,
- ii. lack of support from elected officials and senior staff,
- iii. lack of governing body to draw community stakeholders together,

- iv. lack of consensus within the local cultural sector and;
- v. lack of adequate access to tools, information and expertise.

It is expected that developing countries, Kenya included, that will are now beginning to implement cultural planning will face some if not all of these challenges. But of utmost importance is the need for a clear cultural policy framework or legislative foundation for cultural planning at the County level for it to succeed.

2.2.3 Cultural policy

Cultural policy refers to guidelines and directions by agencies and stakeholders of government and governance relating to the cultural field or domain as defined in the relevant international, national or regional jurisdiction (Teaiwa and Mercer, 2011). At the core of any cultural policy are four guiding principles: the promotion and enhancing of cultural identity, the promotion of cultural diversity, support for creativity and creative expressions and increasing access to culture with individuals participating in cultural life. A cultural policy is intended to prevent cultural loss and provide opportunities for culture to contribute to human development in the society. The policy provides the necessary framework to safeguard against culture erosion.

Cultural mapping, planning and policy can be structured into a process known as the Cultural Mapping, Planning and Policy process (CMPP). This process provides an opportunity for both the local and national communities to strategically leverage on cultural resources to foster development and innovation. Furthermore the process enables the recognition of the diverse practices, knowledge and creativity inherent in our local communities. This recognition will enable the leaders and community at large to recognize the advantages of culture and how the cultural sector can be further exploited for social and economic development. When properly managed, this process will allow creative expression, cultural products, ideas, signs, symbols, and sounds appropriate for the national and global market place to flourish.

2.2.4 Participatory culture mapping

Culture mapping and participatory mapping have two different origins and yet greater benefits can be realized from the convergence of both approaches. Participation implies wider public involvement with decisions being shared between the community and decision makers (Bell, 1995). Previously it was assumed that any development only needed to be technically logical and conducted by professionals. These initiatives resulted in conventional solutions that failed because they were inappropriate for the local context and intended beneficiaries rejected the development (Warburton, 1997). It appears that local and indigenous knowledge is a critical success factor especially where the success of development projects relies on histories, culture and other invisible facts.

The application of a participatory approach to culture mapping presents the indigenous and local peoples with an opportunity to defend their cultural rights and practices from the effects of 'modernization' (Crawhall, 2008). Participatory mapping also serves as a political or policy action whose successful outcome depends on advocacy. The maps produced provide opportunities for dialogue among communities, facilitate passing down of knowledge between generations, and provide common ground for addressing shared problems that have spatial dimensions (Crawhall, 2010).

Participatory mapping projects that are centred on participatory methodologies may be used to serve many potential purposes including but not limited to recording and archiving of local knowledge by communities, land-use planning and resource management, advocating for change, supporting good governance, supporting collaborative research, and conflict resolution. Figure 2.1 illustrates the generic steps in the participatory mapping process.

Participatory approaches to mapping have arisen as a result of a paradigm shift from the more technologically driven GIS to the context and issue driven GIS that is community driven. This newer participatory approaches seek to encourage community involvement

in the development and use of geospatial information. This change from expert GIS to community GIS has created an opportunity for the emergence of new instruments to support GIS; Public GIS and Public Participation GIS herein referred to as PGIS and PPGIS respectively.

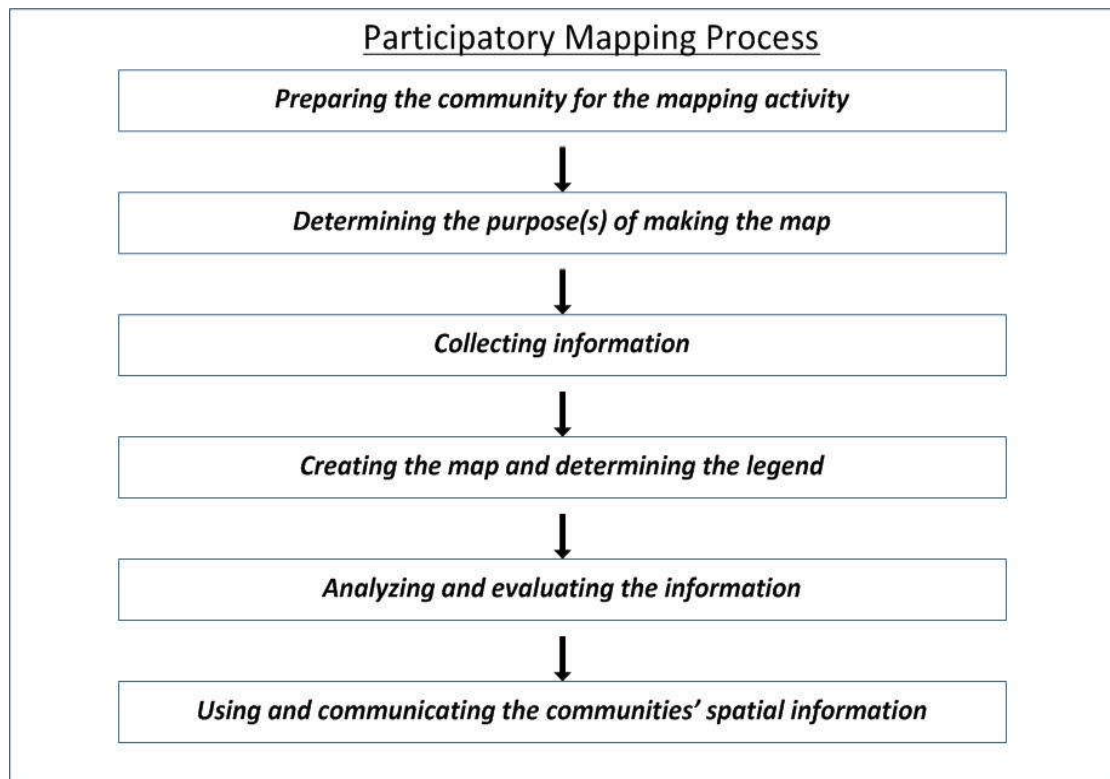


Figure 2.1: Participatory mapping process

Source: Corbett (2009)

Tulloch & Shapiro (2003) define PPGIS as the use and application of geospatial information and GIS technology by members of the public, individually or in groups, for participation in public processes that affect their lives (encompassing data collection, mapping, analysis and decision making). On the other hand PGIS is envisioned as a form of participatory spatial planning (PSP) which relies on maps and GIS (McCall, 2003). The degree of public involvement in the two instruments differs in that PGIS is equated to

technical GIS with some minimum degree of participation from the public. Sometimes the participation may only be during the data collection and presentation of outputs.

This research approaches PGIS as a technical form of GIS with some degree of people participation. The participation is minimal and could be limited to data collection or even simply in the choice of data inputs, analysis and presentation (McCall, 2003). On the other hand PPGIS is viewed as the application of geospatial information and GIS technology in public processes that affect the communities' livelihood. This may include data collection, mapping, analysis and/or decision-making. The usage is distributed across members of the public, individuals, grass roots groups and any other stakeholders. PPGIS incorporates local knowledge and contextualizes spatial information while allowing participants to dynamically interact with the system (Sieber, 2006). Use of the term "PPGIS" traces its roots back to the United States of America and the term "PGIS" emerged from participatory approaches carried out in the rural areas of developing countries which resulted in the merger of Participatory Learning Action (PLA) with geospatial technologies (Rambaldi et al., 2006).

Volunteered Geographic Information (VGI) is also another term that is used to refer to geospatial information offered/submitted by the public. Goodchild (2000) defines VGI as geospatial information obtained and disseminated through community driven participatory initiatives where the citizens operate as voluntary sensors (Goodchild, 2007). However in practice a number of clear differences have emerged between PGIS, PPGIS and VGI one of them being the sampling approach during spatial data collection. PGIS relies on purposive sampling to ensure key stakeholders are targeted during the mapping process. In contrast PPGIS uses probability sampling of individuals through household surveys or interviews to ensure adequate representation while VGI relies on convenience sampling to ensure individual mapping contributions (Brown and Kyttä, 2014).

PPGIS has emerged as a multidisciplinary concept composed of two dominant components; geographic information systems (GIS) and public participation (PP). There

has been ongoing research into this multidisciplinary concept with the main research priorities being centered on how to understand and increase participation rates, recognizing and controlling threats to spatial data, focusing on the human effort (PP) rather than the technology and evaluating the effectiveness of PPGIS (Brown and Kytta, 2014). Participation stands out as a key issue in PPGIS with different research being conducted on how to increase and sustain the same. The role of citizen participation during PPGIS can be identified as one of the following; consultation, advisory, decision making (shared & controlled), or review and comment (Ball, 2002).

Another view is offered by Rambaldi (2010) who suggests that participation during PPGIS can be through one of the following approaches; self-mobilization, interactive participation, functional participation, participation for rewards, participation by consultation, participation through information giving or passive participation. Despite of all these multiple views on participation, it is clear that participation cannot succeed without skilled facilitation. How the participatory process is conducted is far more critical to the outcome than the tools used but it is also important to observe that the modern tools and techniques available in the information age greatly enable and influence the participation roles in PPGIS (Reed, 2008). Though desirable, participatory approaches will still face a myriad of barriers especially in the developing countries. Barriers regarding language, cultural and political traditions coupled with a lack of basic infrastructure still need to be overcome if the participatory projects are to realize their full potential (Kyem, 2002; Martin and Lemon, 2001).

2.2.5 Approaches to participatory cultural mapping

The end product of cultural mapping are the maps produced. However the maps are not the primary purpose of the process but instead they provide a medium for achieving community empowerment and inclusion of the marginalized voices that provide a local perspective on cultural and natural resources (Crawhall, 2010). The overall goal of the process is greater than just creating an inventory of cultural resources. Apart from

involving a variety of mapping techniques, the process also involves dialogues with stakeholders and discussions of current and future societies desirable to the stakeholders (Teaiwa and Mercer, 2011).

Various mapping techniques are available and it is important that the community members are involved in the choice of an appropriate technique. According to Corbett et al. (2010) the key factors to be considered during the choice of an appropriate methodology are; the purpose of the PPGIS activity, resources available, expected outcome and institutional setting or environment. There might be more factors to consider but these will vary from one participatory mapping project to another. The mapping methodologies available for participatory approaches have been the subject of discussion in a number of academic papers. According to (Corbett et. al., 2010 and Poole, 2003), Table 2.3 presents the most common mapping methods used in participatory mapping projects.

After the application of a combination of the mapping methods in Table 2.3, the resultant product is a collection of maps representing various cultural information. The information on these maps can then be used stakeholders. Some of these stakeholders include; local, county and national governments, community-based organizations, inter-governmental organizations, non-governmental organizations, academic institutions and the local community (UNESCO, 2009b).

Table 2.3: Participatory mapping techniques

Mapping method	Brief description
Ground mapping	Community members draw maps on the ground using and available materials for example sticks. The maps are normally reconstructed from memory. Suitable for non-experts but the final product is fragile and technically inaccurate.
Sketch mapping	Free-hand drawings on paper. They represent the broad views of features as perceived by the map-maker. They lack a consistent scale or geo-referencing.
Transcent mapping	Conducted through walking and mapping along a transect line. The aim is to cover as many features as possible along the route. Useful for establishing patterns and interrelationships in the community.
Scale mapping	This are maps drawn such that any distance on the map represents an equivalent distance on the ground. Knowledge can be gathered through holding conversations around a scale map or rigorously developing a scale map from scratch using survey techniques.
Participatory 3D modelling	Involves physical development of 3D models that locate spatial information. Land use, land cover and other features are located and depicted on the model using push pins (for points), yarns (for lines) and paint (for polygons). Use jointly with GPS and GIS for better results.
GPS mapping	A satellite-based positioning system is used while in the field to get the exact coordinate position (latitude and longitude) of a feature on the ground. Data collected is stored digitally and later using specialized software transferred onto a map.
Aerial and Remote sensing images	This involves collecting pictures from above the earth using cameras mounted on aeroplanes and satellite sensors. The data can then be geo-referenced and converted into a map. They are excellent to use as base maps in the field but it is quite costly to acquire up-to-date images.
Geographic information systems	GIS are computer-based systems that capture, manage, analyse, store and present geo-referenced spatial information. They include data management tools that can work with any digital data for example GPS, satellite imagery and aerial photographs.
Internet-based mapping	Involves the use of dynamic maps served through the internet. Points, lines and polygons can be clicked to present the user with multimedia and textual information on the maps. Both open source and proprietary tools are available for web-based mapping.

Source: Corbett et al. (2010) and Poole (2003)

The created maps need to be openly accessible to yield maximum benefits. It is therefore important to appropriately package and disseminate the outcomes of this participatory mapping process through some of the following means; printed and electronic maps, multimedia documentaries, oral communication through village meetings and national conferences and through Web 3.0 platforms that combine all other forms of communication to provide these data interactively online. Though most beneficial, the

Web 3.0 platforms are biased in favour of men and young people who make up the majority of technology literate people in the community.

Engaging in participatory cultural mapping processes has resulted in massive benefits in communities where it has been used. Broadly these maps tend to visualize what was considered invisible in the past but more specifically the following will be gained: cultural maps assist in decision making; support community empowerment; strengthen cultural resource management; support community economic development; and guarantee transmission of local knowledge systems and promotion of inter-cultural dialogue.

2.2.6 Culture and sustainable development

Culture enables and drives sustainable development. In fact culture is now seen as a fourth pillar of sustainability (Hawkes, 2001). The other pillars of sustainability are economic prosperity, social equity, and environmental responsibility. Culture is key for social cohesion and inclusion and is at the core of the current economic revolution that has led to the emergence of creative economies rooted in culture and design. The UNESCO Universal Declaration on Cultural Diversity identifies cultural diversity as a factor in development. Article 3 of the declarations states that " Cultural diversity widens the range of options open to everyone; it is one of the roots of development, understood not simply in terms of economic growth, but also as a means to achieve a more satisfactory intellectual, emotional, moral and spiritual existence" (UNESCO, 2001).

Culture is simply defined as a way of life and development defined as the process to improve the quality of life of locals. There is an inter-relationship between the two concepts that suggests it is futile to pursue development initiatives without any regard for the prevailing culture on the ground. Earlier development theories greatly undermined the role of culture in development. However we have witnessed a massive shift where culture has a critical role in fostering ownership of individuals and communities in the elaboration

of a holistic approach to development. Figure 2.2 illustrates the perceived relationship between culture and development.

Various scholars have provided explanations about the relationship between culture and development. One such scholar, Kreszentia (1999) broadly outlines that culture contributes to development initiatives through the following ways;

- i. Providing new opportunities for communities to generate incomes from their own cultural knowledge and production.
- ii. Serves as a catalyst to local-level development through the diverse social, cultural, economic, and physical resources that communities have to work with.
- iii. Conserving and generating revenues from existing assets by reviving city centers/towns/markets, conserving socially significant natural assets, and generating sustainable, significant tourism revenues.
- iv. Strengthening social capital and in particular, providing a basis on which poor, marginalized groups can pursue activities that enhance their self-respect and efficacy while strengthening
- v. Respect for diversity and social inclusion so that they can share in the benefits of economic development
- vi. Diversifying and intensifying strategies for human development and capacity building for knowledge-based dynamic societies.

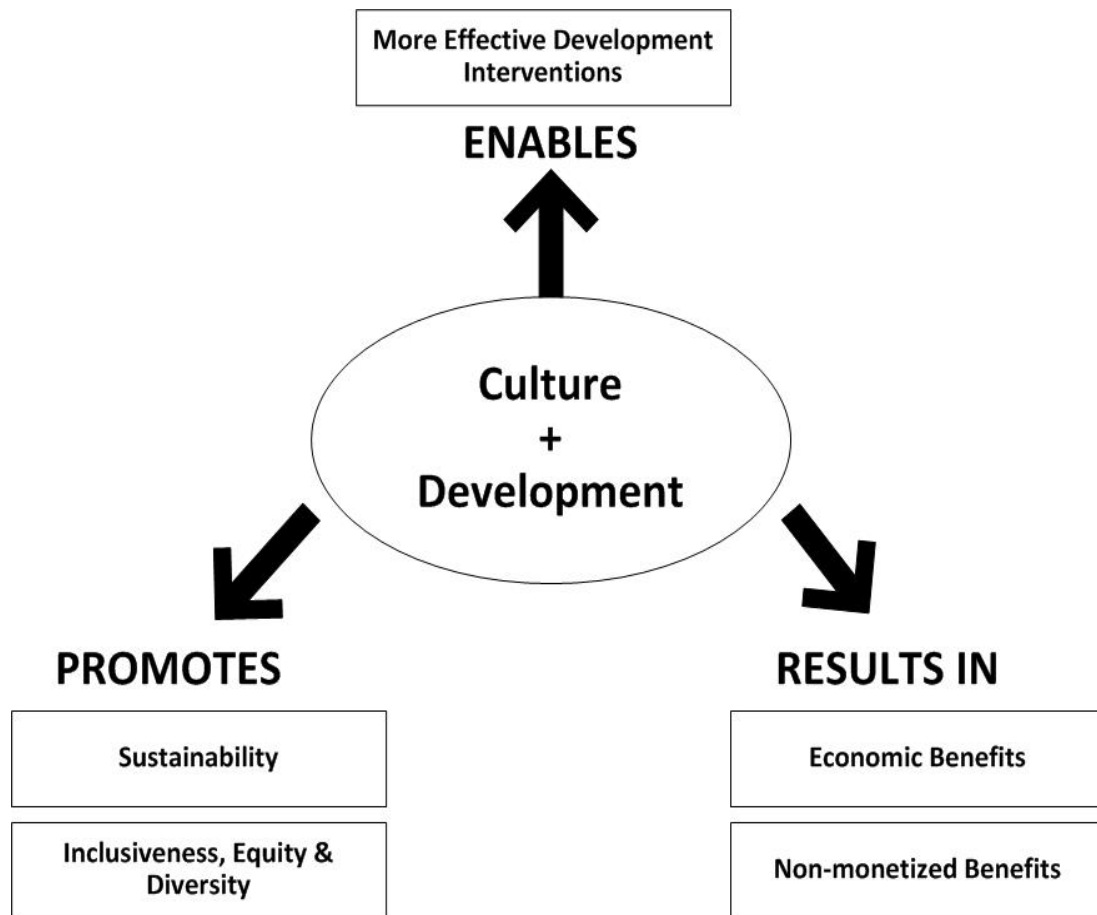


Figure 2.2: Relationship between culture and development

In a nutshell, developing countries can take advantage of cultural heritage, cultural and creative industries, cultural tourism and other cultural infrastructure to generate revenue that directly results in economic benefits. This is possible mainly because of their rich cultural heritage and sustainable labour force.

The governments in developing countries are beginning to realize the important role of cultural heritage in sustainable development and have started developing a broad range of policies at the national and sub-national levels to preserve and support their growth (Kreszentia, 1999). Cultural mapping is emerging as one of the favourite approaches being used to study and understand the spatial distribution of culture before making policy

decisions. The mapping process is a comprehensive effort to document the spatial information of all the tangible and intangible cultural assets during which a lot of awareness and collaboration can be nurtured across a wide range of stakeholders which can then be used to build momentum that can then influence public-policy making.

2.2.7 Cultural heritage and cultural tourism

Relentless cultural heritage preservation efforts such as culture mapping have given rise to culture tourism as an alternative product to traditional nature tourism (Reid, 2000). However cultural tourism is by no means a new phenomenon and for many centuries people have travelled seeking adventure and new experiences of different cultures (Ipara, 2000). Currently culture is the main driving force behind tourism in the global arena. Areas/places designated as world heritage sites attract a broad range of tourists annually (Table 2.4).

Table 2.4: World heritage sites

Region	World Heritage Sites	
	Cultural	Mixed
Arab States	55	1
Europe/North America	347	9
Asia/Pacific	109	9
Latin America	76	3
Africa	30	2
Total	617	24

Source: International Council on Monuments and Sites (2005)

It is this desire to experience and consume cultural heritage that drives tourists to visit a destination. Modern era tourists are more interested in understanding culture other than just experiencing the traditional beach and wildlife attractions (Silberg, 1995; Alzua et.al., 1998). It is therefore in the best interest of every stakeholder to conserve culture nationally and regionally.

Literature suggests that different authors have over the years developed different definitions for cultural tourism. Wood (1993) defines cultural tourism as the art of participating in another culture with the aim of understanding a people's cultural identity. Richards (2001) states that cultural tourism involves the consumption of cultural products of the past (artefacts) and the contemporary culture or 'the way of life' of a people or region. However what is clear from all these definitions is that cultural tourism is a multifaceted concept whose scope is difficult to determine and explain (Ipara, 2000).

In order for cultural tourism to succeed, a bottom up planning approach should be adopted. The traditional mass tourism planning approach conducted at the national level tends to lock out the local community which results in negative gains (Reid, 2000). An integrated planning approach to cultural tourism development will be more favourable as it brings together the consumer (tourist), the supplier (industry, national government) and the producer (community, environment). Such a model is illustrated by Mairr et al. (2000). Community involvement in cultural tourism will result in increased capacity development that will be beneficial to other development initiatives within the community.

Cultural tourism will therefore support rural sustainable development through the creation of jobs and local economic linkages. Locally if Kenya is to maintain its position among the leading tourist destinations in Africa, there is need for the country to diversity its tourism to include the country's unique and diverse cultural attractions.

2.3 Cultural mapping case studies

Culture mapping initiatives have been conducted in different sections of the world in the recent past. It is important to note that cultural mapping is not as widespread in Africa as it is in the rest of the world (Poole, 2003). Most African countries are still plagued by technical barriers such as poor Internet connections. Statistics as at June 30, 2014 indicate that Africa had around 298 million Internet users. This represents a 26.5% penetration rate with the majority of these users being located in urban areas where there is adequate social

infrastructure. In Kenya the Internet penetration rate is 47.1% (Miniwatt Marketing Group, 2014). Despite of this relatively low Internet penetration rate in Africa, several cultural mapping initiatives have successfully been implemented. The following sections highlight some case studies of cultural mapping projects in Kenya and around the world.

2.3.1 Case Study 1: Community mapping in the Bethlehem Area

This was conducted in Palestine in the three historic towns of the large Bethlehem area (Beit Jala, Beit Sahour and Bethlehem). The mapping process was part of a wider conservation and management plan called the Bethlehem Area Conservation and Management Plan (BACMP). The mapping process involved a local community team whose main role was to reduce the cultural barriers between the international consultants and the local people. The local team was well versed in the social, cultural, linguistic and logistic aspects of the study area and their contribution greatly contributed to the success of the project. The main objective of the project was to raise awareness about the historical cultural heritage of the study area to children in 9 schools in the area. For this particular study, the intangible outcomes were more important than the tangible outcomes. The tangible outcomes were in the forms of maps that were displayed in a number of places and the intangible outcomes were a deeper sense of belonging and reinforced identity amongst the participants and community at large (Duxbury et. al., 2015).

2.3.2 Case Study 2: The reindeer herders around lake Khovsgol, Mongolia.

This project involved the mapping of the local reindeer-herders Darkhad and Tsaatan culture who live around the Lake Khovsgol in Mongolia. The project identified that the group suffers from social and cultural difficulties resulting from poor Government policies, modernization, tourism and depletion of natural resources which has resulted in the disappearance of traditional knowledge. The main objective of the project was to address the critical issues of protecting the natural landscape of the Khovsgol region where

the Tsaatan people evolve and depend upon and document their oral traditions and cultural heritage.

Some of the intangible heritage of the community includes Reindeer breeding, Bear hunting, Marriage ceremony, Language and oral traditions, Traditional wigwam and Birchbark containers. The result of culture mapping that involved the locals were maps of the area clearly showing the tangible and intangible cultural expressions. These maps were consolidated into the overall effort of developing a preservation strategy for Lake Khovsgol and the Tsaatan and Darkhad peoples (UNESCO, 2004).

2.3.3 Case Study 3: The Kampong Ayer (water village) redevelopment plan

This is a project that was carried out in Brunei Darussalam in an area called the Water Village (Malay: Kampong Ayer) situated in the Brunei Darussalam River with a population of about 39,000 persons. The village is made up of 42 villages spread across 6 wards linked over 36 kilometres and rich in cultural heritage resources, for instance the buildings constructed on stilts above the river. There have been a lot of changes in the villages over the years with traditional crafts being dropped for other activities such as transport. Previously each ward had a unique craft that defined its identity but that is no more. Accidental fires have also introduced gaps in the once tight settlements predominantly constructed from timber. The culture mapping exercise was part of an effort to exploit Kampong Ayer for economic benefits as a tourist destination. Brunei Darussalam's key tourism strategy was to develop a cultural centre on Kampong Ayer. The centre was completed in 2009 by the Tourism Development Department of the Ministry of Industry and Primary Resources. The centre is a major venue for the tourist to learn about the history, culture and traditions of Kampong Ayer before undertaking a discovery tour into the network of timber walkways and bridges, winding their way through the houses standing on stilts above the water. The centre uses galleries to present the tourist with a unique understanding of the way of life (past and present) that has existed in Brunei Darussalam River. The project is a good example of where cultural mapping of

tangible and intangible resources has been incorporated into urban planning and economic development (Cook and Tyler, 2013).

2.3.4 Case Study 4: A cultural catalogue in Tartus

The project was conducted in Tartus (Syria) as part of a large European Union project on cultural heritage and urban regeneration that involved a number of Mediterranean port cities. The project aimed at raising local awareness about cultural heritage and creating a heritage trail making the tangible and intangible cultural features more visible. The process was not open to the general population but instead participants were a restricted group drawn from civil servants, leaders of national institutions related to urban planning, tourism and heritage preservation. This was mainly due to financial restrictions imposed on this component of the project. The overall results of the project were maps that organized heritage long trails making heritage more accessible and enjoyable for tourists. The maps also provided important knowledge that was used as a source of information for the further planning stage of the project (Duxbury et. al., 2015).

2.3.5 Case Study 5: Kiowa people of Oklahoma in the United States

UNESCO in partnership with the Buffalo Trust undertook a cultural revival project for the Kiowa people of the United States of America. The overall objective of the project was to foster and encourage inter-cultural and intergenerational dialogue. This was achieved through mapping workshops that were aimed at identifying and mapping needs, capabilities, resources and capacities of the Kiowa people. This output was further used to produce local content for media. Participatory video production by the young people of the Kiowa community was further used to document the elders' knowledge (UNESCO, 2009b).

2.3.6 Case Study 6: Cultural mapping in Africa

UNESCO in partnership with the South African San Institute (SASI) conducted a culture mapping project with the Khomani San community to audit and manage their cultural resources as part of the displaced indigenous peoples. It is important to note that the outcome of this project was a publication that catalogues the tangible and intangible cultural heritage. The project worked with the elders in an effort to create a culture inventory and encourage intergenerational dialogue that results in the young people being involved in cultural resources management systems and practices. It is important to note that a key element of the project was to make the intangible heritage tangible through the publication thus making its value and applicability more evident to third parties (Crawhall, 2001).

UNESCO in partnership with Protection et Revalorisation des Cultures en Voie de Disparition (PROCED) an NGO, partnered in a project titled "Protection of the Cultural Resources of the Pygmies in Gabon and their Integration into Processes of Development", a cultural mapping project aimed at protecting cultural resources of the Pygmies in Central Africa. The project resulted in the creation of an inventory of the sites inhabited by the pygmies as well as their cultural resources. This project resulted in better visibility of the pygmies' traditional way of life and this served as a communication tool when planning for development and formulating policies for the community (UNESCO, 2009b).

2.3.7 Case Study 7: Cultural mapping in Kenya

Cultural Mapping has started gaining widespread application in the Kenyan context. Just like many other African countries, Kenya is experiencing rapid 'modernization' and increased population density which has negatively affected its cultural heritage. The Government, community based organizations, non-governmental organisations and other community stakeholders have started embarking on culture and cultural mapping projects

with aim of protecting and preserving the local culture from erosion. The results of a literature review of the topic are presented in the following paragraphs.

One of the earliest participatory mapping exercises in Kenya took place in 2006 in an attempt to map ancestral territories of the Ogiek community. The Ogiek are a hunter-gatherer indigenous community that lives within the Mau Forest. However their existence was threatened through the destruction of the forest by settlers and wood harvesting. Furthermore their small number made it possible to exclude them politically and take over their ancestral land. Participatory 3-Dimensional Models (P3DM) were developed over a period of 11 days which involved school children, teachers, elders and men and women delegated by their 21 clans (Rambaldi et. al., 2007). A similar mapping exercise was carried out with the Sengwer and Yiaku indigenous communities in Cherangany hills and Mukogodo forest respectively (Muchemi et al., 2009).

In 2011 a project by African Cultural Regeneration Institute (ACRI) attempted to map Kenya's creative and cultural industries. It was funded by UNESCO International Fund for Cultural Diversity (IFCD) and lasted for one year. The project resulted in a creative/cultural industries map for the 47 counties in Kenya in the 6 cultural domains (Cultural & Natural heritage, Performance & Celebration, Visual Arts & Design, Books & Press, Audio-Visual & Digital Media and ICT) (African Cultural Regeneration Institute, 2012).

Another cultural mapping project involved the mapping of sacred sites along Kathita River in Tharaka district. The project was undertaken by the Institute for Culture and Ecology (ICE) whose goal was to map the Kathita River ecosystem which has a number of sacred sites along its course. An eco-cultural participatory workshop was held to bring the community around the Kathita River together with the aim of thinking and reflecting upon the sacred sites. The mapping involved One hundred and twenty (120) community members who comprise the Eight (8) communities that live along the sacred sites of Kathita River. The community members produced 3 maps representing their past,

present and future landscapes. The project also produced eco-cultural calendars showing changes during the seasons (Institute for Culture and Ecology, 2011).

The literature provides evidence of culture mapping projects within Kenya, however it is important to note that the efforts are not widespread and well documented. This low coverage presents an opportunity for the widespread adoption of participative culture mapping initiatives to preserve the cultural resources of communities at constituency, county and national levels.

2.4 Critiques of existing literature on culture mapping

Culture mapping is an emerging interdisciplinary field that covers several domains. Since its inception, culture mapping has been positioned as a tool that bridges the divide between marginal groups/voices and those in dominant positions usually the administrative class that has the power to make decisions. It is further seen as an exercise of representing an unrepresented knowledge system in a tangible and geo-referenced medium that describes in new ways and accounts for cultural resources of communities and places.

So far the existing literature primarily focuses at culture mapping's contexts, motivations and outcomes as it is believed that these are the key factors to identifying the site and culture problem to be researched or advocated. The reviewed literature has shown that existing culture mapping projects simply relied on pre-constructed guides and toolkits to initiate community and cultural mapping. However this is not practical because in reality this projects tend to behave like ongoing field experiments whose methods continually and opportunistically evolve in response to a number of factors such as the nature of presented problem, the expertise available, including the working assumptions of the participants, the declared purposes, the less obvious agendas, the politics and power relations present, the prior knowledge and understanding of the available research models and approaches, the time and resources available, and so on. This position presents two possibilities; an opportunity for an array of methodologies applicable to this emerging

field or an emerging field in search of an appropriate methodology. So far, the reviewed cases have shown that academic rigour and the application of spatial theory is not a priority in culture mapping exercises. It appears that they proceed to completion without an extensive self-reflection on how the applied methods influence the social realities being mapped.

Culture mapping draws its influence from community empowerment through participation which tends to emphasize practice over theory, action over reflection. Nonetheless best practices continue to inform us that it is through self-reflection guided by theory that the current assumptions and methodologies around culture mapping will be reinforced and refined. As witnessed in PPGIS approaches, culture mapping is increasingly being informed by theory as well as conducted with careful attention to the methods employed. Some of the mapping undertaken in the local context for example the participatory 3D modelling among the Ogiek indigenous people of Kenya, was guided methodically by conventional social scientific ideas. However there is a need for more standardized and rigorous approaches to data collection that would make it possible for comparative analysis across communities.

Conventional ideas about methodological progress still remain influential among community-engaged researchers who want to develop and test their methodologies. Progress can only be achieved incrementally as standardized methods of data collection and classification are more widely accepted, and more accurate maps can be produced. However evidence from existing literature shows that most of the practitioners engaged in cultural mapping take a very different perspective on method and methodological progress. In some cases like the mapping of the Ogiek community, new views on method emerged out of political and practical concerns, mainly the desire to increase citizen participation in the planning process. The theoretic and aesthetic concerns such as the need to recognize and represent both tangible and intangible aspects of culture has also been influential.

The already popular view of tangible and intangible dimensions of culture represents an important moment in the development of cultural mapping as a method of interdisciplinary inquiry. There is a push to reconcile the tangible with the intangible, the objective with the subjective and the material with the immaterial concepts of culture. Methodologically, if one accepts that the intangible, the subjective, and the immaterial are important to what culture is as an object of study, then quantitative methods alone are inadequate. The interest in visualizing these intangible aspects heightens the importance of drawing on cultural research traditions that are primarily qualitative in nature.

Finally, methods have consequences. The employed methods will determine what we see and how we see it. Choosing to count objects or people or other tangible resources, for example, emphasizes evidence that can be quantified, while choosing to focus on questions of context, human perceptions, and social relations emphasizes evidence that cannot be easily measured or described numerically. When the focus is on an understanding of both the tangible and the intangible, an interdisciplinary mixed-methods strategy is called for. Interdisciplinary studies will require researchers to focus from multiple perspectives. These several disciplinary viewpoints, will then enable researchers to produce an integrated picture of the problem alongside several ways to verify the theoretical concepts. Further research to systematically bring together, compare, and assess the range of methodological approaches used in cultural mapping processes would provide a useful grounding to such triangulation efforts.

2.5 Research gaps

In the literature reviewed it was apparent that culture mapping has not yet gained widespread recognition as a discipline locally. Most of the culture mapping initiatives in Kenya have been conducted through partnerships between government bodies and stakeholders with some interest in a particular site or information. Kenya has a National Policy on Culture and Heritage that recognizes the importance of culture preservation but ignores the role of culture and cultural maps in these preservation efforts. In relation to

media, the policy simply outlines the importance of relying on modern technology for culture and cultural information dissemination but once again fails to provide the priority/preference given to each type of media. It is however notable that each type of media is suitable for propagating specific culture and cultural information and it is therefore necessary to select your media in the order of your cultural projects' goals and objectives.

Although culture mapping projects claim to be a participative community driven affair, there has been no attempt to use modern internet and web technologies to drive the process. Instead emphasis is still placed on the traditional participative approaches such as ground, sketch and 3D mapping techniques. This failure to exploit technology has led to the absence of a participatory model that can be used to obtain culture and cultural information through crowdsourcing directly from community participants. The ability to obtain volunteered culture and cultural information will greatly reduce project budgets and greatly promote inclusion and ownership, as participants will want to be closely associated with their contributions. This participatory mapping model transcends physical barriers and relies heavily on the knowledge of the indigenous participants which is the main target for preservation.

This research has addressed the gaps presented as follows; the research has developed a participatory model that makes use of web and mobile technologies to enable direct collection of culture and cultural information from community participants. The model consists of a user friendly mobile and web platform that the users can access, submit registration details and subsequently submit culture information that is presented on various thematic maps. This model allows for first hand collection of cultural information that is then verified by a cultural expert registered in the system before going live. In the recent past there has been a lot of excitement about public participation mapping but little or no practical solutions to execute this process. It is in this pursuit of pragmatic approaches to participatory culture mapping that the developed model offers a breakthrough innovative approach that relies on familiar actions encountered by a typical

mobile and internet user to collect and present thematic culture information. The developed model can be further ported to other mapping applications/areas that require a participatory approach that involves the wider community.

2.6 Chapter summary

Culture is a complex and multifaceted concept that encompasses several domains. The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines culture as " the set of distinctive spiritual, material, intellectual and emotional features of a society or social group, that encompasses, not only art and literature, but lifestyles, ways of living together, value systems, traditions and beliefs" (UNESCO, 2001). Culture within the context of a community acts as a source of identity, creativity and innovation. It is made up of both tangible and intangible assets that are often fragile and may be lost through modernization. Culture is essential for human development as it promotes peace and stability while making development strategies relevant at the local level. This culture responsive strategies empower and include the community in the development agenda. It is therefore necessary to preserve culture by creating cultural inventories of cultural resources and assets. Culture mapping is one of the approaches used to document and preserve information about landscapes, sites, practices, beliefs and territories from the perspective of local and indigenous peoples.

The existing literature shows that there is still a lot of progress to be made in the evolution of methods and methodologies for participatory culture mapping. The practitioners engaged in culture mapping have varying perspectives on methods and methodologies that have been driven by different concerns such as politics and resources available. The review further proved that methods used directly affect the results achieved. In order to fully capture the tangible and intangible aspects of culture, there is a need for a mixed-method interdisciplinary approach to culture mapping.

This research proposes a participatory culture mapping model that heavily relies on mobile and web technologies to collect culture information from communities. The developed model can be adopted to similar participatory mapping projects that require volunteered information from the wider community.

CHAPTER

METHODOLOGY

3.1 Overview

A research process was adopted for this study. The research process begun with some pre-fieldwork activities seeking to establish and justify the context of the research. This was followed with fieldwork activities aimed at collecting both qualitative and quantitative data on culture and cultural aspects and perceptions. The data was obtained through semi-structured interviews and questionnaires administered to the residents of Emuhaya. Satellite data and literature review were also utilized to support the primary data. During the fieldwork, geographical data about current state of social-economic resources/infrastructure was collected and used to create resource maps in the post-fieldwork phase of the project. The post-fieldwork activities involved data cleaning and coding, analysis and design and development of the geodatabase to capture the cultural information as per the identified needs and also visualize the social-economic resources data collected. The geodatabase was further used to support the web and mobile tools that were developed to facilitate the collection of volunteered geographical information from the local users. These developed tools were adequately tested and the test results documented. The collected data was presented in the form of thematic maps. The final phase of the research process involved raising discussions from the findings and report writing (Figure 3.1).

3.2 Data collection methodology

3.2.1 Research design

The research utilized a quasi-experimental design and made use of qualitative approaches. Quasi-experimental design deals with pre-assembled groups. This design was preferred over other designs such as the co-relational design which analyses the relationship

between two or more study variables (Kruglanski et.al, 2002). The author framed experimental and control systems questions. The pre-assembled system comprised of the expectations of the residents of the study area. These expectations were sought through a descriptive survey. Tests conducted in this case comprised of enquiries on the current and expected state in terms of culture, cultural preservation, socio-economic factors, and technology. The responses were analyzed to show the means and standard deviations of the responses. They were then used to inform the system analysis phase which produced the functional and non-functional requirements of the culture mapping GIS. The differences in output of the developed system and the expectations of the residents were then gradually addressed to ensure that the system was in line with the expectations of the respondents.

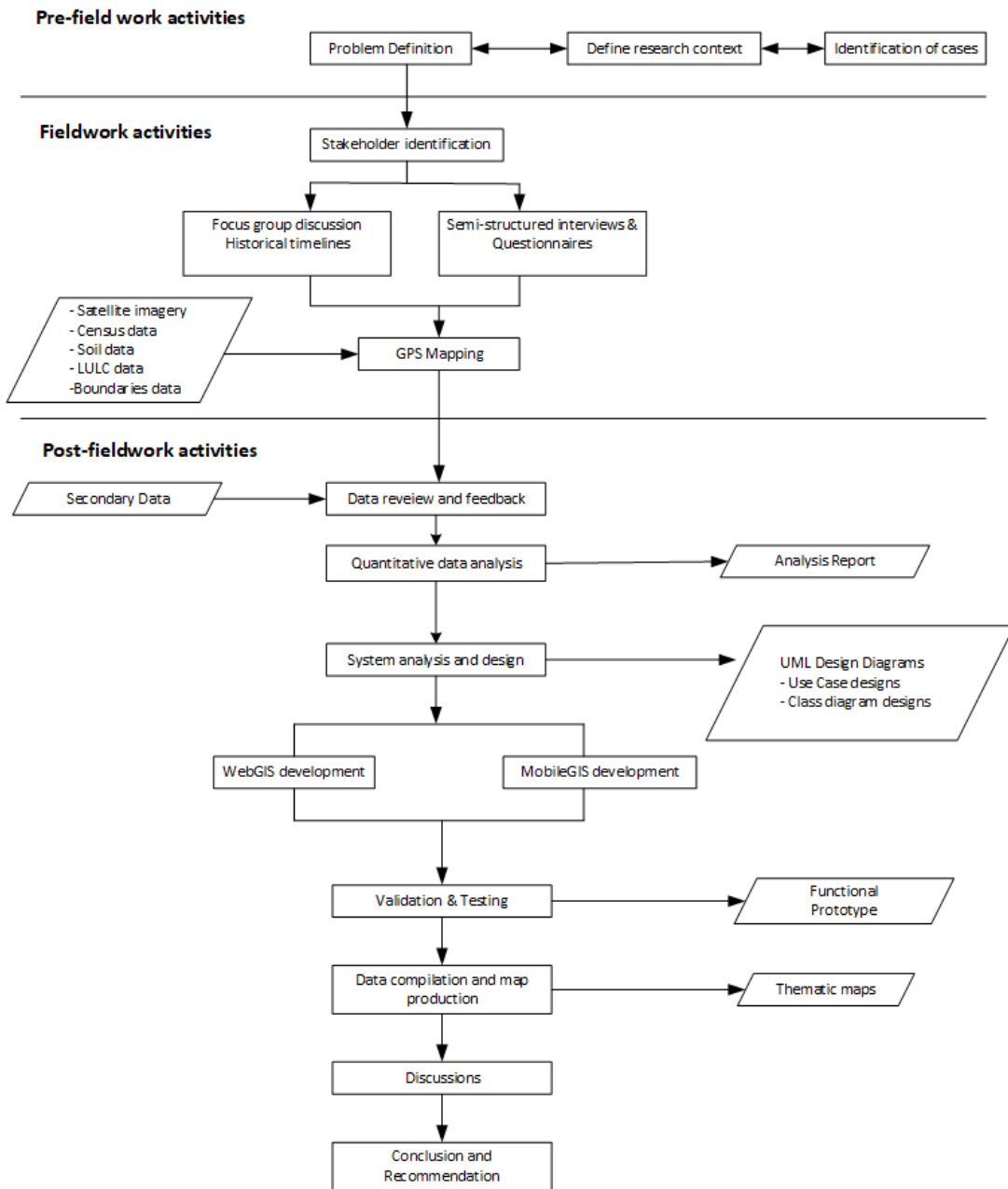


Figure 3.1: Research process

3.2.2 Target population

According to Mugenda and Mugenda (2003), target population in research can be said to be the number of individuals whom the study is interested in describing and making

statistical inferences about. Kombo and Tromp (2006) on the other hand describes population as a group of individuals, objects or items from which samples are taken for measurement in a study, and/or elements that have some similarity. The study targeted the residents of Emuhaya Constituency which is located in Vihiga county of Western Kenya with a total population slightly above 195,000 (Kenya National Bureau of Statistics, 2010). The residents were targeted due to their relevance to the scope and objectives of the research. Moreover, the study objectives revolved around influencing the livelihood of the aforesaid individuals. Administratively it is identified as constituency number 215 while Luanda Constituency its immediate neighbor as number 214.

3.2.3 Sampling frame

According to Denscombe (2014) a sample should be carefully selected to guarantee that it is representative of the population under study and the researcher needs to ensure that the subdivisions made in the analysis are correctly catered for. In this regard therefore, to warrant fair representation of findings to the general population in the study, stratified sampling method was used. This method is preferred since it facilitates the sub division of the population according to inherent similarities. The sampling frame was further stratified by ward. The researcher then used simple random sampling to pick the respondents from each stratum.

A sample size of 384 (Table 3.1) was used which represents a 95% confidence level and a confidence interval (margin of error) of +/-5. Simply put, a confidence level describes how sure you can be that your results are accurate, whereas the margin of error shows the range the survey results would fall between if our confidence level held true. A standard survey will usually have a confidence level of 95% and margin of error of 5%. The sample size was calculated using the following formulas (Kotrlik and Higgins, 2001);

$$Sample\ size = \frac{(Distribution\ of\ 50\%)}{\frac{Margin\ of\ Error\%}{(Confidence\ Level\ Score)^2}}$$

$$\text{True sample} = \frac{\text{Sample size} * \text{Population}}{\text{Sample size} + \text{Population} - 1}$$

The confidence level score is the standard deviation value that goes along with your confidence level. In the case of a confidence level of 95%, the confidence level score would equal 1.96. Distribution, on the other hand, reflects how skewed the respondents are on a topic. It is almost always advisable to choose a 50% distribution, which is the most conservative.

Table 3.1: Sampling frame

Category	Population	True Sample
Residents	195,410	384

3.2.4 Data collection instrument

The study used primary data in addressing the research problem. Primary data was collected through questionnaires which contained questions that were designed to collect data in accordance with the research objectives. The questionnaire was designed to contain both open and closed questions. For the closed questions, a five-point Likert-type scale, ranking from 1 (Strongly disagree) to 5 (Strongly agree) was used for all the constructs with 5 being the strongest/highest. The open-ended questions were used to elicit opinions and feelings from the respondents. See the sample questionnaire in Appendix 6. Questionnaires were the preferred instrument because of consistency as each respondent was issued with the same set of questions in exactly the same way.

3.2.5 Data collection procedure

The questionnaires were administered to the respondents by the researcher assisted by 7 research assistants. Each of the questionnaires was accompanied with a questionnaire forwarding letter and an introduction letter. The questionnaires were then filled with the

assistance and guidance of the team conducting the survey. Upon completion the instruments were collected for analysis.

Pilot test

The questionnaires were designed by the researcher based on the research questions and were pilot tested to refine the questions before they were administered to the selected sample. The pilot test was conducted in April 2015 and it included 10 respondents. This pilot helped in detecting limitations in the design and instrumentation and to provide proxy data for selection of a probability sample. Mugenda and Mugenda (2003) affirm that, the accuracy of data being collected largely depends on the data collection instruments in terms of validity and reliability.

Validity

According to Somekh and Cathy (2005), validity is the degree by which the sample of test elements represents the content that the test is designed to measure. Content validity is a measure of the degree to which data collected using a particular instrument characterizes a certain domain or content of a particular concept. In this regard expert opinion was used to determine the representativeness and suitability of questions and possible rectifications were thereby effected. To establish the validity of the research instrument the researcher sought opinions of colleagues in the field of study especially the lecturers in the departments of Geomatics, statistics, and socio-economic studies in Jomo Kenyatta University of Agriculture and Technology in Kenya. Their opinions and views were collected through mock interviews using the tool followed by detailed desk reviews of the same.

Reliability

According to Mugenda and Mugenda (2003) reliability is increased by including many related or similar items on a measure and by testing a dynamic sample of individuals using

the same testing procedures. The researcher selected a pilot group of 10 individuals from the target population to test the reliability of the research instruments. To test the reliability of the instruments, internal consistency techniques were applied using Cronbach's Alpha. The alpha was computed using the Statistical Package for Social Sciences (SPSS). The alpha value ranges between 0 and 1 with reliability increasing with the increase in value. Coefficient of 0.6-0.7 is a commonly accepted rule of thumb that indicates acceptable reliability and 0.8 or higher indicated good reliability (Mugenda & Mugenda, 2003). The study achieved a Cronbach's alpha value of 0.65 which was considered reliable.

3.2.6 Data analysis

Both quantitative and qualitative methods of data analysis were used in analysing data in the study. The quantitative analysis focused on using descriptive and inferential statistics. Trochim (2006) suggests that descriptive statistics are used to define the basic features of the data in a study or survey. This is because descriptive statistics deliver simple summaries about the sample and the measures. This was done together with simple graphics analysis. The Statistical Package for Social Sciences (SPSS version 21) program and Microsoft Excel (version 2013) was used to generate the frequencies, means, and percentages of the responses. Such frequencies and percentages were crucial in drawing the graphs and charts to visualize the results. Qualitative content analysis was also used to address the qualitative information obtained from the respondents. Hsieh & Shannon (2005) observes that qualitative content analysis is preferred as it allows researchers to understand social reality in a subjective but scientific manner.

3.2.7 Ethical issues

Kimmel (2007) insists on the importance of discerning ethics in the research process. In this regard this study adhered to the appropriate research procedures. Before the questionnaires were administered, consent was sought from the respondents of the study and other stakeholders including The National Commission for Science, Technology and

Innovation (NACOSTI). The respondents were further informed of their right not to take part in the study. Full confidentiality was also assured especially when dealing with questionnaires and the identity of the respondents.

3.3 System development methodology

3.3.1 Web GIS

The methodology used for the development of the web GIS component of the system is the hybrid Y-Model Web GIS development methodology (YWDM). This hybrid methodology is an output of the research and the details of its phases are presented in the results and discussions section.

Software and hardware resources used

To implement the web GIS prototype, the research made use of various hardware and software resources. Mapping software was used to generate maps from the data that was collected in the field whereas a scripting language was used to develop the main components of the web portal. For a complete list and description of the hardware and software resources used, see Table 3.2.

Table 3.2: Web GIS Hardware and Software resources

Hardware/Software	Description
ArcMap	Used in processing the uploaded data after the fieldwork. Was also used to visualize the data.
ArcCatalog	Used in creating the shapefiles
Quantum GIS	Open source GIS software that was used during the creation of the web GIS.
Php Scripting Language	Web scripting language that was used to develop the other sections of the Web GIS server.
Apache	The web server software.
GPS Handset	Used to collect coordinates during the fieldwork
Digital Camera	To capture digital images during the fieldwork.
Microsoft SQL Server Express	Used to store the Geodatabase
MySQL DBMS	DBMS used to store the other data of the web GIS portal.
Erdas IMAGINE	Software used for image processing of the satellite images of the AOI.
Quickbird high resolution	Received on 6th February 2012. Used as a base map for the AOI.
IKONOS high resolution image	Received on August 2006. Used as a base map for the AOI.

3.3.2 Mobile GIS

The methodology employed in the development of the mobile GIS application is based on the agile software development framework that is geared towards timely delivery and customer satisfaction. According to Kaleel and Harishankar (2013), the agile development approach is considered to be a powerful and proficient approach that rapidly accommodates changing needs of the markets and can accommodate modern trends in software development such as mobile application development. The specific agile methodology used in the development of the mobile system in this research is the Agile based Development Methodology for Mobile Commerce applications (ADMMC) (Table 3.3).

Table 3.3: Mobile software development methodology

Phase	Activities	Deliverables
1. Exploration	This step involved determining the requirements of the system. This step relied on user stories and developer experience	Requirements
2. Release planning	This step involved organizing the requirements into various system releases	Release plan
3. Iterations to Release	The first step here was iteration planning. Afterwards in each iteration there was the actual development that involved architecture design, interface design, program & database design and finally the actual programming. System refactoring was also conducted at the end of each iteration.	Architecture report Interface design Program models Database models Program codes
4. Production	This phase involved user acceptance testing and release documentation. All this activities were geared towards certifying the application is ready to go into production.	System release Documentation
5. Maintenance	This involves planning for the next release, conducting the respective iterations to release and production of the next release	System release

Source: Hameed and Oudah (2014)

Software and hardware resources used

The software tools used for the development of the mobile system comprised of Java programming language, the Java platform, the Android SDK (Software Development Kit) and a database management system (Table 3.4).

Table 3.4: Mobile GIS Hardware and Software resources

Hardware/Software	Description
Java	This is a high-level object oriented programming language and used to develop the mobile GIS.
Java platform	This consists of two main components; <ul style="list-style-type: none">• The java virtual machine• The java application programming interface (API).
Android Development Kit	Software The Android SDK provides all the API libraries and tools you need build an Android app.
SQLite Database	SQLite is an open source SQL database that stores data to a text file on a device.
MySQL DBMS	DBMS used to store collected data in the host server.

3.3.3 Testing

Testing is one of the key phases of any software development process. According to Luo (2010), "the overall goal of testing is to affirm the quality of software systems by systematically exercising the software in carefully controlled circumstances". In the context of this project three main types of tests were carried out;

- i. Unit tests - mainly conducted to check the functionality of the main software components. Each unit is tested in isolation from the rest using actual inputs.
- ii. Integration tests - The system developed comprises of a mobile application and web portal that need to work together. Integration testing was conducted to check for compatibility and consistency between the two platforms.
- iii. User acceptance tests (UATs) - This is the final and most important test that involves a sample of the final users of the system. The goal of this test is to have users have a feel of the system and provide you objective feedback on their experience. This feedback was used to improve the system.

Unit and integration tests were conducted and documented by the researcher and they were aimed at confirming that the system meets its overall objective of being able to collect,

store and disseminate geospatial information that relates to culture and cultural resources of Emuhaya constituency.

User acceptance tests (UAT) were the final set of tests conducted on the system. The main objective of the UATs was to check how the system handles the core business as it was assumed that the typical functionalities had already been tested and documented in the previous unit and integration tests. It is common to run two kinds of UATs; Alpha and Beta testing. Alpha testing is normally conducted in the software builder's environment while Beta testing is conducted in the client's environment or the production environment. For this research it was deemed unnecessary to classify the UATs into Alpha and Beta as they both were conducted interchangeably and the results documented.

CHAPTER

PARTICIPATORY CULTURE MAPPING MODEL

4.1 Web GIS platform

This section covers the user requirements discovery, conceptual modelling and design of the Emuhaya Web GIS portal. The presented model is part of the underlying framework that makes up the Emuhaya culture mapping platform.

The core component of any web-based GIS is the mapping and visualization technology. Some of the features to be visualized include high-resolution imagery, routes/directions and thematic maps. Though there has been a rapid evolution of web mapping technologies, there are still a number of mapping constraints. Technical considerations include server performance, maintenance and backward compatibility, scalability, interoperability, total cost of ownership, customization options and network bandwidth capacities (Rao & Vinay, 2009). To address some of the constraints the research referenced and adopted recommendations by Musungu and Jacobs (2015) listed below;

- i. Use smaller file sizes to increase download speeds.
- ii. Incorporate scaling and zooming options in your system.
- iii. Develop a clear visual hierarchy that emphasizes the important elements and logically organizes the contents.
- iv. Use interactive feedback styles like mouse-over events and hotspots.
- v. Use standard and self-explanatory map symbols.
- vi. Use interactive and pop-up legends to explain map symbols.
- vii. Use appropriate font styles and spacing to enhance readability.
- viii. Test the application on the least user configurations and improve through regular feedback.

4.1.1 Web GIS system analysis and design

Analysis is the process of discovering requirements specifications through a close examination of the business processes to be automated while design is the process of specifying the design specifications of the system to be implemented. In a nutshell analysis examines and documents 'What needs to be done' while design examines and documents 'How it will be done'. The project adopted an object-oriented approach for the analysis and the design of the geospatial web-based portal. This process consisted of three major steps;

- i. Use case modelling - This is also referred to as functional modelling. It involved identification of the main participants in the system and the activities carried out within the system. The result of this process is a **use case diagram** that is suitable for discussion with non-technical users of the system.
- ii. Class modelling - This step involved identifying the main classes, attributes, methods and relationships between the classes. The outcome of the process is a **class diagram** that outlines the main structural components of the system.
- iii. Dynamic modelling - The main goal of this step is to show the main flow of activities in the system. The outcome of this process was an **activity diagram** showing the flow of control in the system.

The 3 steps were not conducted in sequence but instead they were carried out in parallel since a change in one diagram triggers changes in all the other diagrams. During the inception of the modelling process the changes on the diagrams were so frequent but towards the end of the process the requirements stabilized with only minor changes affecting individual diagrams.

Use case modelling

The output of this process is a use case diagram which consists of actors, use cases (processes), and a use case diagram. The use cases (processes) are further outlined using formal use case descriptions.

Actors

An actor is a role played in the system. The following are the main actors in the system: web users, registered users, and web portal administrators. Web users are the most general users with the least functionality available. They access the system and are only able to view maps and query geographic features. To access this functionality the web user does not need to be a registered user. On the other hand registered GIS users have access to all functions of their local GIS applications. Apart from being able to view and query maps, the users can also insert, edit and delete geographic features. Finally, the portal administrator is responsible for defining and controlling content that will be available to Web users. For that purpose administrator can specify layer hierarchy through which geographic information will be presented and, depending on a layer type, assign and remove WMS (Web Map Service) and/or WFS (Web Feature Service) services to the layer.

Use cases

A use case is a process happening in the system. The main use cases in the system are as follows: register user, user login, update user profile, view culture, submit culture point, view submitted points, search culture map, update culture map, view static maps, view web GIS, edit map layers, get directions and print map. The interactions between the actors and the use cases have been presented in a use case diagram (Figure 4.1).

Use case descriptions

This section critically examines and explains each use case shown in the use case diagram (Figure 4.1). The aim of the descriptions is to eliminate any ambiguity and duplication in the use cases by explicitly stating the activities involved in each use case while placing emphasis in the chronological order of the activities. The following are the important items to be included in a typical use case description:

- i.) Actor - person or entity that interacts with the system to accomplish a task.
- ii.) Description- high level description of the reason for and outcome of this use case
- iii.) Preconditions - conditions that must have been met before the use case starts.
- iv.) Postconditions - the state of the system after the use case concludes.
- v.) Normal course of events - detailed description of user actions and system responses.
- vi.) Alternative courses - other legitimate use case scenarios that can take place.
- vii.) Exceptions - any error conditions that can occur during the use case execution
- viii.) Includes - other use cases called by this use case.
- ix.) Special requirements - any additional requirements
- x.) Assumptions - Anything that is expected to be true or to have happened before the use case starts.

Use case diagram

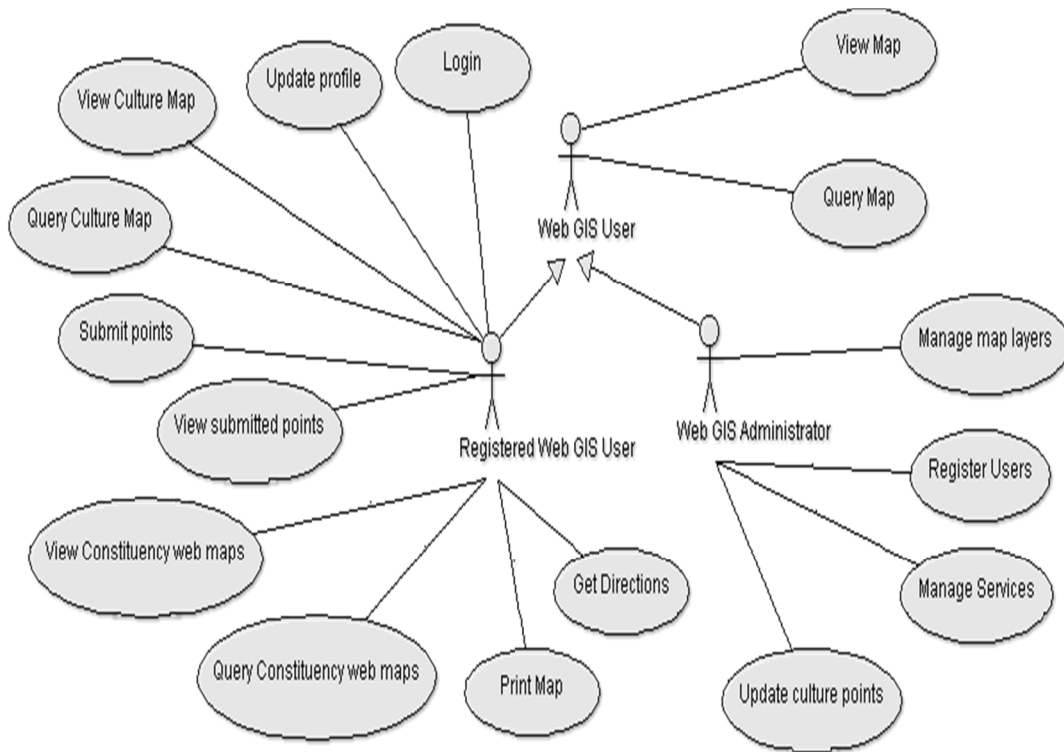


Figure 4.1: Web GIS use case diagram

The presented use case descriptions adhere to the standard format in the UML notation. Each use case description is tabulated with emphasis being placed on the descriptions and normal course of events as experienced by the user when carrying out the activity. Each Table caption represents a use case.

Table 4.1: Register user use case

Actor:	Web User
Description:	This use case is used to register the user on the system so that they can gain access to more functionality such as submitting new data. The users submit their credentials for verification and storage.
Preconditions:	The user has a working connection to the server and is currently on the register user page.
Postconditions:	The user details are successfully stored in the user table.
Normal Course of Events:	<ol style="list-style-type: none">1. Web user accesses the registration form on the register user page.2. User fills all the mandatory fields in the registration form3. User confirms that registration details4. User submits registration form.5. Registration activation email sent to the user's email account.
Alternative Courses:	None
Exceptions:	Invalid entry
Includes:	None
Special Requirements:	User has an active connection to the web portal
Assumptions:	The user had not previously been registered on the system

Table 4.2: Login use case

Actor:	Registered User
Description:	Enables the user to be authenticated on the system.
Preconditions:	The user is a registered user on the system.
Postconditions:	Loads the portal start page
Normal Course of Events:	<ol style="list-style-type: none">1. Access login page2. Provide user name and password3. Submit details.
Alternative Courses:	When user forgets their password, they have to request for an email to change their password.
Exceptions:	Invalid user name or password
Includes:	None
Special Requirements:	None
Assumptions:	The user has a valid user name and password.

Table 4.3: Update user use case

Actor:	Registered User
Description:	Allows existing users to make changes to their stored credentials.
Preconditions:	User has to be validly logged into the system
Postconditions:	Updated user profile stored in the database
Normal Course of Events:	<ol style="list-style-type: none"> 1. Access update profile form 2. Enter relevant changes in the fields 3. Save changes
Alternative Courses:	None
Exceptions:	Invalid entry
Includes:	None
Special Requirements:	None
Assumptions:	The user will only update the relevant fields

Table 4.4: View culture map use case

Actor:	Registered User
Description:	Allows the user to view the culture points submitted.
Preconditions:	User is a valid user and currently logged into the system
Postconditions:	Relevant map is visible on the screen.
Normal Course of Events:	<ol style="list-style-type: none"> 1. Select category to preview 2. Display map 3. Zoom and pan map appropriately
Alternative Courses:	<ol style="list-style-type: none"> i. Activate page to view maps ii. Display all culture points iii. Zoom and pan map appropriately
Exceptions:	None
Includes:	Login
Special Requirements:	User has reliable internet connection
Assumptions:	User is already logged into the system

Table 4.5: Submit point use case

Actor:	Registered user
Description:	Allows the registered user to map new culture points on the culture map.
Preconditions:	User is logged in and on the submit point page
Postconditions:	Submitted point added to the DB and awaiting approval.
Normal Course of Events:	<ol style="list-style-type: none">1. Activate the point submission page2. Zoom in to the appropriate section of the base map3. Identify and select point of interest on the base map4. Enter descriptive data into the fields available.5. Add more fields where necessary6. Save entry
Alternative Courses:	The points can also be submitted via the mobile platform of the system.
Exceptions:	Invalid form entry
Includes:	Login
Special Requirements:	User has reliable internet connection
Assumptions:	Only points within the AOI will be submitted

Table 4.6: View submitted point use case

Actor:	Registered user
Description:	Allows the user to have a look at the data they have contributed
Preconditions:	System is active and user is logged in
Postconditions:	Map with points displayed on the screen
Normal Course of Events:	<ol style="list-style-type: none">1. Activate the personal profile page2. Select submitted points option3. Select point status whether all, approved or pending4. Display
Alternative Courses:	User can also use the same procedure to view points on the mobile platform
Exceptions:	None
Includes:	Login
Special Requirements:	User has reliable internet connection
Assumptions:	None

Table 4.7: Search culture map use case

Actor:	Registered User
Description:	Allows the user to query for specific points on the map
Preconditions:	Search page is currently active
Postconditions:	Display points if any as per the criteria
Normal Course of Events:	<ol style="list-style-type: none">1. Enter description of point to search in the search bar2. Activate search process3. Display results on base map and description on a pop-up form
Alternative Courses:	Multiple points can also be searched by category
Exceptions:	None
Includes:	None
Special Requirements:	User has an idea of the culture items being searched
Assumptions:	Searched for point exists in the map.

Table 4.8: Update culture map use case

Actor:	Web GIS Administrator
Description:	Allows the user to make changes to submitted points
Preconditions:	Admin is logged into the system
Postconditions:	Updated record is stored in the database
Normal Course of Events:	<ol style="list-style-type: none">1. Search point to update2. View point on map and fields on the details form3. Make necessary modifications to fields4. Store changes
Alternative Courses:	None
Exceptions:	Invalid entry
Includes:	Search culture map
Special Requirements:	None
Assumptions:	The point had been previously authenticated and approved by the administrator

Table 4.9: View Emuhaya web map use case

Actor:	Web user
Description:	Allows normal user to check the various web maps on the portal
Preconditions:	Web map page is active
Postconditions:	Web map page remains active
Normal Course of Events:	<ol style="list-style-type: none">1. Load Web Map page2. Select layer to display3. Browse layer contents
Alternative Courses:	None
Exceptions:	Invalid map layer
Includes:	None
Special Requirements:	Stable internet connection to the web server.
Assumptions:	The user observing the web maps has basic information about the area

Table 4.10: Query web map use case

Actor:	Web user
Description:	Allows the user to display specific details from a thematic map layer
Preconditions:	Web map page is active
Postconditions:	Results displayed on thematic map layer
Normal Course of Events:	<ol style="list-style-type: none">1. Select relevant map layer2. Enter search keyword3. Display result if any
Alternative Courses:	None
Exceptions:	Information Does not exist
Includes:	View Web Map
Special Requirements:	None
Assumptions:	The user observing the web maps has basic information about the area

Non-functional Requirements

The most important non-functional requirements for the Web GIS portal designed are *usability*, *scalability* and *openness*. Usability is a very important non-functional requirement, as the system will be used by multiple users distributed all over the world. It is therefore important that the system requires minimal effort and technical GIS competence to learn, use, provide input and interpret results produced. User interfaces have to be friendly with clear program paths that have simple and natural dialogue. Help

menus and other relevant documentation should also be provided as part of the system. Scalability requires that the system have the ability to accommodate a large number of users and large quantities of information. It should also be possible to extend the portal to link it to new web maps and WFSs. Openness is important in the system and can be achieved by use of commonly accepted standards for exchange of data. This requirement is satisfied using Open Geospatial Consortium (OGC) standards Web Map Service (WMS) and Web Feature Service (WFS) for Web services, interfaces and data interchange.

Class Diagram

The preliminary identified conceptual classes and their relationships within the domain of the Emuhaya web portal are shown in Figure 4.3. Below is a brief description of each class in the model.

- i. Web GIS - This is the abstract class that defines the major components of data capture and dissemination.
- ii. Client - This refers to the software that forwards user service requests from the server.
- iii. ClientGUI - Defines the graphical user interface through which the user interacts with the client workstation.
- iv. LocalDB - Defines the database model on the client device.
- v. Server - This refers to the software that responds to the user service requests from the client.
- vi. ServerGUI - This is the server interface that administrator uses to define services and other information relevant to the clients.
- vii. CultureGeodatabase - Defines the geospatial database for storing culture information contributed by the members through the web and mobile platform.
- viii. SpatialData - Defines the spatial data in the database.
- ix. AttributeData - Defines the attribute data associated to a spatial data.

- x. ImageData - Defines the image data captured as part of the cultural information in the system.
- xi. PointData - Defines the point data of culture resources mapped by the users of the system.
- xii. CultureData - Defines the details of a cultural entry.
- xiii. Image - Defines the image stored in the system.
- xiv. User - generalization of the system user.
- xv. Administrator - Defines a specific kind of user that has more privileges and duties in the system.
- xvi. WebUser - Defines a normal user who accesses and queries existing system data without making any contributions.
- xvii. RegUser - Defines a registered user who can contribute new information in the system.

Activity diagram

The purpose of the activity diagram is to show the main flow of activities. The diagram incorporates vertical columns known as "swim lanes" to clearly show and which actor is responsible for the activity. As previously identified, the system will have 3 primary users; the registered user, administrator and web user who is just a normal user who is yet to formally register on the portal. The administrator of the system plays an oversight role of user management, data management and other system related functions illustrated in Figure 4.2. The web user is only able to query and view existing culture maps. However in order to contribute any new culture points, the web user needs to register. The registered user is the one with the most functional privileges on the system. A registered user can basically submit new culture points, view and query submitted points on both the culture maps and the web maps. The activity diagram is shown in Figure 4.3.

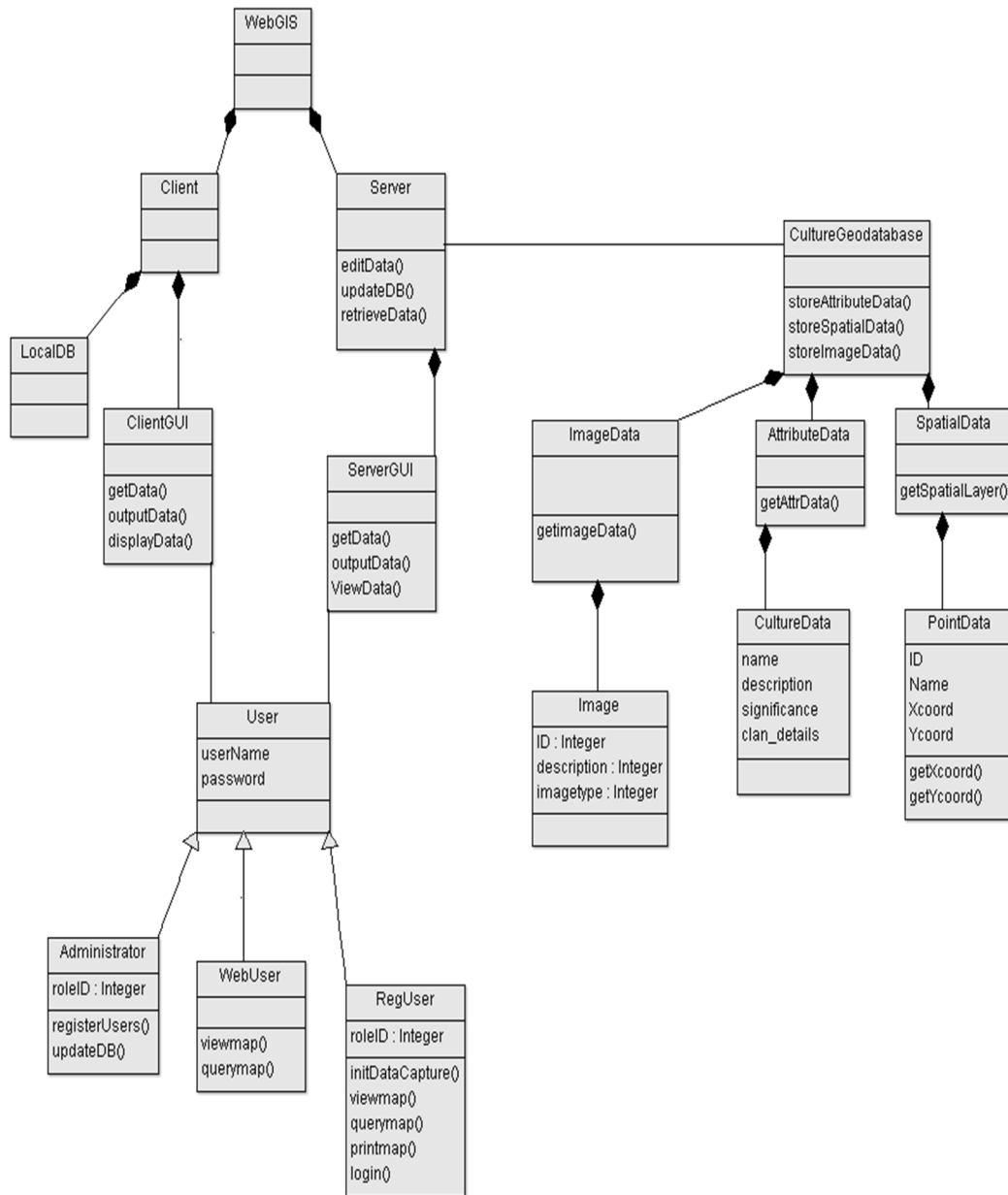


Figure 4.2: Web GIS class diagram

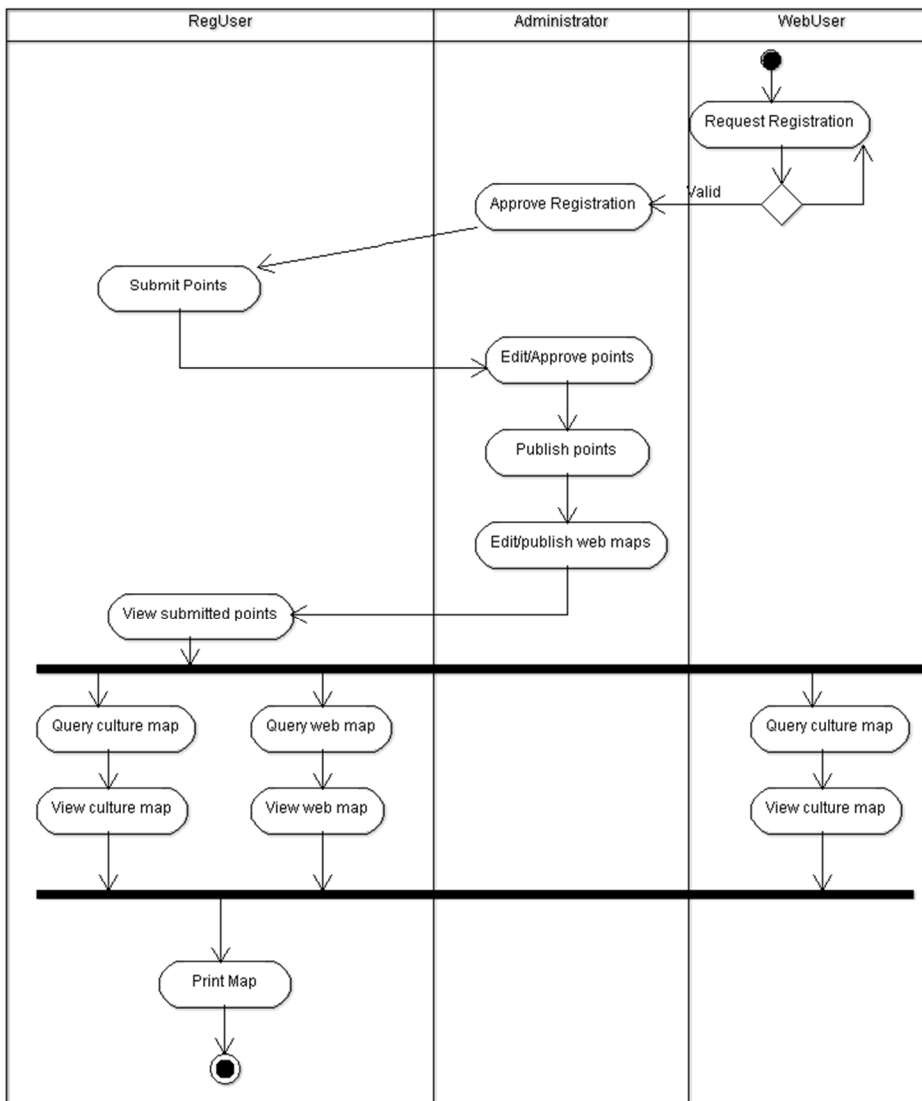


Figure 4.3: Web GIS Activity diagram

4.2.Mobile GIS platform

This section provides a detailed look at the approach used to develop the mobile application used for culture information management. Flora et al. (2014) define mobile software development as the process of creating software products that can work on small, low-power hand held devices such as mobile phones. The software can either be distributed through factory pre-installations on devices or downloads from app stores such as the Google app store or any other mobile distribution platforms. Unlike conventional software engineering, mobile software development poses several challenges. The main challenges of such applications are rapidly changing business requirements and technical constraints of mobile devices such as screen size and resolution, considerably low processing power compared to desktops and memory capacity constraints. However the specific considerations that the developer had to make for this project are:

1. The final users of the systems are not technical users and may lack the know how to navigate through complex system functionalities. It is therefore desirable that the final system has a simple and friendly interface design.
2. The system needs to be location aware as most of the computations will rely on the location details of the user.
3. The final application has to be light weight to allow for easy distribution through the app store or other sharing media.
4. The user demography is so varied that the system needs to find a middle ground that addresses the needs of all the users.

For this research the application developed is considered medium scale and as such the developer was responsible for the idea conception and development. However a lot of emphasis was placed on product quality as the product will be used by a wide customer base with changing needs and expectations. It was thus necessary to make use of a standardized and documented mobile software development methodology. The following subsection examines the methodology used.

4.2.1. Mobile GIS system analysis and design

The project adopted an object-oriented approach for the analysis and the design of the mobile GIS. This process involved three major activities: use case modelling, class modelling, and dynamic modelling. The description of these activities is provided in the following sections.

Use case modelling

Actors

There are two main roles in the system are: guest user and registered user. Guest users are the most basic users with the least functionality possible. Anyone who downloads and installs the system on their device automatically qualifies as a guest user. In order to access high level functionality such as submitting new culture information, the user need to seek approval as a registered user. All registration approvals are automatically handled by the system.

Use case diagram

The following are the use cases (processes) that were identified for this system: register user, login, and view categories, view culture points, add new points, change map view, and find direction. The actors' interaction with the use cases has been represented in a use case diagram (Figure 4.4).

Non-functional requirements

The most important non-functional requirements for the Mobile GIS designed are *usability*, *reliability* and *efficiency*. Usability as a non-functional requirement is important as it guarantees that the final users will require minimal effort to learn, use and interpret results from the application. Reliability on the other hand is important as the application

requires to work with accurate and precise information to guarantee that the data presented on the maps reflects a true picture of the situation on the ground. The users of the application will demand great accuracy to be able to locate and contribute information about cultural resources in Emuhaya. Finally efficiency as a non-functional requirement in this context will mainly be concerned with addressing the desirable response time for the application and the throughput (number of instructions performed per second).

Class diagram

The identified conceptual classes and their relationships within the domain of the Emuhaya Mobile GIS application are shown in Figure 4.5. The following is a brief description of each class in the model.

- i.) Mobile GIS - This is the abstract class that defines the major components of data capture and dissemination.
- ii.) MobileDevice - This is the class that defines the mobile device used in the field by the user.
- iii.) MobileGUI - Defines the graphical user interface through which the user interacts with the system.
- iv.) LocalDB - Defines the database model on the client device.
- v.) Server - This refers to the software that responds to the user service requests from the client.
- vi.) ServerGUI - This is the server interface that administrator uses to define services and other information relevant to the clients.
- vii.) CultureGeodatabase - Defines the geospatial database for storing culture information contributed by the members through the web and mobile platform.
- viii.) SpatialData - Defines the spatial data in the database.
- ix.) AttributeData - Defines the attribute data associated to a spatial data.
- x.) ImageData - Defines the image data captured as part of the cultural information in the system.

- xi.) PointData - Defines the point data of culture resources mapped by the users of the system.
- xii.) CultureData - Defines the details of a cultural entry.
- xiii.) Image - Defines the image stored in the system.
- xiv.) User - generalization of the system user.
- xv.) GuestUser - Defines a normal user who accesses and queries existing system data without making any contributions.
- xvi.) RegisteredUser - Defines a registered user who can contribute new information in the system and conduct complex queries.

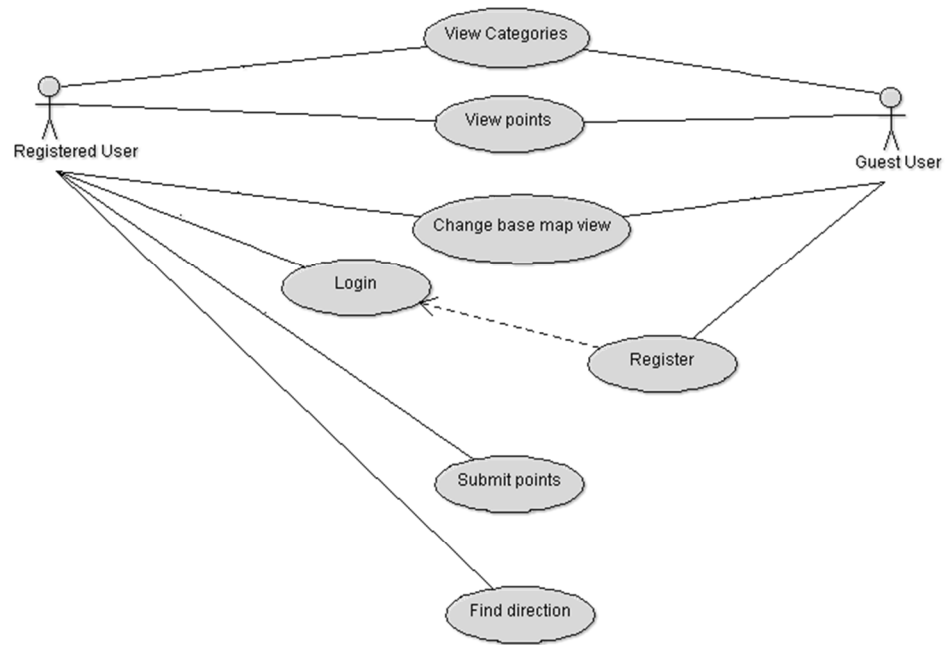


Figure 4.4: Mobile use case diagram

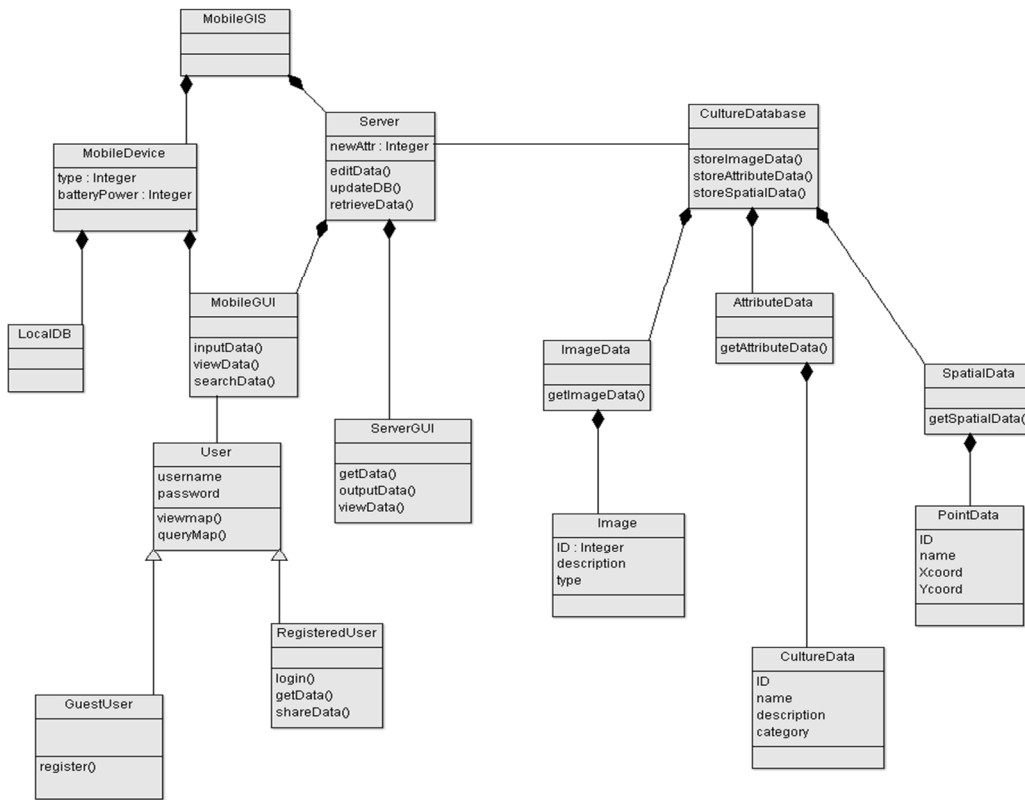


Figure 4.5: Mobile GIS class diagram

4.2 Chapter Summary

This chapter focuses on the conceptual model of the participatory culture mapping platform implemented. The model has been further sub-divided into web and mobile sub-models. An object oriented approach was adopted for the development and thus UML notation was the preferred notation for modeling the system. The results of the system development are presented in Chapter 5.

CHAPTER

RESULTS AND DISCUSSION

5.1 Culture and culture perceptions of Emuhaya

This section delivers findings from the culture survey conducted in Emuhaya as part of the study. Three hundred and eighty four (384) questionnaires were distributed for the field work but only 300 were duly filled and collected from the sampled individuals. This represents a 78.12% response rate. These properly completed questionnaires were subsequently used in the study. The findings discussed and presented in this section are based on the responses from the administered questionnaires. The following sub-sections show the sample characteristics and the results based on the study objectives.

5.1.1 Demographic information

Gender of the respondents

Information on gender of the respondents was considered essential in determining the distribution of both genders in the target population. This information would be important in ascertaining the representativeness of the sample in the target population. The study found that 73% of the respondents were male while 27% were female (Table 5.1). This is an indication that the males are the dominant gender amongst the Abanyore community who reside in the vast Emuhaya constituency of Kenya. It is important to note that the gender ratio as per government regulations which advocates for at least one third representation of either gender was not achieved since the proportion of the female respondents is below the required 33.33%. This disparity resulted from the inaccessibility of women during the duration of the study given that they are solely responsible for household chores. Moreover, many women declined making responses to the data instruments but instead opting that their husbands respond on their behalf whenever they were present.

Table 5.1: Respondents gender

Gender	Frequency	Percent (%)
Male	218	73%
Female	82	27%
Total	300	100

Respondents' level of education

The aim of this question was to determine the highest level of education qualifications attained by the respondents. This was crucial given that the focus of the study entailed the use of information technology whose prerequisite is basic education. Information about the education levels in the study area was essential in determining the ease with which the study objectives would be achieved especially in the implementation of digital culture maps that would be used to permanently preserve local culture. For the purpose of this study, education levels were categorized as follows; *non-formal education (loosely organised and may or may not be guided by a formal curriculum)*, *lower primary(1-3)*, *upper primary(4-8)*, *some secondary education*, *completed secondary*, *post-secondary*, and *informal(no formal curriculum and no credits earned)* (Figure 5.1).

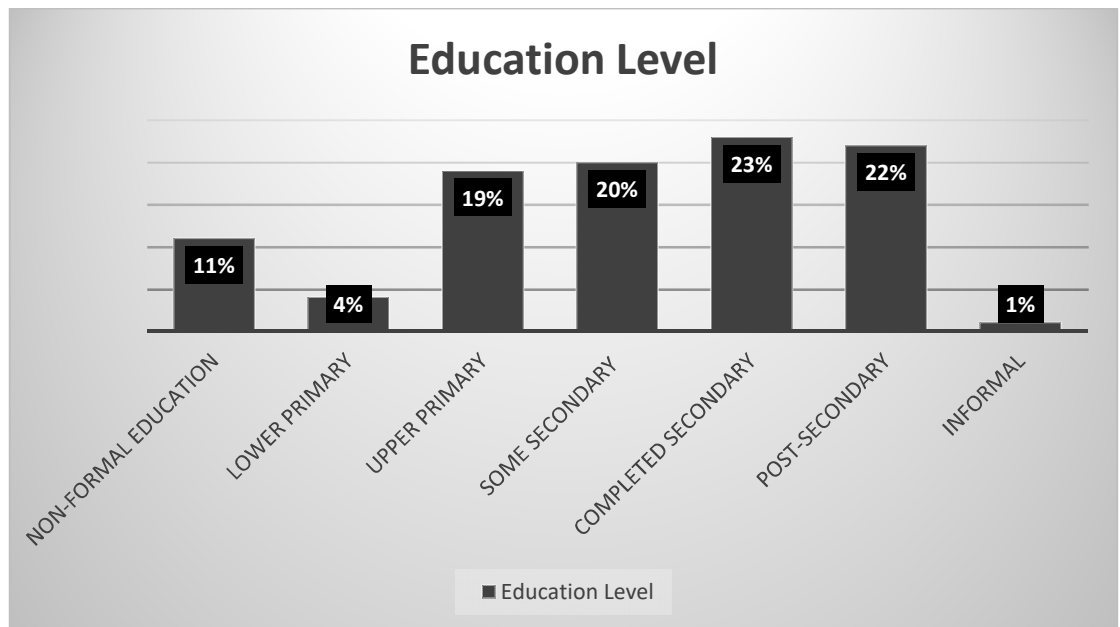


Figure 5.1: Respondents education level

The study found that 11% of the respondents had no formal education, 4% had lower primary education, 19% upper primary education, 20% had some secondary educations, 23% had completed secondary education, and 22% had post-secondary education, while 1% of the respondents had informal education. The results imply that at least 88% of the respondents had some form of education. The findings however show that the a majority of the respondents have only attained the basic education in the Kenyan 8-4-4 system given that only about 22% of the respondents had post-secondary education.

The findings were further broken down into gender representation of the respondents relative to the respective level of education (Figure 5.2). This was to determine the level of equality in promotion of education among both genders in the study area. This is essential since the objective of the study in respect to cultural preservation would be better achieved if both genders involved are literate.

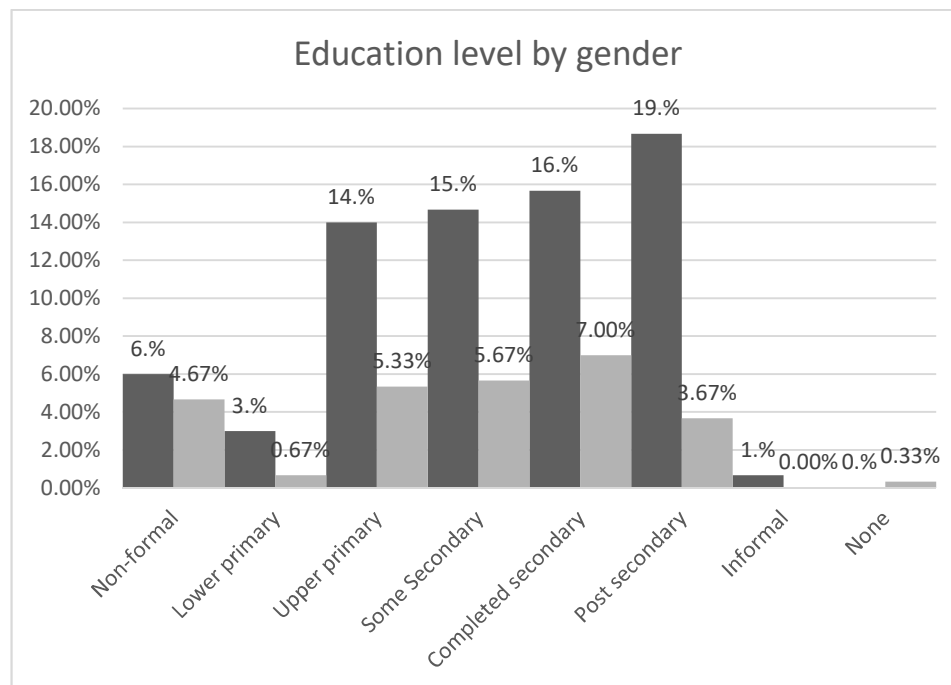


Figure 5.2: Education by gender

The findings in this case show that there is a considerable disparity between the distributions of education among the two genders. Male respondents with post-secondary education surpass their female counterparts with a margin of about 15% with almost similar differences being observed in both secondary and primary education. The findings show that a majority of the respondents were literate and easily understood the subject matter of the questions raised in the questionnaires. It further supports the premise that the respondents clearly understood the ethics of research and thus the expectation that they would give reliable and beneficial responses.

Respondents' affiliation to the study area and the practices therein

The study additionally sought to determine the level of association of the respondents to the study area. The extent of affiliation to the study area would be a good indicator of their willingness to participate and promote approaches to document and preserve the local

culture in the area. A question that required the respondents to comment on whether they considered themselves members of the study area was included in the questionnaire. This information was crucial in determining the suitability of a Public Participation approach in the development of community culture maps which would require the direct and continued involvement of the public throughout the life of the system/project. The respondents in this regard were simply required to state whether or not they considered themselves a member of the study area (Table 5.2). The findings show a strong affiliation by the respondents to the study area with slightly over 93% of the respondents identifying with the study area. This indicates a high sense of belonging by the respondents which positively supports engaging the locals as stakeholders in the development and deployment of PPGIS platform for collecting and preserving cultural data in the area.

Table 5.2: Affiliation to the Study Area

Response	Frequency	Percentage (%)
Yes	277	93.58
No	17	5.74
Not sure	2	0.68
Total	298	100

The study further needed to explain the reason behind the observed trend of the respondents' affiliation to the study area and in this regard the respondents were required to indicate how they are affiliated to the study area. This was essential in determining the attributes that the respondents considered valuable in the study. The findings are presented in the table 5.3.

Table 5.3: Factors influencing affiliation to the study area

Statement	Male	Female	Combined
I was born here	87%	81%	85%
I live here	5%	8%	6%
I own property here	0%	0%	0%
I work here	2%	1%	2%
I run a business here	2%	5%	3%
I am married here	2%	4%	2%
Others (specify)	1%	1%	1%

The findings show that a majority of the respondents are native to the study area through being born in Emuhaya. This is distantly followed by respondents who are affiliated to the study area as a result of living in the area for a considerable amount of time. The high affiliation rate to the study area by birth points to the fact that a majority of the respondents are residents of the area since they have never relocated. Such individuals would be willing to support and participate in measures aimed at protecting and preserving the heritage of the area. This assertion is supported by the findings of the question on what the respondents consider the main defining characteristic of Emuhaya people. The statements in this regard were similar to the former with the views having minor variations as shown in the table 5.4.

Table 5.4: Defining attributes of Emuhaya people

Statement	Male	Female	Combined
Being born here	70%	67%	69%
Living in Emuhaya	6%	7%	6%
Working in Emuhaya	1%	1%	1%
Doing business in Emuhaya	5%	5%	5%
Owning property in Emuhaya	3%	1%	3%
Having ancestors in Emuhaya	1%	5%	2%
Other (specify)	11%	11%	11%
None	3%	2%	3%
Total	100%	100%	100%

The findings in this case show that the respondents believe that being born in Emuhaya is the major defining attribute of the people of Emuhaya with at least 69% of the respondents supporting this assertion. These findings show that a majority of the respondents are proud to be associated with Emuhaya through birth. Furthermore 94% of the respondents indicated that there is a strong sense of belonging amongst the Emuhaya people. This therefore implies they will be more willing to embrace and support new initiatives aimed at improving development in the constituency

Factors uniting people in Emuhaya

The study further sought to determine the social and cultural activities that bring the people of Emuhaya together. Determination and promotion of such factors is crucial since their appraisal can be used to ensure there is continued harmony in the area. Moreover, the determination of these factors was important to the study area since it would facilitate the incorporation of such cultural factors in the system developed with the aim of ensuring that it is resourceful to the users. The study asked the respondents to identify the uniting factors among the residents of Emuhaya and the findings are presented in the Table 5.5. The findings indicate that there are a number of factors that the respondents consider to be uniting among the people of Emuhaya. However, sharing of physical resources, common needs, intermarriages, religion, and culture stands out with 24%, 11%, 17%, 15%, and 14% respectively. These uniting factors greatly influence the cultural mapping process.

Table 5.5: Factors uniting people in Emuhaya

Factor	Frequency	Percentage (%)
Sharing physical resources	72	24
Common needs	33	11
Being a resident	16	5
Common problems	8	3
Intermarriages	51	17
Religion	44	15
Culture	42	14
Political inclinations	6	2
Ethnicity	16	5
Other	8	3
None	4	1
Total	300	100

5.1.2 Willingness of the respondents to live in Emuhaya

Stair and Reynolds (2012) notes that the development of a GIS becomes feasible when the said location is a residence or possibly a potential destination. In this light, the study sought to determine the likelihood of the respondents moving to other areas. The respondents in this regard were required to respond as to what they think makes them prefer to live in Emuhaya and if at all there was any possibility of them relocating. The findings on whether the respondents lived in Emuhaya by their own choice are presented in figure 5.3.

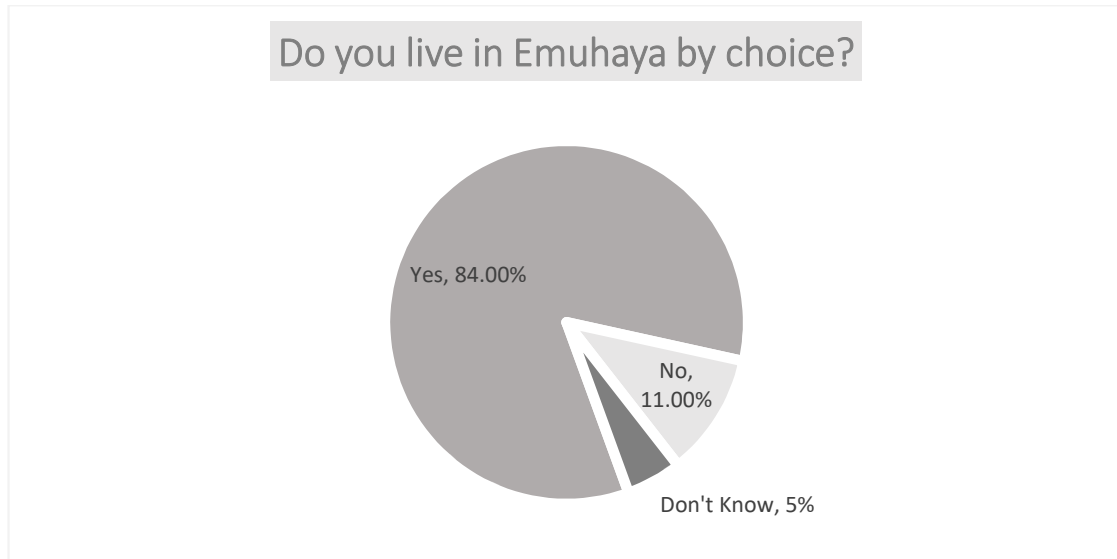


Figure 5.3: Willingness of the respondents to live in the study area

The findings show that a majority of the respondents voluntarily live in Emuhaya as indicated by the high response rate of 84% while the rest are either unwilling or uncertain. These findings contrast the findings on affiliation to the study area discussed earlier where over 72.67% (218) of the respondents agreed to affiliating themselves to the study area. The fact that a majority of the respondents were born in Emuhaya explain their great desire to reside in the area thus giving them the aspirations to be affiliated to Emuhaya. This therefore provides a great opportunity for voluntary culture mapping initiatives driven by the community.

The study also sought to determine the level of satisfaction with the quality of life experienced by the respondents from the study area. This was done in an effort to quantify the level of utility derived from the area by the respondents. The level of satisfaction would be used to determine the urgency with which measures need to be taken to improve the lifestyle of the residents of Emuhaya. In this case the respondents were required to rate their views on a five point Likert scale in which 5, and 1 represented continuum scores

for *Very Satisfied* and *Very dissatisfied* respectively. The findings in this case are shown in the figure 5.4.

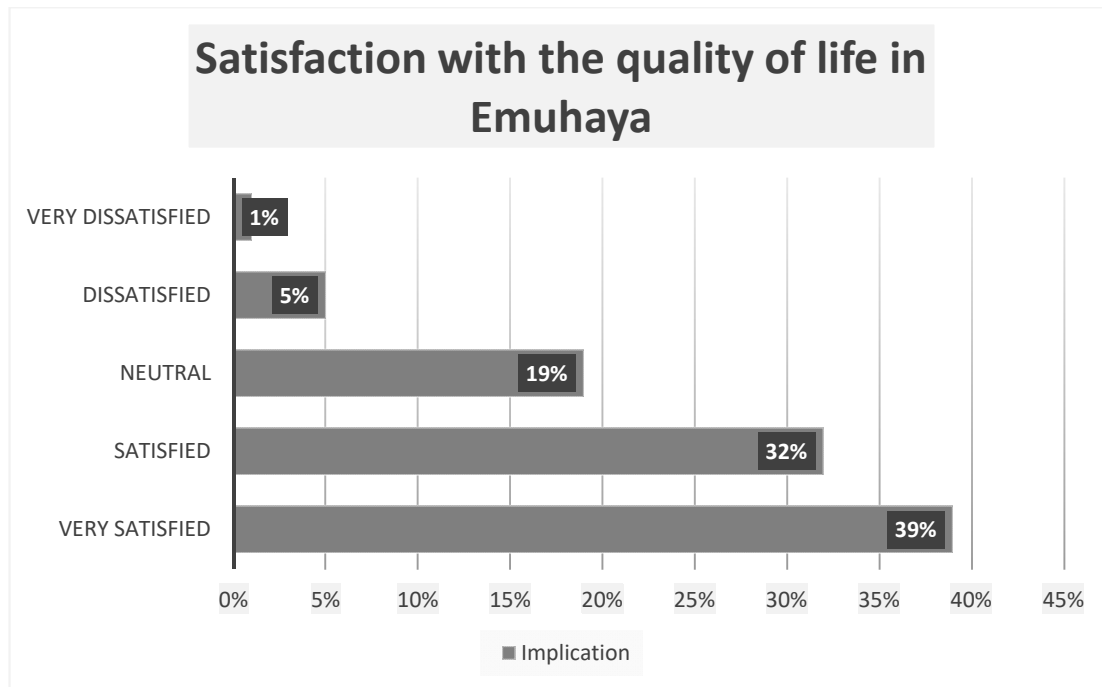


Figure 5.4: Satisfaction with the quality of life in Emuhaya

The findings show that there is a positive relationship between the respondents level of satisfaction and the frequency of the respondents with the proportion of *very satisfied* respondents amounting to 39% while the *very dissatisfied* amount to only 1%. These findings point to a positive view by the respondents on the study area.

5.1.3 Distribution of social amenities in the study area

The study sought to determine the distribution of social amenities such as learning institutions in the study area. This was done for an array of reasons. First, the study sought to determine the quantity of each of these amenities in the study area for possible policy recommendations. Secondly, the study sought to determine the ease of access of the available amenities among various residents in the study area to determine the need for

GIS in assisting the respondents' access and locate these amenities with ease by mapping their locations and basic details in an amenities map. In this case the study sought to determine the availability, usability, conditions, accessibility, and adequacy of amenities in Emuhaya. The findings in this case are presented in the table 5.6.

Table 5.6: Distribution of amenities in Emuhaya

	Availability		Usability of		Condition of		Accessibility		Adequacy of	
	Amenities		Amenities		Amenities		of Amenities		Amenities	
	<u>%</u>	<u>freq</u>	<u>%</u>	<u>freq</u>	<u>%</u>	<u>freq</u>	<u>%</u>	<u>freq</u>	<u>%</u>	<u>freq</u>
N	100%	295	100%	294	100%	295	100%	295	100%	295
Basic amenities	96%	283	82%	240	72%	213	90%	265	78%	230
Public Schools	88%	259	72%	213	73%	214	69%	205	61%	180
Private Schools	90%	265	69%	204	65%	191	69%	204	67%	198
Public Health facilities	80%	235	65%	192	66%	195	68%	200	62%	183
Private Health facilities	70%	206	58%	171	57%	167	61%	179	59%	174
National Government offices	70%	206	64%	188	59%	174	65%	191	61%	180
County Government offices	67%	199	58%	171	59%	173	59%	175	67%	198
Security (Police, chiefs etc.)	60%	177	56%	165	53%	157	55%	161	56%	165
NGO/CBO offices	63%	187	61%	180	55%	161	60%	178	60%	177
Water points	62%	183	66%	195	70%	207	65%	193	66%	195
Sanitation/drainage facilities	71%	208	64%	187	67%	197	68%	202	69%	204
Roads	64%	189	68%	200	58%	172	65%	191	64%	189
Electricity in home	67%	198	67%	198	68%	202	69%	204	66%	195
Shops/markets	61%	179	65%	191	64%	188	64%	188	58%	171
Banks	65%	193	51%	149	53%	157	59%	174	62%	183
Social Halls	38%	112	63%	186	44%	131	43%	126	40%	118
Technical training facilities	46%	135	91%	269	52%	154	52%	152	50%	148
Places of worship	89%	263	80%	235	89%	264	87%	258	92%	271

5.1.4 Infrastructural development in Emuhaya

The study further sought to analyse the general trend of infrastructure development in the study area. This information is important as it will present us with the knowledge of what kind of development is prevalent in the study area. The amenities map will capture this information by identifying and mapping all development projects. This will be useful in deriving a relationship between the user perceptions of development and the actual resources on the ground. Furthermore it will be useful in identifying the areas that feel marginalized due to lack of equity in development projects as the rest of the study area. In this regard, the study first sought to determine the development initiatives taking place that the respondents were familiar with in the study area. The figure 5.5 illustrates the responses provided.

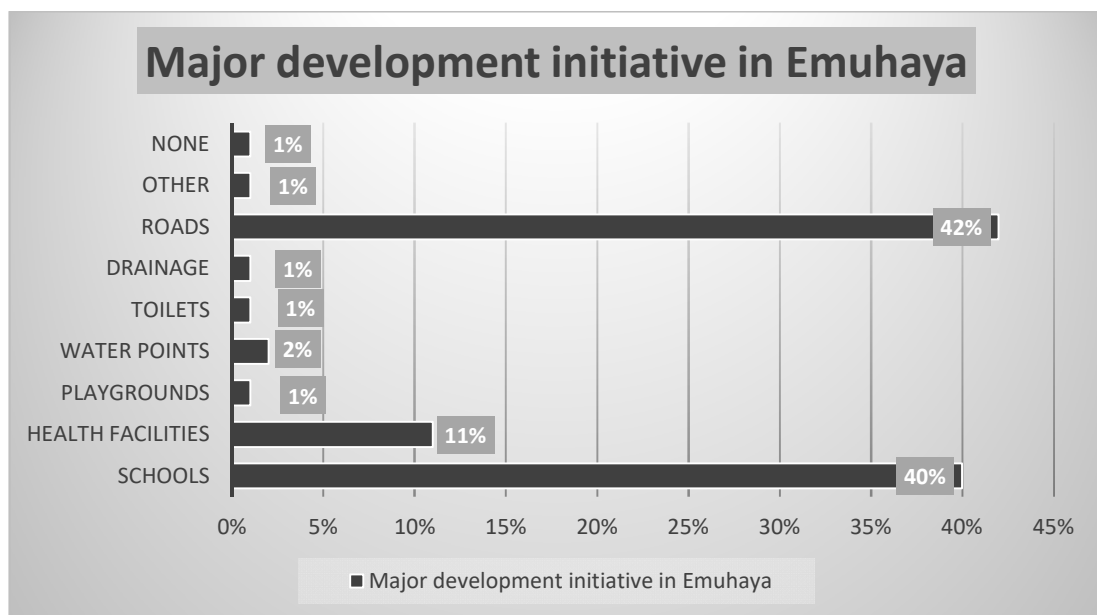


Figure 5.5: Major development initiative in Emuhaya

The findings show that roads and schools dominate the major development initiatives in the study area with 42% and 40% respectively while health facilities also has a significant response of 11% as shown in figure 5.5. The development of other infrastructure such as

water points and playgrounds are present but according to the respondents not so significant given the low response of less than 2%. It is therefore necessary to highlight and map the development projects, and make this information available on the GIS platform. This will make this information easily available and usable for future development planning within the constituency administrative units. The study further sought to determine the stakeholders responsible for the development of these projects. This was done by enquiring from the respondents who was responsible for the major developments taking place in the area. The responses in this case were in predetermined suggestions. This information was sought in an effort to determine the sustainability of these projects. The findings in this case are shown in the table 5.7.

The findings show that Constituency development fund (CDF), the national government and the county government are the major entities involved in initiating and implementing projects in Emuhaya with 49% and 18% and 15% respectively. Religious organisations, non-governmental organisations, local leaders, and local people also have substantial influence with 2%, 2%, 4%, and 10% respectively. From the assertion by Teaiwa and Mercer (2011) that projects should be initiated and implemented by desirable stakeholders to have higher rates of success, the observed results indicate a high likelihood that the development projects initiated in Emuhaya have a high success rate. This therefore makes the documentation of these projects a crucial part in the implementation of the GIS platform.

Table 5.7: Stakeholders initiating projects in Emuhaya

Stakeholder	Frequency	Percentage
Local people	30	10%
Local leaders	12	4%
NGO/CBOs	6	2%
Religious organization	6	2%
Government of Kenya	54	18%
County government	45	15%
CDF	147	49%
Other (specify)	0	0%
None	0	0%

The study also set out to determine the extent to which the beneficiaries of these projects were involved in their identification and initiation. This information was necessary to establish the perception of the beneficiaries towards these projects and their willingness to support and guarantee the success of the same. The findings are shown in the table 5.8.

Table 5.8: Involvement of residents in development of projects

Involvement	Frequency	Percentage
Involved a great deal	48	16%
Involved a lot	81	27%
Involved a little	66	22%
Not involved	81	27%
Not involved at all	24	8%
Total	300	100%

The findings point to a significant level of involvement of the residents in the identification and development of the projects with 16%, 27%, and 22% being involved; a great deal, a lot, and a little respectively while 27%, and 8% not involved and not involved at all respectively. The findings show that cumulatively over 65% of the respondents agree that they are involved in these projects though at varying extents. This involvement/participation of the residents in the implementation and management of the projects indicates that there is a high probability that these projects will be successfully implemented thus making them a focal point of concern in the study area. These views are collaborated by the respondents' responses on networking of the various projects in the area. The findings show that about 74% of the respondents feel that there is a common sense of networking among the various development projects ongoing in Emuhaya.

The study further sought to determine the views of the respondents on the management of these projects. The study in this case sought to determine whether the ongoing projects are well managed by the responsible stakeholders. The findings in this case are presented in the table 5.9.

Table 5.9: Description of management of development projects in Emuhaya

Extent	Frequency	Percentage
Very well managed	78.00	26%
Well managed	126.00	42%
Neutral	66.00	22%
Badly managed	12.00	4%
Very badly managed	3.00	1%
Don't know	15.00	5%
Total	300	100%

The findings show that 26% of the respondents feel that the projects are very well managed, 42% well managed, 22% were neutral while the rest felt that the projects were either badly managed or had no idea. This shows that there is high potential of successful completion of the ongoing projects given the high cumulative responses of respondents (68%) who indicated that the projects were well managed. It is therefore important to maintain adequate information about these projects as they directly affect the socio-economic life of the people of the constituency. Subsequently, the study found that local authorities and elders were adequately involved in the identification and implementation of these projects. This has greatly contributed to a high approval rating for these projects among the residents of Emuhaya.

5.1.5 Social challenges facing the residents of Emuhaya

A key objective of the study was to examine the quality of life of the people of Emuhaya. As such it was important for the study to try and establish the social challenges facing the community. This inquest sought to determine the severity of these problems, the implications on the livelihood in the area, and corrective remedies in place if any. In the big picture this would provide insight into possible problems affiliated to cultural inclinations. The study identified common leading problems facing other constituencies nationally and the respondents were required to indicate their responses against the predetermined alternatives with an open option for 'others' to avoid limiting the respondents. The findings in this case are presented in the table 5.10.

Table 5.10: Major problems facing households in Emuhaya

Problem	Frequency	Percentage
Marital misunderstandings	33	11%
Low income/poverty	168	56%
Prevalence of disease	18	6%
School fees	39	13%
Lack of adequate shelter	6	2%
Drunkenness	18	6%
Drug abuse	6	2%
Infidelity	0	0%
None >29	12	4%
Other (specify)	0	0%
Total	300	100%

The tabulated findings show that poverty attributed to low income is the major problem with 56% of the respondents followed by school fees and marital misunderstandings with 13% and 11% respectively. Prevalence of diseases, and drunkenness also have a substantial effect with 6% of the respondents for each. From the results it is impossible to totally detach culture from the identified problems. Culture in Emuhaya determines the way of life and thus has a great influence on the socio-economic activities of the people. These activities will in turn determine the wealth generated and shared within the economy. Furthermore most of the weddings here are performed under customary law. This also greatly influences the families and the roles of the man and the woman. All this factors put together determine the quality of marriage life in Emuhaya.

When further queried on the main cause of poverty in the area, 64% of the respondents cited lack of employment opportunities as the leading cause of poverty in the area. 15% of the respondents attributed the problem of marital misunderstandings to lack of adequate finances which further reinforces the problem of low income as the pivotal problem. 41% of the respondents attributed drunkenness to idleness amongst youths and middle aged men who lack any gainful employment which further provides evidence that Emuhaya has a shortage of employment opportunities.

5.1.6 Culture in Emuhaya

The final outcome of this research project is a culture and cultural map of Emuhaya constituency that aims at promoting cultural tourism in the region and thus it was important for the study to interrogate and present the varying culture amongst the respondents. The study area is predominantly occupied by the Abanyore sub-tribe of the Luhya community. It was important to establish the community's knowledge of existing culture and elicit their feelings and perceptions on the state of culture deterioration including the preservation approaches suitable to curtail culture loss. The first step was to determine whether the residents were knowledgeable about the history and origin of their culture (Figure 5.6). The findings show that 66% of the residents of Emuhaya are not privy to information on the history and origin of their culture. This is about two-thirds of the total population in the study area which is a great indicator to a possible massive erosion of cultural heritage amongst the members of Abanyore community.

The study further sought to find out whether cultural events are organized within the community and to what extent the residents are involved in the organization and running of such events? This was a crucial factor in determining the extent to which culture is valued and shared within the community. The findings here would provide a good picture about the level of cultural activity still rife within the Abanyore community of Emuhaya. The results show that 58% of the respondents affirmed that cultural events and activities are organized and held in Emuhaya while the rest felt otherwise. Subsequently, the study established that a majority of the cultural events were held annually as stated by 88% of the respondents, with the remaining splitting on 6% each that events are held quarterly, and semi-annually.

There was a need to further establish the respondents' extent of participation in these cultural events in order to see if there was a relationship between the cultural diversity showcased and user participation (Figure 5.7). The findings show that 26% of the residents are involved in cultural events to a great deal, 16% and 29% are involved a lot and a little

respectively while the rest are either not involved or not aware of their influence or contribution to organized cultural events. Cumulatively, the findings show that about 71% of the respondents participate in cultural events in Emuhaya thus reaffirming that the Abanyore culture is still rich within the Emuhaya people.

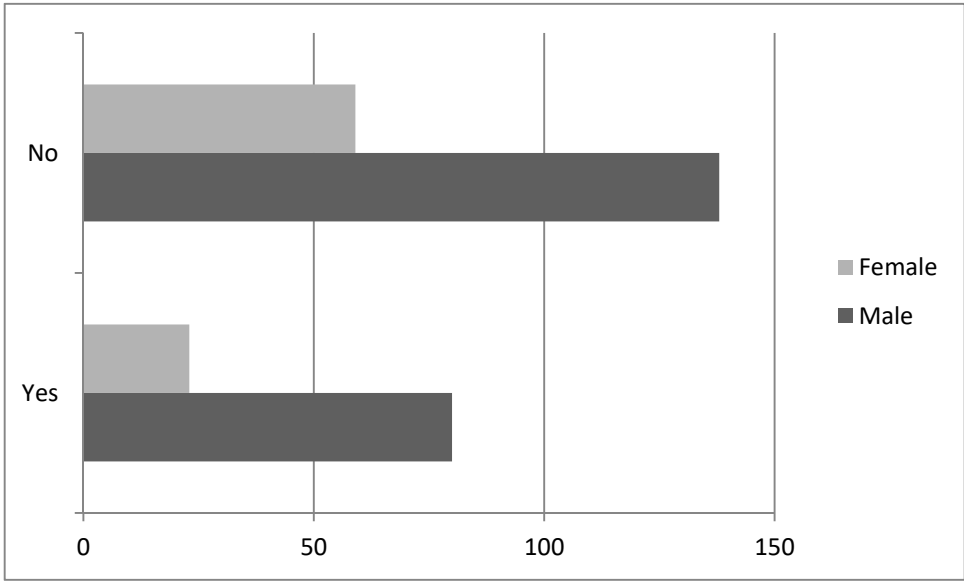


Figure 5.6: Respondents with knowledge about origin of their culture

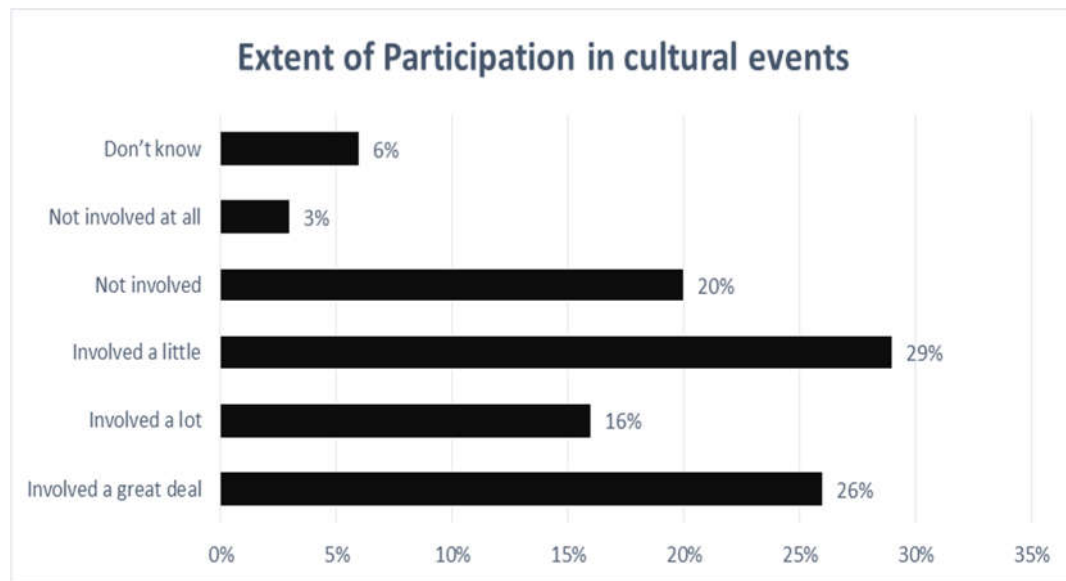


Figure 5.7: Extent of Participation in cultural events

It was further important to establish the main cultural events/items showcased during the cultural forums. This information was crucial in identifying the identity of the Emuhaya people in terms of their cultural affiliation. The determination of the cultural aspects showcased was also necessary in development of the system in line with the research objectives. The findings in this case found foods, artwork, songs, dances, and ceremonies during various occasions, such as rites of passage, to be the major aspects showcased in Emuhaya. The songs and dances vary based on the ceremony at hand.

Establishing the aspects of cultural diversity within the Abanyore people was also another key objective of the study. This would be useful in justifying the use of culture mapping techniques to preserve and share the Abanyore culture. The respondents were asked whether there were variations in the cultural practices of the different clans that comprise the Abanyore community. The findings revealed that 56% of the respondents feel that they are similar while 44% felt that they differed.

In an effort to further explain the anticipated differences in culture, the study sought to determine factors that affected the rate of cultural differences amongst the people of Emuhaya (Table 5.11). The findings indicate that the clan is the major factor that influence the rate of cultural differences in the study area with 67%, followed by geography having 15% only and other factors such as rapid urbanization accounting for 18%. These shows that cultural inclinations in Emuhaya are to a large extent influenced by the respective clans within the Abanyore community.

Table 5.11: Factors determining the rate of cultural differences in Emuhaya

Factor	Frequency	Percentage (%)
Geography	20	15
Clans	89	67
Other factors	24	18
Total	133	100

The study further sought to determine the extent to which the various clans observed the cultural practices. The respondents in this regard were required to rate on a five-point Likert scale the extent to which they practised with 1 and 5 representing *do not know* and *greatly practised* respectively (Figure 5.8).

The findings show that 26% greatly practice their cultural systems, while 33% and 22% averagely practised and rarely practised their cultural views respectively. Cumulatively 59% observed their cultural practices though to varying extents. The study further sought to establish the methods that were used in preserving the cultural information in Emuhaya as well as the approaches used in passing this cultural information to other generations. The findings in this case were collected in an open question to avoid limiting the respondents to predetermined responses. In this case the study found sharing of information between the elderly and the young to be the major approach adopted. Informal sharing of information plays the role of preservation by ensuring that information is passed on to younger generations. However the lack of formally documented cultural information

means that the knowledge lives and dies with the host in the event it is never informally passed to the next generation.

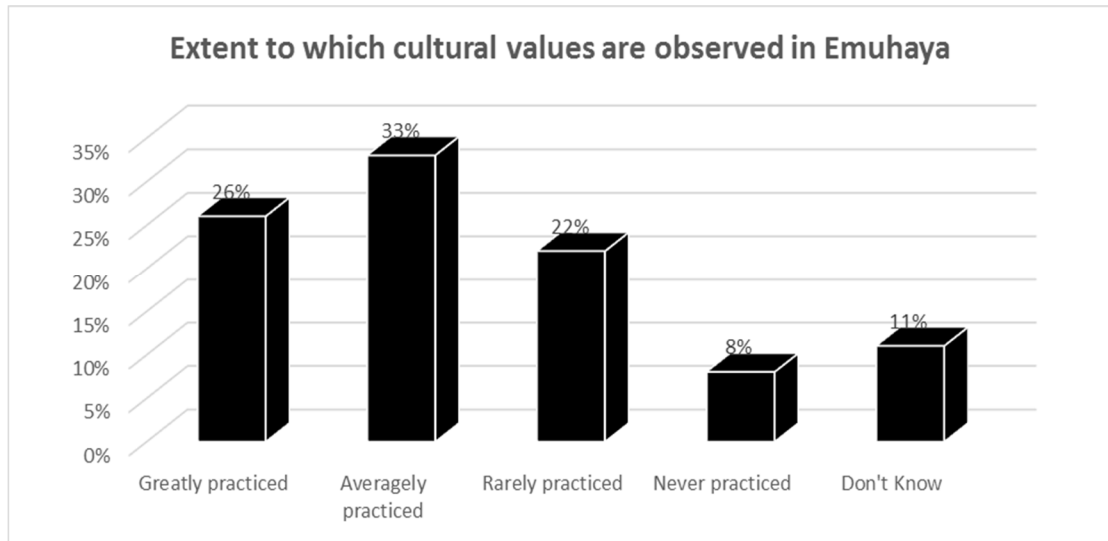


Figure 5.8: Extent to which cultural values are observed in Emuhaya

The study further set out to determine the extent of culture change over time. The respondents were expected to rate the culture change over a five-point likert scale with 1 and 5 representing *no extent* and *very large extent* respectively (Table 5.12). The findings showed that about 79% of the respondents felt that cultural practices were changing overtime while the rest felt there has been no change. The respondents who felt that cultural values were changing overtime were further required to indicate the extent of the rate to which the cultural values were changing.

Table 5.12: Extent of change in cultural values in Emuhaya

Extent	Frequency	Percentage (%)
No Extent	21	9
Low Extent	50	21
Moderate Extent	90	38
Large Extent	64	27
Very Large Extent	12	5
Total	237	100

The findings show that the *moderate extent* rating was the highest with 38% followed by *large extent* and *low extent* with 27% and 21% respectively. It is therefore evident that change in cultural values in Emuhaya is present and cannot be ignored. These findings were further supported by the responses given on whether it was necessary and worthwhile to preserve cultural information. In this regard, 71% of the respondents felt that it was necessary to preserve culture with the rest feeling otherwise. This contrasts with the views of the respondents on whether they felt that culture had been lost overtime. In this case, 48% of the respondents felt that some of the culture had been lost overtime. It is therefore clear that the respondents value the Abanyore culture especially given that 52% of the respondents felt that culture in Emuhaya could be exploited for tourism activities in the area.

The study further employed an open-ended question to determine the specific cultural activities and resources that can be potentially exploited for tourism. The findings in this case found cultural ceremonies which involves songs and dances to be exploitable for tourism activities. The respondents asserted that by creating awareness about the schedule of the various cultural activities in the community, tourists could be attracted to participate which would be a form of cultural tourism that would generate income for the local community. These findings can thus be incorporated in the development of the system by ensuring that the information about cultural ceremonies, songs and dances are captured and mapped thus making them more widely accessible to create more awareness.

5.1.7 Technology perception and competence in Emuhaya

A key component of the study was to determine the rate of technology awareness and advancement among the people of Emuhaya. The aim was to establish whether the current technology competence levels would be supportive of the web GIS and mobile GIS initiatives for culture preservation. Technology is a key ingredient in the proposed cultural mapping platform.

For the purpose of this research project it was important to determine how prepared the people of Emuhaya are to embrace new technology. This was determined through assessing their current use of technology in their everyday life. The respondents were thus taken through a series of questions to determine their current extent of use and dependency on the available mobile and web technologies. The study first sought to determine the proportion of the respondents who owned mobile phone handsets and how many of these phones were Smart phones. In this regard 86% of the respondents owned a mobile phone handset while the 14% did not. From the respondents that answered yes to owning a mobile handset, the details of those that were Smart phones are tabulated in Table 5.13.

Table 5.13: Ownership of Smart phones in Emuhaya

Response	Frequency	Percentage (%)
Yes	116	45
No	142	55
Total	258	100

The findings show that 45% of the handsets owned by the respondents are Smart phones while the rest are the standard models (In this context a Smart phone is any cellular phone that performs many of the functions of a computer, typically having a touch screen interface, Internet access, and an operating system capable of running downloaded applications). This makes the proportion of residents who own Smart phones in line with conditional probability to be 38.7% (= 86% * 45%). This means that the probability that a person selected randomly in Emuhaya owns a phone and that the phone is a Smart phone

is 38.7%. This therefore points to an above average interest in technology among the residents which favours the research objective of developing a technology driven system to preserve culture. The study further sought to determine how the respondents typically used their phones. The respondents were required to specify their usage among, voice calls, messaging, and data services. The findings showed that 44 % of the respondents commonly use their mobile phones for voice calls, 12 % for messaging, and 2% for data services. Those who used their phones for all the purposes accounted for 42% of the respondents. These findings showed that only 2% of the respondents restrict their use of mobile phones strictly to data services. The high number of respondents who use their phones for the three purposes justifies the fact that the respondents appreciate the convenience that comes with owning a Smart phone and are well conversant with its operation.

The study further sought to establish how acquainted the residents are to computers and Internet technologies. In this regard the study first enquired of the proportion of the respondents who were computer literate. The findings in this case showed that 51% of the respondents are computer literate while the rest are not. This indicates that slightly more than half of the residents in the study area are computer literate. Subsequently, the study wanted to establish what proportion of the computer literate respondents was knowledgeable about the Internet and related technologies (Figure 5.9). The study shows that 80% of the computer literate respondents know about the Internet while 20% have no working knowledge of the internet and its related technologies. For the respondents who use the Internet they were further required to indicate the frequency with which they access the Internet (Table 5.14). The findings indicate that 43% of the computer literate respondents use the Internet at least daily, 14% hourly, 13% weekly, 10% monthly while the rest rarely use the internet. The findings cumulatively show that 80% of the respondents are active users of the Internet with the least frequency being monthly. Among these respondents the levels of participation in social media was substantially high with 24% of the respondents participation *to a great deal*, 22% involved *a lot*, 29%

involved *a little*, while the rest are either not involved at all or not aware of their involvement.

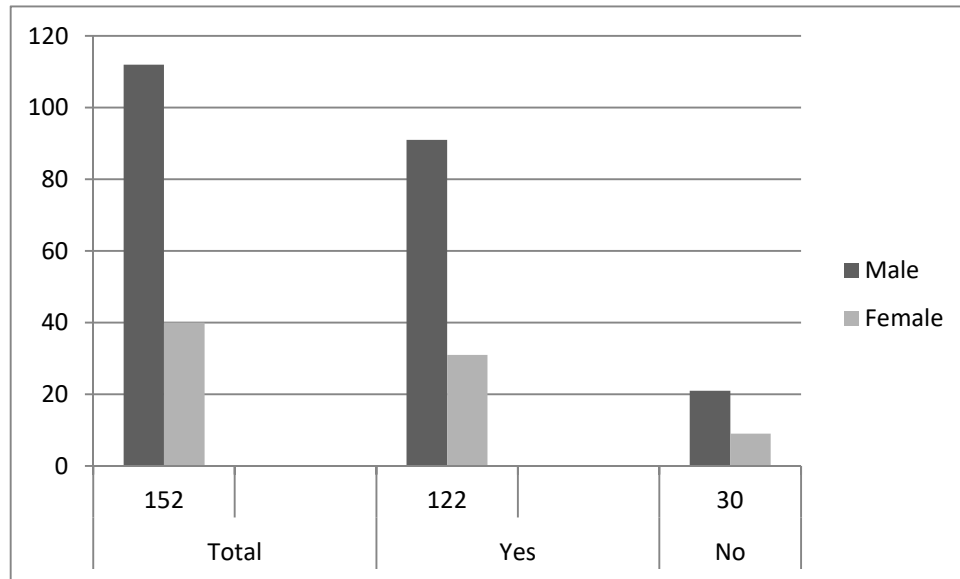


Figure 5.9: Respondents with Knowledge of the Internet

Table 5.14: Frequency of access to the Internet

Period	Frequency	Percentage (%)
Hourly	21	14
Daily	65	43
Weekly	20	13
Monthly	15	10
Rarely	30	20
Total	152	100

The study further sought the views of the residents on the preservation of culture through the use of technology. In this case 83% of the respondents thought there was an opportunity to use technology in the preservation of culture while the rest felt otherwise. The respondents suggested the use of digital media, and website as some of the methods that could be used to preserve culture. These ideas contrast with the study objective of developing a system that would serve this purpose. Furthermore, 76% of the respondents

were willing to take learn and actively take part in culture preservation using mobile and web technologies while the rest were not willing. The major reason given by the respondents who were not willing to participate was because of their basic computer skills as they felt this would be a major hindrance to effective participation. However with proper training they indicated that they would be more willing to participate. The results also showed that 81% of the respondents were in support of the cultural information of Emuhaya being preserved through mobile and web technologies and being made freely available to everyone. Only 14% of the respondents were not in support of their cultural information being made available to everyone while 5% were not sure how to respond to the question. The major reason cited by those not in support of widely disseminating their cultural information was that it would be impossible for aliens to understand the reasons behind the various culture and cultural activities undertaken in Emuhaya.

5.1.8 Summary of the culture survey

The findings show a high level of affiliation and interest among the residents to the study area. This is depicted by the high sense of belonging to Emuhaya, and the high interest among the residents to the study. Moreover, the findings depict a high level of interest to the affairs of the study area as shown by the high awareness among the residents to ongoing projects and the dynamics there in.

The findings further show a high level of integration among stakeholders involved in development projects in Emuhaya. There is also a high level of involvement of the residents in the development of the area as depicted by the high level of understanding of the diverse ongoing projects in the area. There however exist variations on the responses given on the distribution, accessibility, condition, and usage of these projects in the study area. This could be an indicator of uneven distribution of these projects. This therefore forms one basis for the development of a system that would map these projects and thus alleviate chances of increasing the uneven distribution of these projects.

Unemployment and low-income levels also stood out as the major challenges facing the residents with their repercussions being severe and varying from insecurity, drunkenness, and domestic conflicts which are all issues affecting the socio-economic status of the study area.

The findings further reveal that information on culture in Emuhaya is on the verge of extinction. This is evidenced by the significant proportion of the respondents who are not aware of their origin in terms of culture and clans. There is also a substantial number of the respondents who do not take part in cultural activities. This forms another basis for development of a system that would provide information on the cultural heritage to promote awareness while at the same time encouraging participation among the residents. The system has the potential to be used to map and in extension preserve cultural activities for future generations and cultural tourists.

Moreover, there is a significant level of penetration of technology in Emuhaya as shown by the significant number of respondents who are knowledgeable about computers and web technologies. This shows the prevailing inter-relationship between culture change and preservation and sustainable community development. Evidently, though residents uphold their culture, they are also quite receptive of mediums, such as technology, that can facilitate in more efficient cultural preservation. This has further been boosted by the high number of respondents who own smartphones that are used for browsing the internet. The observed high level of willingness by the respondents to participate in preserving their cultural heritage digitally provides a favourable opportunity for the study to exploit web and mobile technologies to spatially document the Abanyore culture in Emuhaya Constituency.

5.2 Culture mapping GIS

The developed and deployed cultural mapping GIS platform provides the basic GIS functionalities including positioning and locating points of interest. The web platform is

accessible through <http://www.emuhayawebgis.info> while the Emuhaya mobile application can be downloaded from the **Google Play Store** by searching for the **Emuhaya Guide** application. A download link has also been provided on the Web platform where the users can directly download and manually install the Android application package (APK) file to install the mobile GIS. The following sections explain the capabilities of the web and mobile GIS system.

5.2.1 Web GIS prototype implementation

Prototype architecture components

The overall system architecture is made up of several components. (Figure 5.10). The implemented architecture relies on the client/server model. In the model, the client subsystem that enables access to the geo-information is the Web GIS portal while the role of sharing which is to be handled by the server is realized by extending traditional GIS with a WMS and a WFS. The WMS is a standard protocol for serving georeferenced maps from a geodatabase while the WFS offers direct fine-grained access to geographic information at the feature and feature property level.

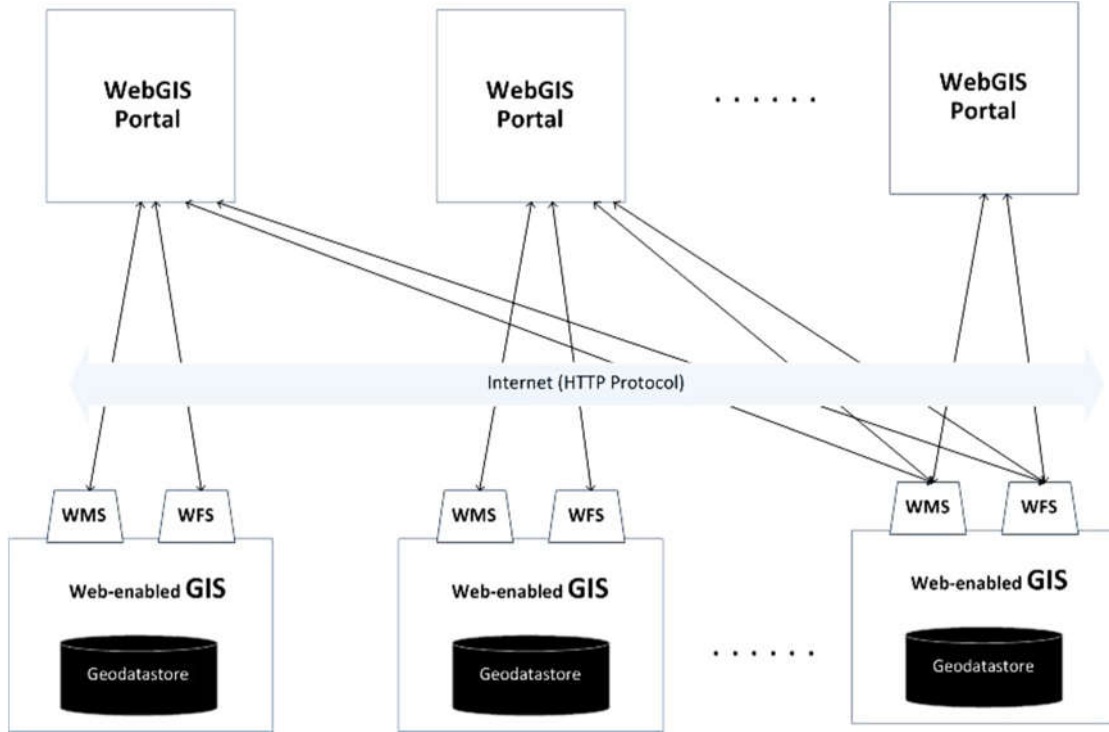


Figure 5.10: Schematic view of web GIS prototype architecture

Application Overview

The developed Emuhaya Cultural Mapping GIS is made up of two major components: a web GIS component for capturing and disseminating cultural information and a mobile GIS component built on the android platform that is more flexible and portable for users on the move. The platform relies on Volunteered Geographic Information (VGI) to visualize the cultural information. The collected infrastructural resource information is presented on thematic maps. The information on the thematic maps was collected during field surveys of the study area conducted by the researcher. The thematic maps combined with the volunteered culture information is then presented to the users through the Emuhaya Cultural Mapping portal that is accessible via any modern web browser **on <http://www.emuhayawebgis.info>**. Before beginning any work on the platform it is recommended that the user registers an account and updates their profile information.

Figure 5.11 shows the first screen one will encounter when they access the web GIS through the provided resource locator.

The site hosting this portal is made up of 6 navigational pages: home, culture mapping, culture listing, categories, maps and reach us. The home page is the main landing page when you access the portal. It provides you with easy to use navigational paths to various sections of the portal. The culture mapping page shows you a base map with the already mapped culture points and allows you to include new points if you are a registered user and have already logged in. The culture listing page provides you with a detailed list of the mapped culture points and an additional capability of filtering through all the information using different criteria. The categories page provides you with details of the categorization used to organize culture information in the portal.

The maps page provides an option of viewing the static and web resource maps of the study area. The web maps can either be viewed through the QGIS cloud offering or as web maps with OSM layer (open street maps) as the base map. Each web map contains the mapping functions to search, zoom, pan, and user location finder. Exposing the legend and layers provides an extra utility for data viewing with an additional level for attributes displayed as pop-ups. The reach us page provides the users with information of how to contact the researcher. Scrolling down on the home page reveals other amazing options with the most interesting being the most recent culture locations added by users on the platform. Before beginning any work on the platform it is recommended that the users register an account using the login to submit listing button on the top-right corner of the homepage and update their profile information. The system will allow the users to register and validate their own accounts via email before gaining access to functionalities that allow one to submit culture information. These users database is important for keeping track of what users submit including other relevant user statistics.

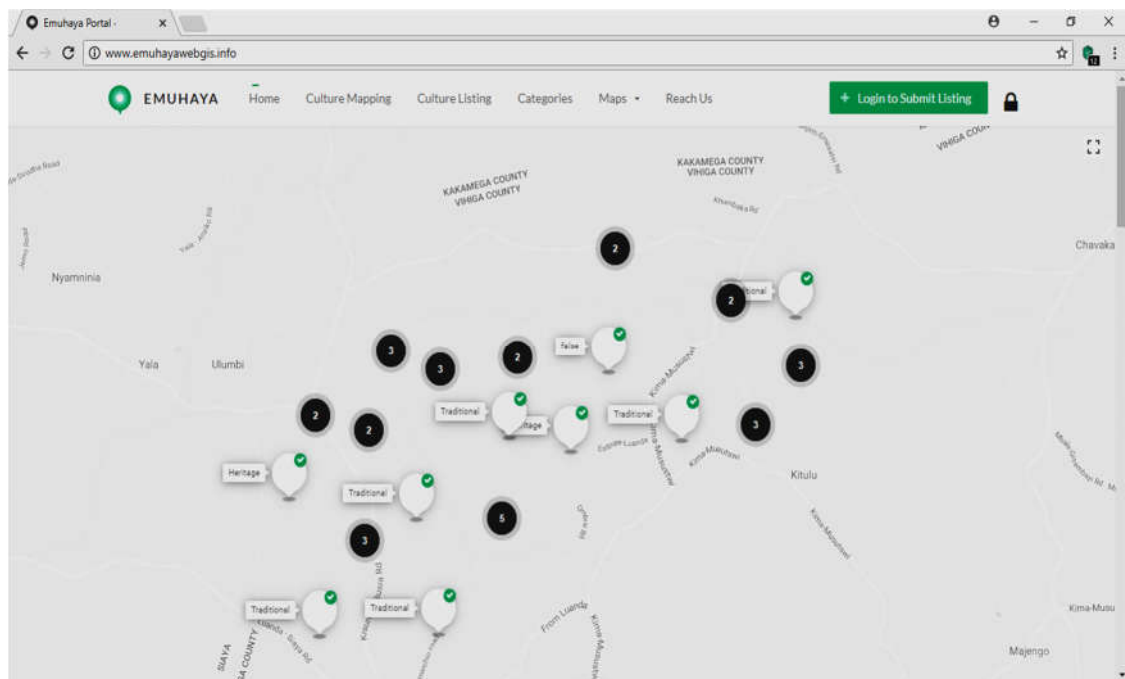


Figure 5.11: Partial view of Emuhaya culture mapping GIS home page.

The page is hosted at <http://www.emuhayawebgis.info/>

Demonstration of user registration

This feature is used to create user profiles within the system. The users have three classifications: guest, registered user and administrator. A guest is not required to provide any information before using the system. However their role is only limited to viewing what is available without making any contributions to the existing information. On the other hand, a registered user is required to provide their details which are used to create and manage his/her profile. A registered user can view and submit culture data. The administrator plays an oversight role of managing the data submitted including the created user profiles. Once registered and the account activation process completed through email verification, the user can now log onto the system using the login page.

Demonstration of view culture points page

The user uses the culture listing item on the home page to land on this page. This feature allows the user to view all the cultural information that has already been submitted to date and activated for view by the administrator. The data is overlaid on a base map of Emuhaya so that users can be able to visually locate features. The available data is purely based on the submissions made by the users on the platform (Figure 5.12)

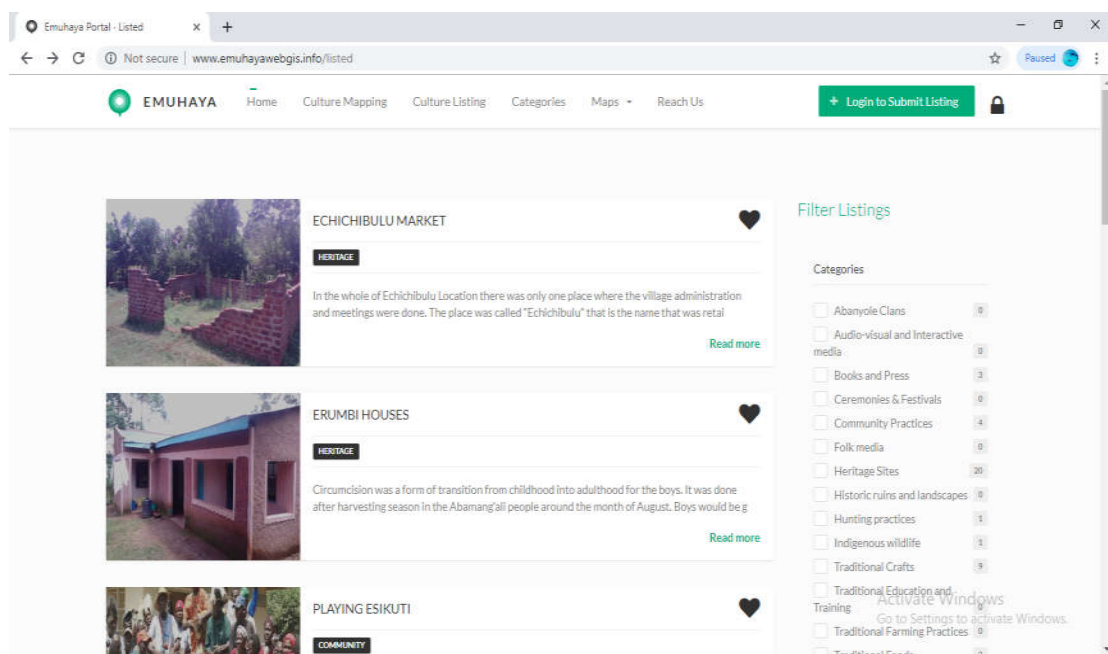


Figure 5.12: Sectional view of the listed culture items page.

The page is hosted at <http://www.emuhayawebgis.info/listed>

Once on the page the user can then filter through using the options on the right-hand side of the screen. Once you arrive at the desired feature, simply clicking on the option moves you to the screen below where you can further explore the entry (Figure 5.13). Within the context of this system, culture has been presented as simply a place, an object or a practice. The idea behind this simple classification was informed by the fact that culture is quite

multifaceted with a number of classification schemes already in place. However for the typical user, a simple classification that attaches coordinates to; a cultural place, where a cultural object is located and where a particular culture is practiced was desirable. Reviews of previous culture mapping studies informed the research that most users are only interested in visualizing these tangible and intangible cultural features using their general coordinate information.

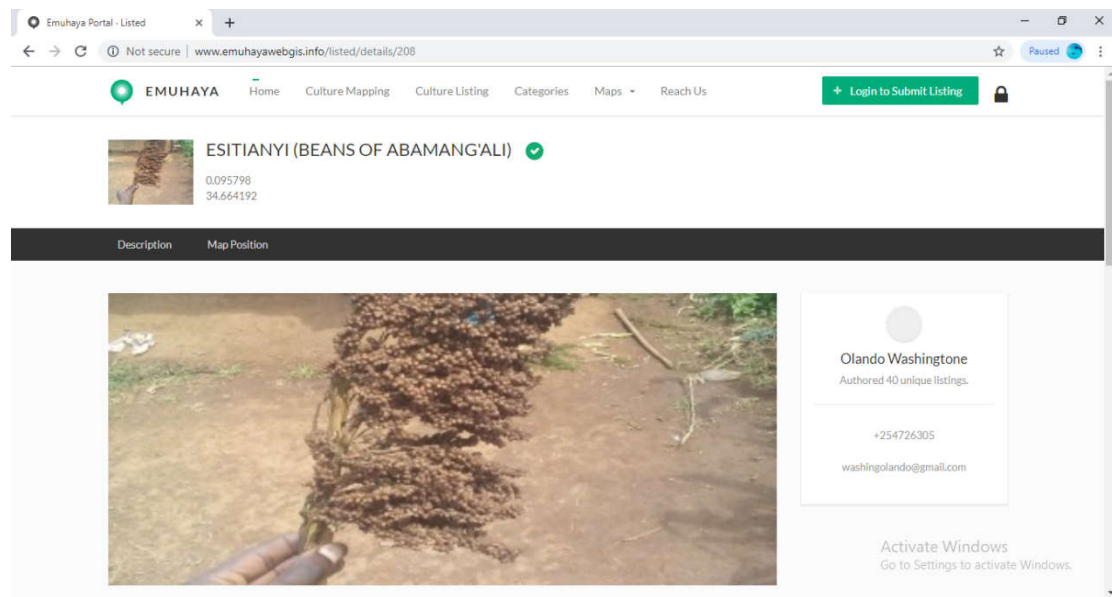


Figure 5.13: Fragment view of culture listing.

The page is hosted at <http://www.emuhayawebgis.info/listed/details/208>

Demonstration of submit culture point page

This feature is used by registered users to contribute new cultural information into the portal. Once the user logs in, there will be a change in the button on the top-right of the screen to allow the user to submit a listing (Figure 5.14).

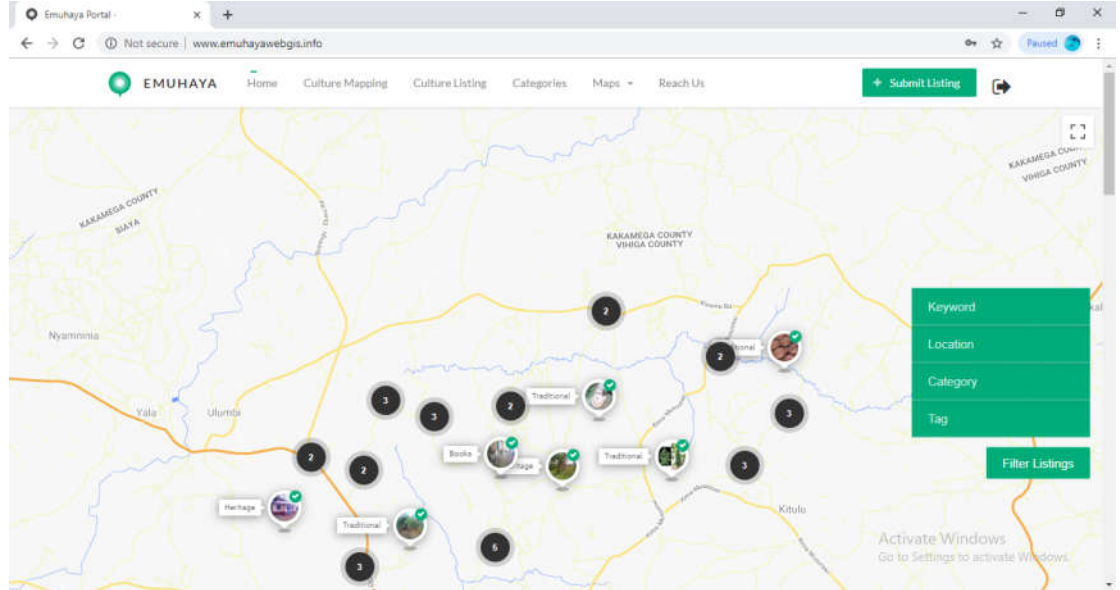


Figure 5.14: Sectional view of the registered user page after login.

The page is hosted at <http://www.emuhayawebgis.info/>

Once the user selects on submit listing by clicking on the button, a dialogue will appear that will allow the user to enter the name of the culture entry, the correct category that corresponds to either a place, an object or a practice, the detailed description of the entry, the location (latitude and longitude) and an image of the feature.

Once the user completes the form, they can then use the submit point button at the bottom-left corner of the form. It is once again important to note that a lot of validation has been taken into consideration when submitting a point. The area of study has been geo-fenced and the system will not allow any coordinates outside the area. That is why the user is required to select the exact location on the map when making the entry on the web platform. Secondly, once an entry has been submitted, it does not go live immediately. It is instead placed in an inactive queue that is visible from the administrator's dashboard (Figure 5.15). The administrator will then liaise with relevant reviewers to verify the authenticity of the submission before going live. The submission procedure don not totally

deter jokers from providing false information but it significantly reduces the number of false entries through the multi-step approach.

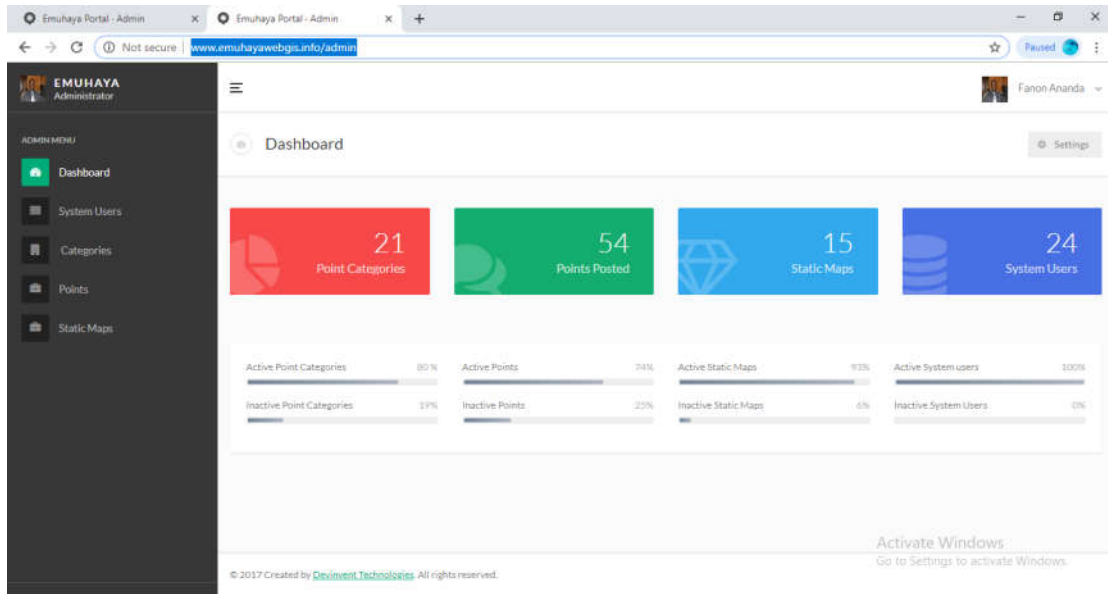


Figure 5.15: Partial view of the administrator’s dashboard

The page is hosted at <http://www.emuhayawebgis.info/admin>

Demonstration of viewing web maps

This feature allows the user to browse the Emuhaya web maps that exist on the system. The web maps have been created from existing shapefiles that were created from the collected socio-cultural data after the fieldwork phase of the project. There are 2 options to viewing the web maps; you can either view them as shapefiles overlaid on an OSM base map or through the QGIS cloud option for distributing web maps. To access the web maps, from the home page select Maps option and from the list that appears select either the second or third items which are QGIS maps and Web maps respectively. Figure 5.16 shows a sample web map view on the system.

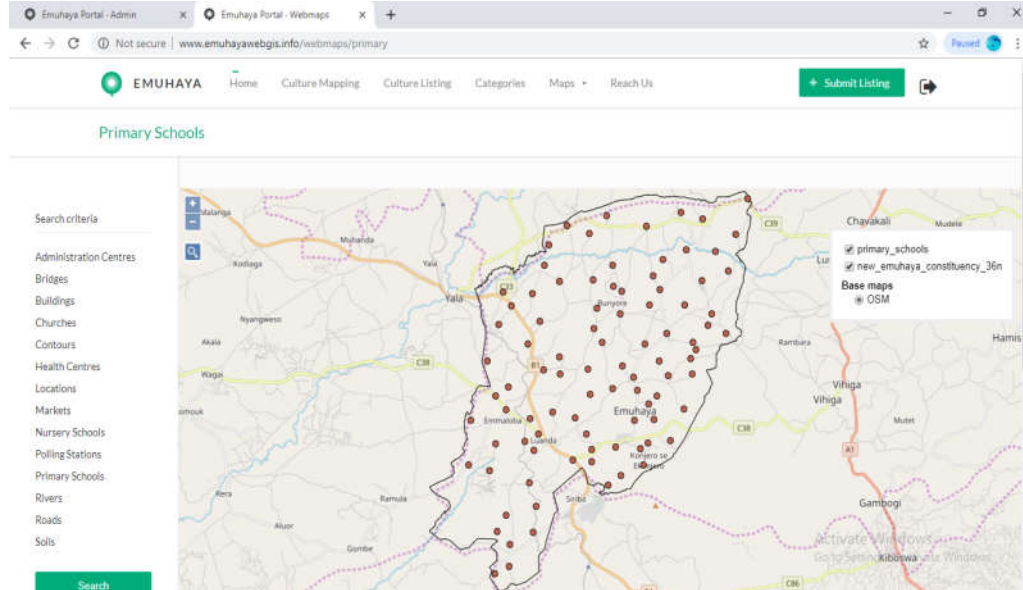


Figure 5.16: Partial view of the web maps showing schools in the study area

The page is hosted at <http://www.emuhayawebgis.info/webmaps/primary>

Demonstration of viewing static maps

The static maps were created from the socio-economic data that included spatial attributes that were collected during the fieldwork. This feature allows the user to browse the static Emuhaya maps that exist on the system (Figure 5.17). The user can access this page by selecting the static maps option under the maps menu that is located at the top of the home page.

the use of the data on both the mobile and web platforms. Figure 5.18 illustrates the relationships between these mobile system components.

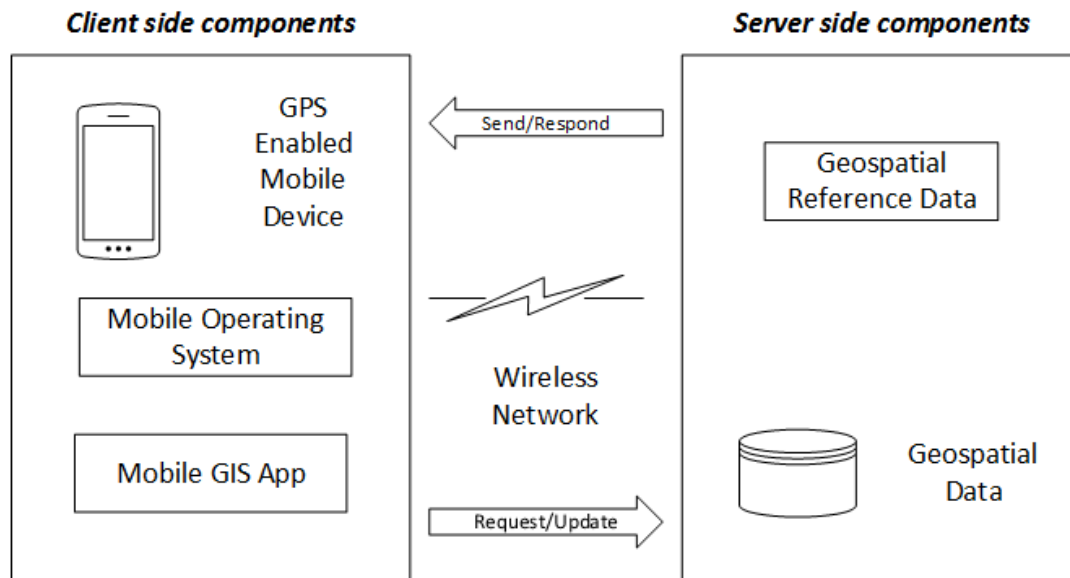


Figure 5.18: Mobile application components

Application overview

The mobile GIS version of the application is accessible for free via the Google Play Store. The potential user of the application can access it on the store by searching for **Emuhaya Guide** application using the search option within the play store (Figure 5.19). They can then download the Android application package (APK) file to install the mobile GIS.

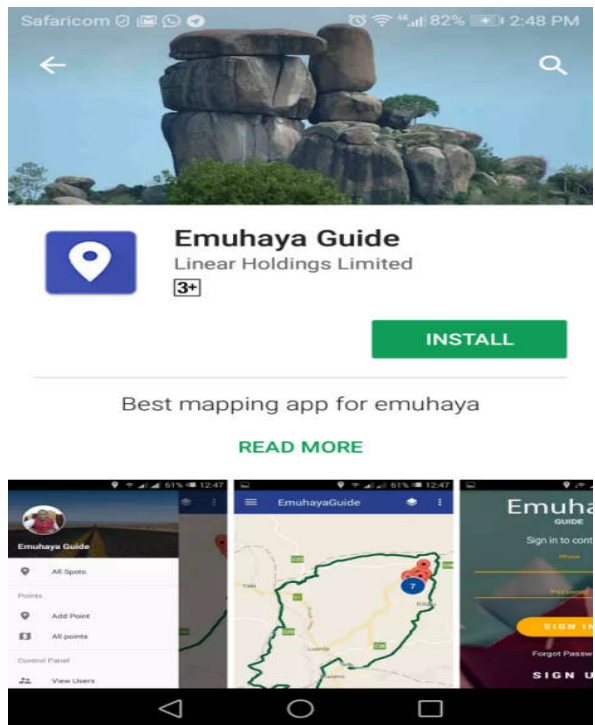


Figure 5.19: Mobile GIS installation screen on Google Play Store

Once fully installed, the user can then proceed to the first screen (Figure 5.20).

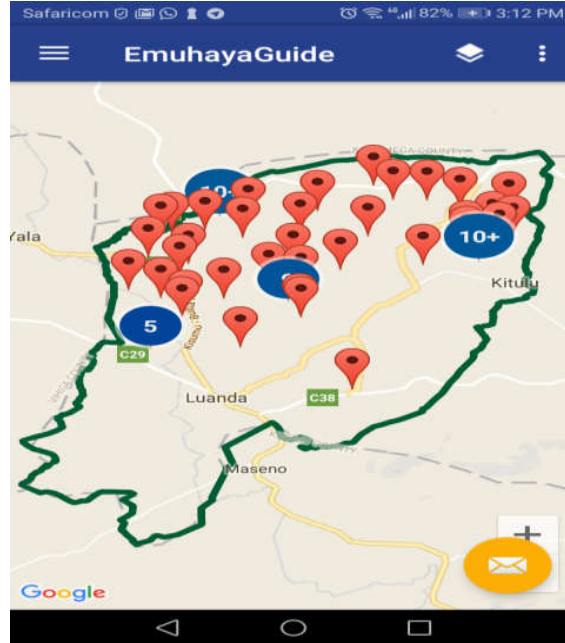


Figure 5.20: First screen when the application is started

Demonstration of submitting a culture entry

This feature is similar to the previously explained feature in the web GIS. Albeit slightly different in its operation, the end result will be a culture entry that is visible both on the web and the mobile platform. To submit a point, the user needs to be registered and currently logged into the platform. The system will allow the user to capture an image of the entry and it will also pick the location coordinates automatically from the GPS (Figure 5.21).

Demonstration of viewing culture information

This feature allows the user to access all the uploaded and activated (a function of the administrator after review) culture entries. On the menu in the mobile GIS accessing the All points option will lead you to the culture screen that further allows you to filter through the content (Figure 5.22).

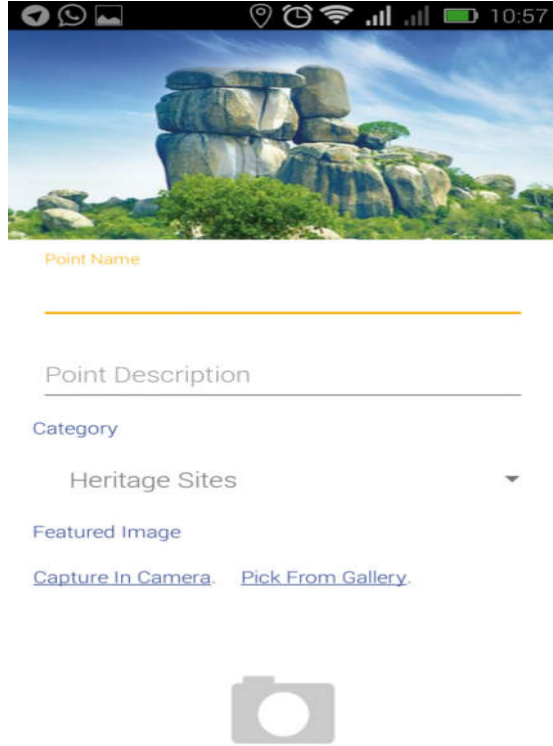


Figure 5.21: Fragment view of the submit entry screen

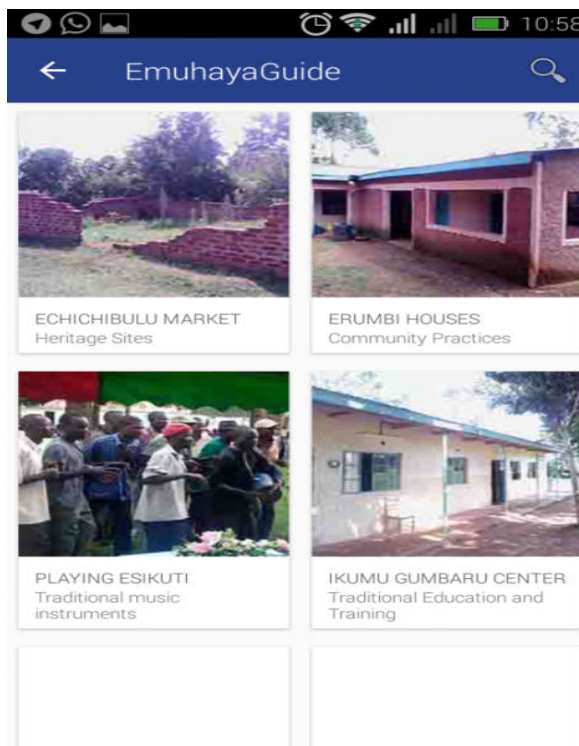


Figure 5.22: Partial view of the view culture screen

5.2.3 User statistics

The statistics were obtained using PIWIK, an open web analytics tool. PIWIK was used to collect and analyse information about users visits, downloads, duration spent on the platform and many more facts over a period of 60 days after going live. The data was tabulated and includes the dates of visits, the number of unique visitors, the number of actions performed during the visits, the maximum actions performed per visit, the total time in seconds spent by visitors and details about return visits. See Appendix 5.

It is important to observe that the platform is yet to gain significant traffic. This is due to the fact that just like any other new product, there is a need to create awareness amongst the intended users. The project intends to further seek opportunities to create awareness through partnerships with the constituency and county administration amongst other stakeholders because the publicity drive will require funds and goodwill. The initial

outreach targets to raise the number of regular users of the system to 1000 within a period of 3 months from the start of the first publicity drive. This has target has been informed by the already guaranteed support from the current constituency leadership who are also keen on piloting the platform for collecting other spatial data within the study area.

5.2.4 Application summary

The Emuhaya Cultural Portal offers an integrated tool for use for the community, planners, leaders and cultural tourists. Each of these users will rely on the portal to accomplish different tasks: The community at large will provide a good and reliable source of cultural information through a crowdsourcing model that allows them to volunteer cultural information that is classified and stored in the portal database; the planners will rely on the various web maps for socio-economic development planning as these maps capture various information about resources distribution and utilization; the leaders will utilize the portal to play an oversight role on the planners as they execute their mandate through ensuring that the best interests of all stakeholders are met through equitable distribution and preservation of resources; the cultural tourists will rely on the portal to discover exciting cultural artefacts and sites to visit within Emuhaya which is part of the Western Kenya tourist circuit. This will greatly market the region and aid in economic growth through increased revenue from tourism.

The user friendly portal and mobile application make the system easy to use for any first time user. The menus have been clearly displayed with fewer keystrokes or clicks required to get some meaningful feedback from the system. The system also relies on open source technology thus making it easy to operate and deploy as there are no licensing restrictions on the product. The maps derived from the portal can be downloaded or printed by users for use offline. The inclusivity of all stakeholders created by the system through public participation supports the project's premise that PPGIS can be utilized for mapping and management of natural and cultural resources within the Emuhaya region of Western Kenya.

5.3 PPGIS portal development methodology

The last objective of the research was to propose a software development methodology suitably adapted for public participation GIS portals. This objective was informed by the need for a simplified and robust PPGIS portal development methodology that draws from the best practices of other software development methodologies in other domains. As evidenced in the literature review, many development methodologies are in existence, each suitable for different project scopes and domains. It was therefore necessary for the research to adopt a more formal approach while deciding which methodology to use. Avison and Fitzgerald (2006) propose a check list that can be employed by developers while selecting a methodology. Table 5.15 provides this list of evaluation criteria that was considered.

Table 5.15: Methodology selection check list

Evaluation Criteria	Description
Rules	Does it provide clear formal guidelines to cover phases, tasks and deliverables?
Coverage	Does it cover the entire development process?
Design	Does it separate physical and logical design?
Inter-stage communication	Work should be communicable to other stages
Teachable	Are the techniques in the methodology understandable?
Designing for change	Can the designs be easily modified?
Simplicity and pragmatic	Is it easy to use?
Participation	Fostered through simplicity and good communication

Having reviewed the existing methodologies for web, GIS and Web GIS projects, the research had to make a choice whether to adopt, adapt or build a methodology suitable for the current project. Table 5.16 shows the cross comparison results between the three Web

GIS methodologies reviewed. It is clear that there is a need for a hybrid methodology that aggregates all the elements and emphasizes inter-stage communication while at the same time is simple enough and pragmatic for a novice user. The methodology should embrace the well tested approaches of conventional and web methodologies but at the same time accounts for the unique development activities typical in such systems.

Table 5.16: Cross Comparison of Web GIS Methodologies

Evaluation Criteria	Web GIS Development Cycle	Rapid GIS Development	Web GIS Navigational Development Techniques (NDT) Methodology
Rules	✓	✗	✓
Coverage	✓	✗	✓
Design	✗	✗	✓
Inter-stage communication	✗	✗	✗
Teachable	✓	✓	✓
Designing for change	✗	✓	✓
Simplicity and pragmatic	✓	✗	✗
Participation	✗	✗	✓

The result presented here is a methodology that was developed and tested during the development of the Emuhaya culture mapping portal. The methodology used in the development of the system is known as the Y-Model Web GIS development methodology (YWDM). This hybrid methodology was an output of the research process. The research relied on the Capability Maturity Model Integration (CMMI) developed by the Software

Engineering Institute (SEI) at Carnegie Mellon University (CMU) to improve the current development processes as explained in the following section.

The methodology is a blended approach that uses both the iterative waterfall and the classical software development life cycle (SDLC) as the baseline software development methods. Object oriented modelling was used to document the analysis and design models of the system. Figure 5.23 illustrates the main five phases of the methodology. The development process is organized into three distinct sections; GIS development, Web application development and Integration & Management. The methodology takes into account that a Web GIS project produces a hybrid product that has qualities of both traditional GIS and web applications and hence fuses the best practices of each development approach. The methodology has clearly defined phases with deliverables at the end of each phase including a feedback loop to previous phases in an attempt to introduce flexibility so as to accommodate user requirement changes. The activities undertaken during each phase are summarized in the following sub-sections;

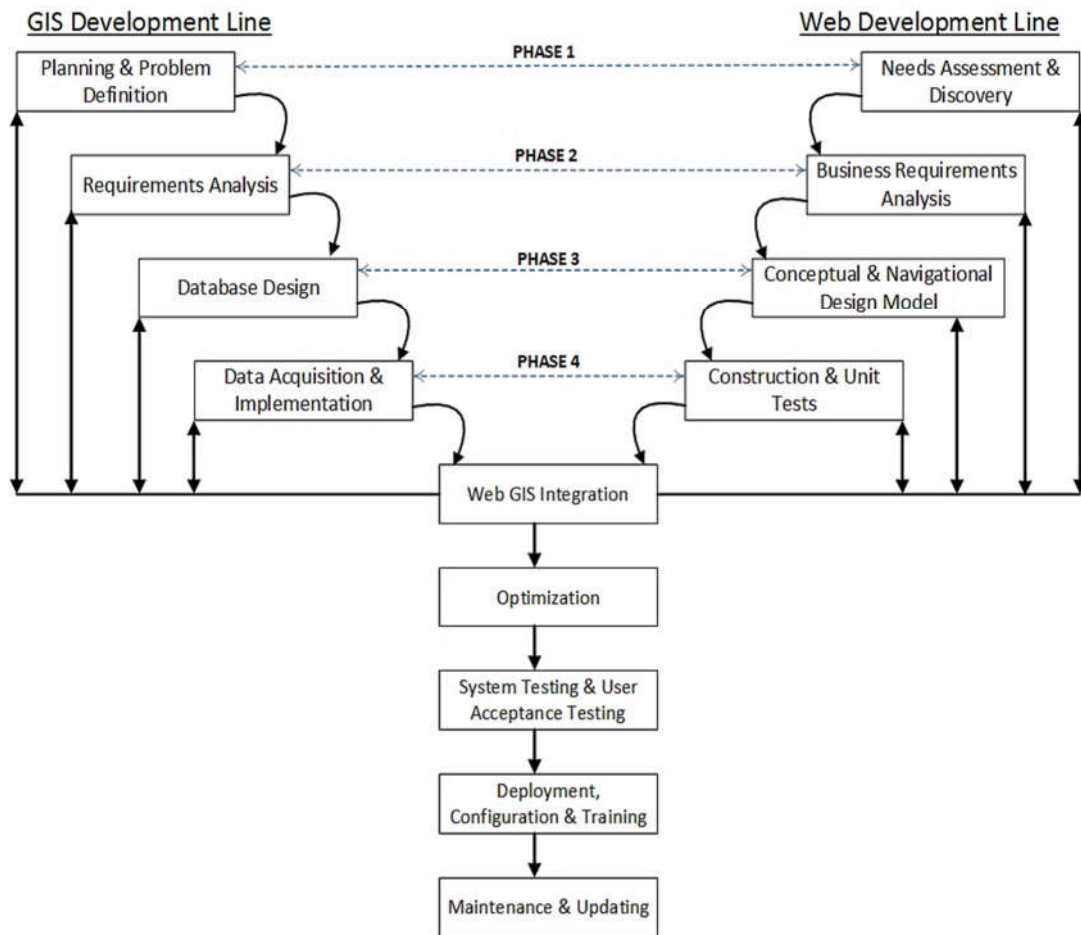


Figure 5.23: Y-Model web GIS development methodology

Phase 1

This was the initial stage in the software development and it involved defining the problem and indeed determining the scope of the problem. There are two main concurrent activities undertaken during this phase:

- i. Planning and problem definition- It was important to express the problem being solved with reference to its geographical relevance since the system being developed had specific geospatial aspects to address. It was also

important to develop an overall plan for the GIS development process. The plans were expressed through feasibility reports and work flow diagrams.

- ii. Needs Assessment and Discovery- Web applications are interactive in nature and it was important to consider the end user needs earlier in the development process. This section involved answering questions like; what are the user expectations of the system? For this research this question was answered through simple user surveys with the technical and non-technical users and brief focus group discussions with some of the intended end users of the system.

Phase 2

This constituted the analysis phase of the project. It was at this phase that the researcher embarked on discovering the functional and non-functional requirements of both the GIS and the web system. Various tools were used during this phase depending on the section being tackled. GIS requirements were discovered through discussions and interviews. Web requirements were discovered through structured interviews and questionnaires. As part of the tasks in this phase, it was also important to critically examine the business processes that will be supported by the system one being delivered so that one can tailor make the system to address these needs. The main deliverable in this phase was a requirements specification detailing the geographical and user requirements of the system.

Phase 3

Web applications are interactive applications by nature. It was therefore important to design the conceptual and navigation models of such a system. A conceptual model was developed to provide a summarized snapshot view of the overall system. This model enabled the researcher to develop an understanding of the main aspects of the system. These system aspects were expressed through diagrammatic models. A web navigation model was developed to show how the different web pages in the system are linked

together. UML-based (Unified Modelling Language) web engineering provided the developer with the appropriate notation to express this model. The database models for the system were also modelled during this phase.

Phase 4

This was a crucial phase for the GIS development line. Data collection was conducted at this point using a variety of approaches namely; field surveys, satellite data, and use of GPS. The collected data was then represented within the data model designed earlier. The web pages were coded using PHP scripting language. However various open source software tools are available for use. During this phase only the web page prototypes were developed as the final implementation was dependent on the data in the geodatabase. Most of the work on the web pages was centred on rendering and analysing of the geospatial data in the geodatabase. Unit testing was done on the web pages to check for errors at individual functional points.

Phase 5 (Integration and Management Phase)

This was the final and longest phase of the project. Integration involves interfacing various system components so that they can work together. Integration testing was conducted during this phase to check for compatibility issues and performance in general. The system was also optimized for better performance especially when serving the map layers. Different optimization techniques such as optimizing the tile cache are performed here to improve performance times. System testing is very important as the system is tested in its final operational environment which can be real or simulated.

The shift from development to operational environment during deployment and configuration can expose the system to various incompatibility issues. It is therefore crucial to conduct the structural and functional tests exhaustively. A sample of the users of the system were afforded an opportunity to examine the usability aspects of the

system. This was done through alpha and beta tests. Alpha testing is normally conducted in the software builder's environment while Beta testing is conducted in the client's environment or the production environment. The aim of these tests is to have as many users as possible participate in the testing process to reduce any potential resistance to the system. The tests also yield useful feedback that can be used to improve the system. Maintenance of the system is ongoing and will strive to accommodate any emerging needs. However due to a limitation in funds, the current maintenance is only handled periodically.

In conclusion, the presented Web GIS methodology is a theoretical model based on academic research and the researcher's experience with this type of applications and existing development methodologies. The methodology is an attempt to provide a structured approach to Web GIS development that can be widely adopted for both small and medium size projects. Its simplicity and similarity to existing approaches will make it a favourite for the novice developer. The methodology was applied to the development of the Emuhaya Web GIS Portal. The methodology needs to be further tested on a number of projects so that empirical evidence can be collected to prove its success in aiding the development of Web GIS applications.

5.4 Discussions section

The research's main objective was to develop a participatory mapping model that conceptualizes and constructs a system that can be used to create a digital culture repository for the study area. The research questions presented in chapter one (1) are the basis for this discussion section.

5.4.1 Culture classification scheme

The first research question was derived from the objective to review cultural resources mapping and develop an appropriate classification scheme. The answer to this question is

that for any meaningful information about culture to be georeferenced and visualized on culture maps, then it would have to be broadly classified as a cultural place, a cultural object or a cultural practice. This classification was adopted because it provides a simple and non-technical view of culture and cultural resources that can be easily understood and implemented. Interactions with the users in the field and a review of user habits revealed that they did not possess the technical competence in GIS and could only provide simple and specific data that has a fixed geographical position. This consequently informed the study to represent the data collected as culture location points on a base map of the study area. Capturing this information relied on user actions already familiar to the users such as right-clicking on a location or double-clicking on a location. The research relied on these familiar actions to engage users to submit and view culture information.

Within the context of this study, this classification scheme was quite successful. The result was informed by the literature review that revealed that different studies have adopted different approaches for classifying cultural heritage information (Ipara, 2000; Bradshaw et al., 2011; Evenson and Tilden, 2010). Bradshaw et. al. (2011) had earlier initiated work on the classification scheme that was adopted and contextualized to the area of study. The classification scheme combined with the work of Ipara (2000) further informed the research of the material and non-material culture (presented in Table 1.2) that would adequately capture the required information. These reviews and sample data from the field were the primary methods that were utilised to arrive at this result. An important limitation of the classification scheme used in the research is that it provides for the capture of data that can only be used for reference and basic analysis. No detailed technical analysis can be performed on the data to discover new patterns.

The relevance of this finding for future culture mapping projects is that it informs these projects the importance of adopting a simple classification for the data to be collected and mapped. The average user does not desire complexity but is instead drawn to simple and usable information.

5.4.2 Culture perceptions

The second research question was informed by the need to establish the culture perceptions amongst the people of Emuhaya. This question was answered through a culture survey that was conducted in the study area. 384 questionnaires were issued out to the respondents in the area and 300 were fully completed and used to generate results. The results are as follows: A majority of the interviewed residents have a high affiliation to the study area as presented in Table 5.2 with the main reason for the high affiliation being born there, Table 5.3. The respondents identified sharing of physical resources as the main unifying factor amongst the residents in the study area among other factors as presented in Table 5.5. 66% of the population lacks information about their origins and culture (Figure 5.6). 71% of the respondents take part in cultural events organized within the study area. The main events showcased at these events are foods, artworks, songs, dances, ceremonies and traditional regalia. On cultural differences, 67% of the population believe that the clan one belongs to will greatly influence their cultural practices (Table 5.11). Interestingly 59% of the respondents revealed that culture is still being observed albeit at varying levels in the community (Figure 5.8). The main form of cultural exchange is through interactions between the elderly and the young. This process is not formalised and the information is not documented. 70% of the respondents feel that culture has been changing in Emuhaya and it is a good idea to formally document their culture and cultural resources before they become extinct. 71% further responded that there is a need to preserve culture, with only 52% agreeing that the culture can be exploited for cultural tourism. There is a notable adoption of technology in the area with a good number of the respondents being knowledgeable about computers, mobile and web technologies. There was also a willingness among the respondents to use technology to preserve culture through participatory mapping approaches.

The culture survey produced results that supported the earlier assumption that culture in the study area has been rapidly changing and there is a need to preserve the culture in a digital culture repository. The data collection process was successful in meeting its final

objective however the one limitation of the study is that it did not achieve the gender ratio as per government regulations. The total female respondents were only 82 out of the possible 300 which is below 33.33%. As pointed out earlier in the demographics information (Table 5.1), this disparity resulted from the inaccessibility of women during the fieldwork sessions. The study had not anticipated that most women would decline making responses to the interviewers and instead opting that their husbands respond on their behalf. Most of the women polled were accessed in the market centres and other other significantly urban areas of Emuhaya. However the researcher believes that this limitation did not significantly affect the quality of the results. The questionnaires solicited a common response that was devoid of gender preferences.

The results obtained from this objective point to the fact that culture is fast changing in the study area. A number of reasons have been cited for this shift in practices but rapid urbanization and globalization through technology are the key driving forces. The results are significant for culture planning in the study area. Literature review revealed that cultural mapping is a critical early phase of culture planning. The goal of the process is to identify and leverage the community's cultural resources, strengthen the management of these resources and integrate cultural resources in planning and decision making. Cultural planning at the community level is an important approach to culture and heritage preservation. The study identifies the following as barriers to cultural planning (in order of priority); need for dedicated financial resources to support planning, lack of support from elected officials and senior staff, lack of governing body to draw community stakeholders together, lack of consensus within the local cultural sector and lack of adequate access to tools, information and expertise (Baeker, 2005).

Culture needs to be managed from within a culture policy framework or legislative foundation for culture planning herein referred to as the Cultural Planning Process (CPP). The need for a CPP has been informed by the massive economic shifting towards creative economies that are rooted in culture. A significant contribution of this result is the creation of a generic CPP framework for Vihiga County Government governing the study area.

The framework can also be reviewed and scaled up for cultural planning at the national level. Figure 5.24 visually depicts the culture planning process framework that comprises of 5 distinct phases.

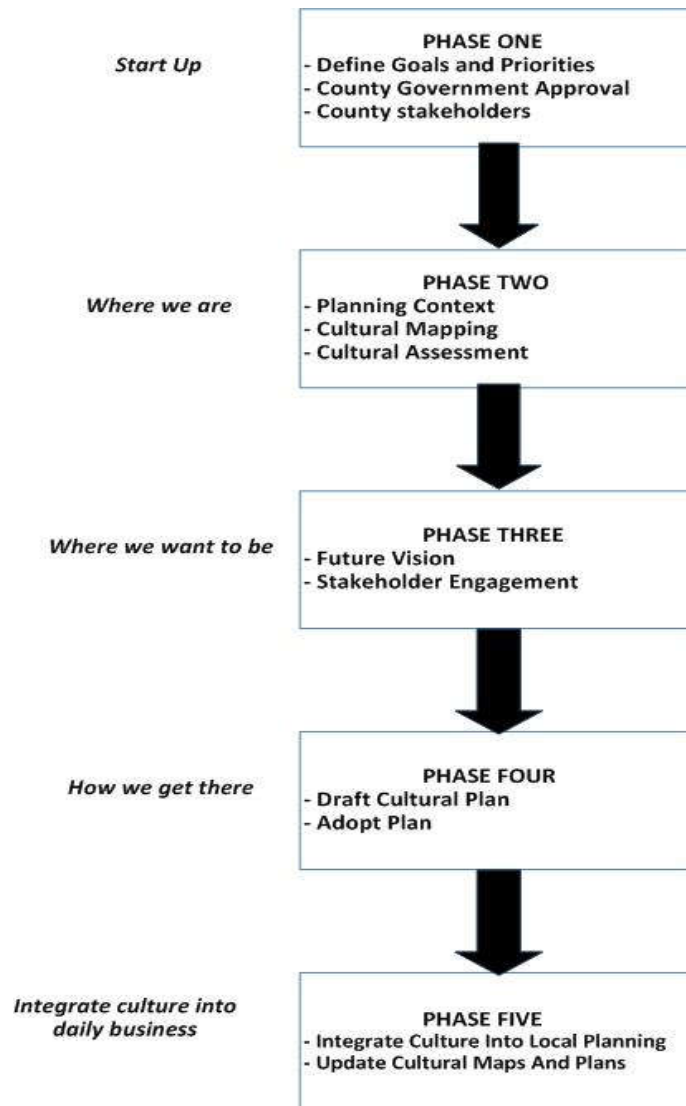


Figure 5.24: Culture Planning Process

Phase one is the start-up phase that involves setting goals and priorities for the process. Phase two involves establishing the current context and will involve cultural mapping and assessment. Phase three is concerned with determining a vision and strategic direction through consultation. Phase four outlines the cultural plan that determines how we get there including a monitoring and evaluation plan. The plan is adopted at this phase. The final phase strives to integrate culture in all aspects of local planning and decision-making. This will include the constant updating of cultural maps and plans. If adopted, this five-step model has the overall benefit of making local culture and cultural resources more visible thus recognizing their contribution to sustainable development when planning for development. The culture planning process framework is a notable approach to culture planning that is practical and well structured. The recommended time frame for using this framework shall be dictated by the scope of the project or area to be covered. An adopted culture plan is also a notable output of this process.

5.4.3 Participatory mapping models

The third research question was informed by the project's objective that sought to develop a participatory mapping model to be used to create a digital culture repository for the study area. This question was answered through a process that involved the analysis, design and technical implementation of the web and mobile GIS for culture mapping.

The project succeeded in implementing a GIS system that relies on web and mobile technologies for culture mapping in Emuhaya. The presented solution is not unique in technical implementation, however the use of the technology and the context in which the technology has been applied is what has resulted in a unique product for the study area. The web platform of the system is accessible on <http://www.emuhayawebgis.info> while the mobile version of the system is a mobile application that can be accessed on the Google play store. All the information within the repository is presented to the user via thematic maps that are both static and dynamic. A further unique component in the system is that it employs a crowdsourcing as a technique to solicit for culture information from the non-

technical users through their desktop and mobile devices. Unlike the traditional participatory techniques such as participatory forums that require the participants to be in a single location to collaborate, the same is achieved on the platform by users who are in disparate locations with a single moderator as the chief reviewer of all submissions. The desired participatory feel of such a project is still retained and can cost-effectively reach a wider audience. Previous fieldwork and reviews of the study area had already informed the research that the technology and especially mobile technology penetration in the study area was adequate with 45% of the handsets owned being smartphones and 51% of the respondents being computer literate. 80% of the computer literate respondents had working knowledge of the internet.

The initial data populated into the repository was solicited through face to face forums with cultural leaders in each location. Each of these forums was chaired by the area chief whose authority greatly influenced the participation of the locals. However what was clear from each of the participatory sessions is that you need to constantly reward/motivate the participants to guarantee success of the data collection effort. These sessions provided the researcher with a unique opportunity to popularise the culture mapping platform to its intended beneficiaries. The participants in these forums seemed really excited and eager to participate on the mobile platform. They were excited by the prospect of having something they have contributed accessible worldwide through the platform. The challenge is, and still remains as to how one can sustain user interest and experience on the platform. The research discovered that if incentives are not provided to users, it will be difficult to motivate them to voluntarily provide culture information. An intermediate solution to the problem was to reward every participant with 10 Kenya shillings worth of airtime for every contribution. These finances were re-allocated from the original project budget. Although this reward system worked at the time, it is not sustainable in the long-run since the project funds are limited. Secondly due to the prospect of being rewarded the volume of information from the participants increased but so this the volume of unusable/inaccurate information because it was more of a competition to get the most

rewards. However a key challenge still remains on how to develop a sustainable reward model based the local user's contribution on the platform. The provision of airtime for every authentic contribution that goes live still remains the most viable option. It however requires partnerships with the leadership in the area and other development stakeholders to establish a continued source of funds for this purpose. The lack of a reward system for contributors on the platform has greatly hampered the volume of authentic information in the repository which directly affects the visitors on the platform.

Kenya has in the past had some culture mapping projects under different initiatives (African Cultural Regeneration Institute, 2012; Institute for Culture and Ecology, 2011; Rambaldi et. al., 2007; Muchemi et.al., 2009). All these projects yielded a culture map that addressed the project objective however none of the projects has explored a technology oriented approach this participation component. In fact most of the community mapping projects insist of a participatory approach but it is this same participation component that has eluded the project implementers. Globally there have been some successes with technology assisted culture mapping but the mobile mapping devices have to be specialized for mapping in the field. This research has made an attempt to provide a solution that relies on the readily accessible user devices and software that is your smart phone and open source mapping technology. The results show that this approach to participatory mapping has the potential to involve a wider stakeholder base while utilizing minimum resources. While successful in its initial technical implementation, this project has disclosed a number of revelations that have shaped this and future technology-oriented participatory culture mapping initiatives:

- i. Intensive local community lobbying and participation have to be part of the process from the beginning. Do not attempt to develop a solution without all stakeholders being on board. Communities care less for products that seem distant as they will be labelled "foreign affairs".
- ii. Most community users are not technology literate and thus introducing this technology may be a challenge. It will be useful to create a throwaway

prototype that can be used for creating awareness, further data collection and end user training.

- iii. Data collected from the community may be incomplete, inconsistent or altogether incorrect. There is a need for continued reliance on scientific approaches to verify the data. This project relied on existing low and high-resolution satellite imagery, document reviews and field visits to verify volunteered data.
- iv. End users at the community level are excited when introduced to the system for the first time. However sustaining the interest through continued use of the system is difficult. Most users require a personal identity on the platform that helps them build a social network that allows users to interconnect and share information and alerts on various issues e.g. an alert if a place close to you has been mapped or modified.
- v. The system requires continued monetary support from alternative sources other than student research funds. When the funds run out, it is difficult to keep it running. GIS initiatives are yet to fully take root in local governments and they are reluctant to make a budgetary allocation such projects. Outside support by donors can still sustain the project but for true success to be achieved, a lion's share of the budget should originate from the local government. This will make the system more accountable when audited for benefits versus costs.
- vi. A GIS resource office with staff and other resources should be created at the community administrative level. Members of the community should be recruited and trained to support all aspects of the system. This will create a local identity for the system. They can further create a community version in the local language to accommodate the wider community. Supporting the system through the current project structure will not be sustainable in the long run.

5.4.4 Participatory GIS software development methodology

The last research question was informed by the researches' objective to propose a software development methodology adapted for public participation GIS applications. The assumption formed after a review of existing software development methodologies is that they may not adequately cover the needs of this type of emerging GIS applications with a unique set of needs.

The resultant methodology developed and used in the development of the culture mapping application for this research project is known as the Y-model web GIS development methodology (YWDM). This methodology was used to successfully implement the Emuhaya culture mapping portal. The presented methodology is based on a blended approach to web development that uses both the iterative waterfall and classical SDLC as baseline software development methods. The methodology organizes the development process into three distinct sections; GIS development, Web application development and Integration & Management. The details of each of these sections including the visual representation of the same have been presented in the results section of this thesis. During the development of the methodology, it was taken into account that a web GIS application consists of a hybrid product that has qualities of both traditional GIS and web applications. It was therefore necessary to fuse the best practices in the development of each product. This resulted in a methodology that has clearly defined phases with deliverables at the end of each phase phase including a feedback loop to introduce the flexibility of accommodating user requirement changes.

Review of existing literature revealed that most of the existing methodologies were suitable for structured medium-sized professional projects within an organizational setting. Community projects cannot be effectively implemented using these "broad" approaches to GIS systems development. Therefore, there was a need for a hybrid methodology suitable for such projects that was simple enough and pragmatic for the novice user. The study relied on the Capability Maturity Model Integration (CMMI)

developed by Software Engineering Institute (SEI) at Carnegie Mellon University (CMU) to improve the current waterfall and classical software development life cycle (SDLC) development processes resulting in a hybrid GIS development methodology. More specifically, the CMMI-DEV, V1.3 (SEI, 2010) continuous representation was used as a baseline software process improvement model in developing the presented methodology. This model was chosen mainly because it has gained international acceptance among the software engineering community and it is a comprehensive software improvement model that adheres to international standards.

To evaluate the presented methodology, the study adopted a framework proposed by Avison and Fitzgerald (2010). Currently it is very difficult to compare or evaluate methodologies as there are many views on methodologies as there are writers. However Avison and Fitzgerald (2010) have devised a comprehensive framework that comprises of seven elements. Table 5.17 presents how the methodology was evaluated against these elements.

Table 5-17: YWDM Evaluation

Element	Description
Philosophy	Paradigm- The methodology follows a science paradigm that belongs to the objectivist approaches. Objective- To build web driven geographical applications. Domain- It is a problem solving methodology that is adapted to solving specific pre-identified problems Target- Small and medium organizations and suitable for geographical web-based applications.
Model	The methodology relies on process, data and object oriented models to represent different aspects of the system.
Techniques and tools	The methodology provides a structured approach to systems development. It does not recommend a specific set of tools as web applications can be developed using a wide range of tools and technologies. Data, process, object oriented and project management techniques are applied.
Scope	The methodology covers the entire range of the systems development life cycle. These stages are; feasibility, analysis, logical design, physical design, programming, testing, implementation and maintenance.
Outputs	Adopts the same approach as the classical SDLC by producing document products at each significant milestone i.e. feasibility report, requirements specification, design documents, test reports, system documentation and implementation reports.
Practice	The methodology has an academic background. The main users of the methodology would be programmers and analysts. Depending on the system scope the role could be played by a single individual. Currently it is still difficult to justify/evaluate the user base.
Product	The methodology is straight forward and intended to be used with minimal training or consultations. Academic papers are available as supporting documents.

The main limitation of the presented methodology is that it is a theoretical model based on academic research and the authors experience with this type of applications and existing development methodologies. The methodology has this far been tested once during the development of the Emuhaya culture mapping application. The methodology needs to be further tested on a number of projects so that empirical evidence can be collected to prove its success in aiding the development of Web GIS applications. On the other hand, the unique contribution of the proposed methodology is that it combines the milestone-driven easy to use approach of the iterative waterfall model with the classical, scalable and plan-driven SDLC. Secondly the dual approach of the methodology enables different teams to simultaneously work on the two aspects of Web GIS development

concurrently and allowing for an integration and testing of the system before final completion. It is hoped that the methodology presented in this thesis will serve as a useful framework harnessing the technical skills and creative thinking of the Web GIS developer while retaining the simplicity desirable by both novice and expert developers.

5.5 Chapter summary

This chapter presents the results and the corresponding discussions. The results and discussions presented in this chapter have been organized according to the objectives that were pursued during the research. The results section of the chapter has results on; the culture perception and situation in Emuhaya, the developed culture mapping GIS for the study area and the finally the proposed software development methodology for participatory mapping portals. The discussion section of this chapter further interprets the presented results showing how each result has responded to a specific research question of the research.

CHAPTER

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This research focused on the application of technology in community driven participatory mapping of culture. The research implemented a participatory mapping model that was used to develop a digital culture repository for the study area. The study area is Emuhaya constituency of Western Kenya that is predominantly inhabited by the culturally rich Abanyore sub-tribe of the Luhya community. The main outcome of this study is a viable participatory mapping model that implements a digital cultural repository to be used to preserve culture information. The system relies on crowdsourced information through the web and mobile GIS platforms implemented. The conclusions in this section are informed by the objectives presented in Chapter 1.

In line with the first objective, this research can then conclude that for any meaningful information about culture to be georeferenced and visualized on culture maps, then it would have to be broadly classified as a cultural place, a cultural object or a cultural practice. This simple classification scheme offers a simple and non-technical view of culture that can be easily understood and documented. The culture information captured within the developed platform is organized as culture location points overlaid on a base map of the study area. Capturing this information further relies on familiar mouse actions. This simplicity makes the information user-friendly.

In line with the second objective, a culture survey of the study area revealed that the respondents lacked adequate cultural information about their origins and history of their clans. The youth were the most affected with a large percentage not having any knowledge about their cultural heritage. The survey involved 300 respondents in the study area. The produced results further supported an assumption made earlier that culture in the study

area has been rapidly changing and there is a need to preserve the culture in a digital culture repository.

In line with the third objective, a key output of the research is a participatory mapping model that has been used to implement a system for mapping culture information in the study area. The system comprises of a web and mobile GIS component. The web component relies on existing Internet technologies to enable the user retrieve and post culture information on the platform. The mobile GIS is built on the open source Android platform and to enable the user to access, query and update the culture map. The rendered map displays already mapped culture information and can be further reorganized as per the user needs. Both platforms rely on coordinate information to locate culture information that is either represented as a cultural place, cultural object or cultural practice that can be spatially located. The developed system provides a tool to be used by the community, planners, leaders and cultural tourists to accomplish different tasks; the community will provide a good and reliable source of cultural information through a crowdsourcing model that allows them to volunteer cultural information; the planners will rely on the various web maps for socio-economic development planning as this maps capture various resources information; the leaders will utilize the portal to play an oversight role on the planners as they execute their mandate through ensuring that the best interests of all stakeholders are met through equitable distribution and preservation of resources; and the cultural tourists will rely on the portal to discover exciting cultural artefacts and sites to visit within Emuhaya which is part of the Western Kenya tourist circuit. This will greatly market the region and aid in economic growth through increased revenue from tourism.

Finally, in line with the final objective, the research developed the Y-model web GIS development methodology (YWDM) that was used to successfully implement the Emuhaya culture mapping portal. The presented methodology is based on a blended approach to web development that uses both the iterative waterfall and classical SDLC as baseline software development methods. The methodology organizes the development process into three distinct sections; GIS development, Web application development and

Integration & Management. A review of existing methodologies revealed the need for a hybrid methodology suitable for such projects that was simple enough and pragmatic.

6.2 Knowledge contribution

The research has made a few key contributions to the existing body of knowledge in the study domain. First, the thesis presents a culture classification scheme that is viable for documenting culture information in the context of the research area. Second, the research provides a quantitative and qualitative assessment of the current state of culture in the study area. Third, a key outcome of the research is a participatory mapping model that has been used to implement a digital culture repository for culture preservation. The model relies on technology to crowdsource culture information from the masses. In line with implementing the digital culture repository, the research further develops the Y-model web GIS development methodology, which is a hybrid methodology for creating participatory mapping portals. Finally, the research reports a culture planning process model suitable for supporting culture planning at the county and constituency levels of administration in Kenya as part of a wider framework for culture preservation and application to sustainable development.

6.3 Further work

This study has demonstrated the use of web and mobile technologies to support public participation by non-technical users during a culture mapping exercise. Although fully implemented, the system solution still needs to further leverage on social networking platforms as a means of crowdsourcing geographical data/information. A key objective of the research is to increase the participation levels of the ordinary non-technical user who may not necessarily want to spend so much time on the platform. Future research needs to pursue partnerships and techniques that will enable the integration of the platform at all levels. There is also a need for more research into what incentive-based approaches are

best for systems that rely on volunteered geographic information. Without active user participation, such systems are easily forgotten and under-utilized.

Finally such systems are resource intensive and there is a need for research into how to optimize web and mobile GIS applications running on open technologies for efficient low-level retrieval and posting of geographical data/information. You cannot be able to use the mobile application without a good smart phone that has adequate storage and processing power. Similarly you cannot use the web GIS without a relatively stable internet connection with adequate bandwidth. Optimization of the mobile and web GIS is of great importance as it will go a long way in enhancing the usability of the system and its application to other domains.

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APPENDICES

Appendix I: Web GIS test cases

Login Test Case						
Test Case ID: Fun_001			Test Designed by: F. Ananda			
Test Priority (Low/Medium/High): Med			Test Designed date: 06/04/2015			
Module Name: Login Module			Test Executed by: F. Ananda			
Test Objective Verify login with valid username and password			Test Execution date: 23/04/2016			
Description: Test the Google login page						
Pre-conditions: User has valid username and password						
Dependencies:						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status	Notes
					(Pass/Fail)	
1	Navigate to login page	User= example@gmail.com	User should be able to login	Login screen		
2	Provide username	valid Password: 123456		No error		
3	Provide password	valid		No error		
4	Click on Login button			Home page	Pass	
Post-conditions: User is validated with database and successfully login to account.						

Query Culture Map Test Case

Test Case ID: **Fun_002**

Test Priority (Low/Medium/High): **High**

Module Name: **Culture Map Module**

Test Objective **Verify that a user can search and display map items**

Description: **Test that users can search and view map results**

Pre-conditions: User is a valid user and is already logged into the system

Dependencies:

Test Designed by: F. Ananda

Test Designed date: 06/04/2015

Test Executed by: F. Ananda

Test Execution date: 23/04/2016

Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Navigate to map page	Search parameter = "Point 1"	If the search parameter exists the result should be displayed as an overlay on the Emuhaya map.	Result is found and displayed on map.	Pass	
2	Provide search parameters					
3	Execute search					
4	Display search result on Emuhaya map					
Post-conditions: User is validated with database and successfully login to account.						

Submit Point Test Case

Test Case ID: Fun_003

Test Priority (Low/Medium/High): High

Module Name: Submit Point Module

Test Objective Verify user is able to submit new culture points

Description: Test that the users can add new points

Test Designed by: F. Ananda

Test Designed date: 06/04/2015

Test Executed by: F. Ananda

Test Execution date: 23/04/2016

Pre-conditions: User has valid username and password and is logged into the system

Dependencies:

Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Navigate to submit point page	Test data = "Point 4"	User should be able to add a	The submitted point was uploaded to the server awaiting approval by the Admin.	Pass	
2	Zoom to the desired point on the map		New point of interest on the map			
3	Right click point of interest					
4	Enter relevant form details					
5	Click submit point					
6	Click confirm submission					
Post-conditions: User is validated with database and successfully login to account						

View Web Map Test Case

Test Case ID: Fun_004

Test Priority (Low/Medium/High): High

Module Name: Web Map Module

Test Objective Verify that a user can view and query the web maps

Description: Test that the users can access the web maps

Pre-conditions: User is a valid user and is already logged into the system

Dependencies:

Test Designed by: F. Ananda

Test Designed date: 06/04/2015

Test Executed by: F. Ananda

Test Execution date: 23/04/2016

Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Navigate to web map page	Search parameter =	If the search parameter exists the result should be displayed as an overlay on the Emuhaya map	A map of administrative centres was displayed when the web map link was activated	Pass	
2	Select thematic map	Not applicable	.			
3	Execute choice					
4	Display Emuhaya shape files overlaid on the Google maps API.					

Post-conditions: Relevant thematic map is displayed showing all the available information in the database

Appendix II: Mobile GIS test cases

Login Test Case						
Test Case ID: Fun_001		Test Designed by: F. Ananda				
Test Priority (Low/Medium/High): Med		Test Designed date: 06/04/2015				
Module Name: Login Module		Test Executed by: F. Ananda				
Test Objective Verify login with valid username and password		Test Execution date: 23/04/2016				
Description: Test the mobile app login page						
Pre-conditions: User has valid username and password						
Dependencies:						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Navigate to login page	User= user11	User should be able to login	User is logged in	Pass	
2	Provide valid username	Password: 123456				
3	Provide valid password					
4	Click on Login button					
Post-conditions User is successfully validated and presented with an opportunity to proceed to add points or load culture map.						

View Point Test Case

Test Case ID: Fun_002

Test Designed by: F. Ananda

Test Priority (Low/Medium/High): High

Test Designed date: 06/04/2015

Module Name: Culture Map Module

Test Executed by: F. Ananda

Test Objective Verify that a user can search and display map items **Test Execution date:** 23/04/2016

Description: Test that the users can access and query maps.

Pre-conditions: User is a valid user and is already logged into the system

Dependencies:

Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
		Search parameter=	If the selected point exists in the database, it will be displayed alone on the map.	Selected point is found and displayed on the mobile map.	Pass	
1	Navigate to start page	"Point 1"				
2	Select view list from menu					
3	Select point to view					
	Select view on map option or view point details to get					
4	more information					

Post-conditions: Relevant map is displayed showing the desired point of interest.

Submit Point Test Case

Test Case ID: Fun_003

Test Designed by: F. Ananda

Test Priority (Low/Medium/High): High

Test Designed date: 06/04/2015

Module Name: Submit Point Module

Test Executed by: F. Ananda

Test Objective Verify user is able to submit new culture points

Test Execution date: 23/04/2016

Description: Test that the users can add new points

Pre-conditions: User has valid username and password and is logged into the system. Device GPS is turned on.

Dependencies:

Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Navigate to submit point page Activate GPS if not enabled	Test data = "Point 3"	User should be able to add a new point of interest on the map	New point was uploaded successfully awaiting approval from the Admin.	Pass	
2	Enter point name					
3	Enter point description					
4	Select category					
5	Select and upload photo					
6	Select upload					

Post-conditions: User successfully uploads the details and coordinates of new point.

Find Direction Test Case

Test Case ID: Fun_004

Test Designed by: F. Ananda

Test Priority (Low/Medium/High): High

Test Designed date: 06/04/2015

Module Name: Web Map Module

Test Executed by: F. Ananda

Test Objective Verify that a user can find direction to a point

Test Execution date: 23/04/2016

Description: Test that the users can navigate to point of interest

Pre-conditions: Device GPS is turned on.

Dependencies:

Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
			If the search parameter exists the result should be displayed as an overlay on the Emuhaya map		Pass	
1	Navigate to start page	Search parameter = "Luanda Market"				
2	Select view list from menu					
3	Select point to view Select view on map option or view point details to get more information					
4						

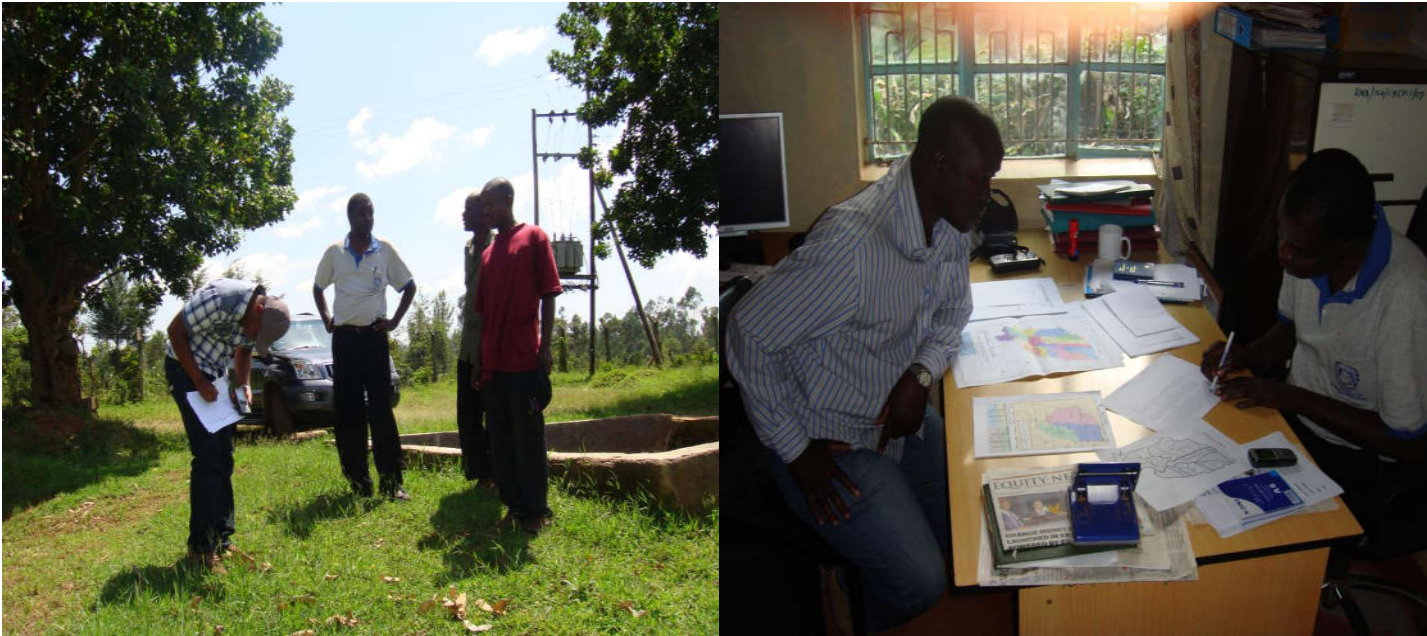
Post-conditions: Relevant thematic map is displayed showing all the available information in the database.

Appendix III: User Acceptance test results

Number	Acceptance Requirement	Critical		Test Result		Comments
		<i>Yes</i>	<i>No</i>	<i>Accept</i>	<i>Reject</i>	
1	The system should adequately keep track of all registered users and their activities. It should also allow the users the flexibility of managing their user profile independently.	✓		✓		
2	The system user should be able to access the existing culture map and navigate the map with minimum effort. In addition, the user should be able to search the map to extract specific information. The only requirement is for the user to be computer literate.	✓		✓		
3	The user should be able to use the system to contribute culture information. Since this information is crowdsourced the user should have the flexibility to enter all the required details. The submitted information will then be visible to the administrator who will decide either to approve or disapprove the submission.	✓		✓		

Number	Acceptance Requirement	Critical		Test Result		Comments
		Yes	No	Accept	Reject	
4	The user should be able to access, display and further query the thematic web maps that are part of the system. The maps are to be overlaid on the Google maps API for ground referencing. Users should be able to save and print the maps as per their requirement.	✓		✓		
5	The users should be able to get directions to various points of interest on the map through a simple click of a button. Routes should be clearly mapped out and labelled. The users should have the flexibility of assessing alternative routes.	✓		✓		
6	The platform should allow for integrated exchange of information with other forms of social media on the internet.		✓		✗	The system is only limited to sharing locations and directions either on WhatsApp or Facebook. As for a more detailed interoperation with other social media this is an area recommended for improvement.

Appendix IV: System data collection

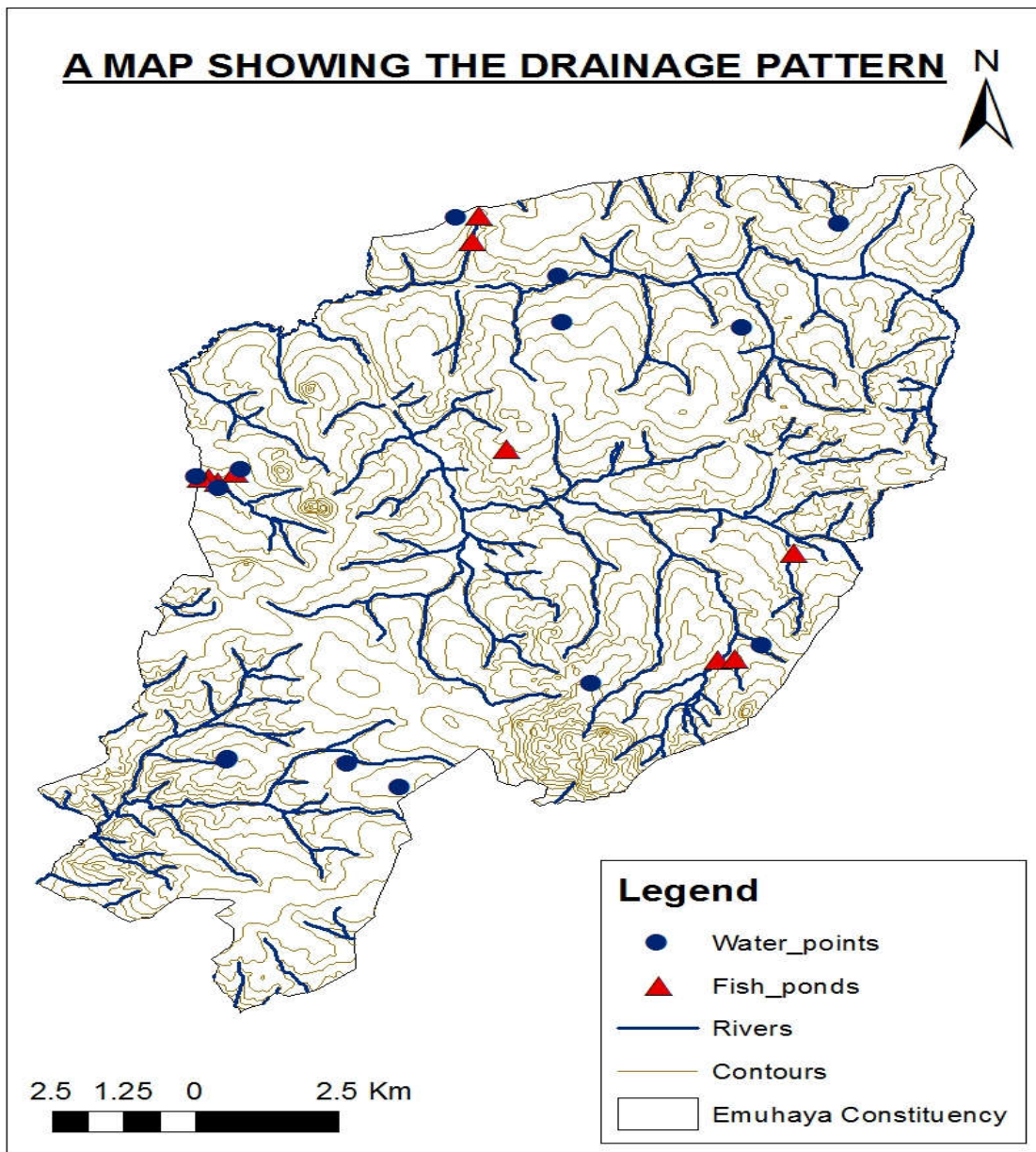


The research team collecting data in the field and verifying mapped points.

Appendix V: User statistics

Date	Unique visitors	Visits	Actions	Maximum actions in one visit	Total time spent by visitors (in seconds)	Returning Visits	Actions by Returning Visits	Unique returning visitors	Maximum actions in one returning visit	Page views	Unique Page views	Average Actions per Visit	Average Visit Duration (in seconds)
8/8/2016	1	3	10	7	87	1	2	1	2	10	10	3.3	0:00:29
8/10/2016	1	1	3	3	1927					3	2	3	0:32:07
8/17/2016	1	1	1	1	0					1	1	1	0:00:00
8/18/2016	1	1	3	3	852					3	2	3	0:14:12
8/24/2016	1	1	1	1	0					1	1	1	0:00:00
8/25/2016	1	1	6	6	75					6	5	6	0:01:15
8/28/2016	1	1	1	1	0					1	1	1	0:00:00
8/29/2016	2	2	6	5	424	1	1	1	1	6	5	3	0:03:32
8/31/2016	1	1	8	8	2299					7	4	8	0:38:19
9/2/2016	1	1	13	13	96					12	7	13	0:01:36
9/10/2016	3	3	7	5	114					7	7	2.3	0:00:38
9/14/2016	3	5	43	17	11952	3	35	3	17	43	15	8.6	0:39:50
9/15/2016	1	2	21	17	4552	1	4	1	4	21	5	10.5	0:37:56
9/16/2016	1	1	1	1	0	1	1	1	1	1	1	1	0:00:00
9/19/2016	1	2	8	4	361	1	4	1	4	8	5	4	0:03:01
10/1/2016	2	2	33	32	139					33	29	16.5	0:01:10
10/3/2016	1	1	6	6	47					6	6	6	0:00:47

Appendix VI: Sample static map showing drainage patterns



Appendix VII: Culture survey questionnaire

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

EMUHAYA CULTURAL SURVEY

JULY 2015

Survey Questionnaire

Interviewer Name.....	Respondent Clan.....	
Respondent Name Respondent Religion	
Respondent Address		1
		2
Telephone		3
		4
		5
		6
		7
		8
Location.....	Marital Status of Respondent	
	Married	1
Sub-location.....	Single	2
	Widowed	3
	Divorced/Separated	4
Village/ Kijiji.....		
Other physical details..... details.....	Interviewer Number.....	
SEX of respondent: M / F (circle one)	Day of the interview	
	Monday	1
Emuhaya Locations	Tuesday	2
1	Wednesday	3
2	Thursday	4
3	Friday	5
4	Saturday	6
5	Sunday	7
6		
7	Interview Date.....	
8		
Interview duration.....		
Questionnaire Verification		
	Team Leader	Supervisor
Fully Completed		

SELF PERCEPTIONS OF EMUHAYA PEOPLE

Q. No.	Question	Code List	Code	Filters
Q2	Do you consider yourself a MEMBER of Emuhaya?	Yes	01	
		No> Q4	02	
Q3	If YES, what makes you say so? (ONE MAIN REASON)	I was born here	01	
		I live here	02	
		I own property here	03	
		I work here	04	
		I run a business here	05	
		I am married here	06	
		Others (specify)	07	
Q4	If NO, why do you say so?	I was Not born here	01	
		I am new here	02	
		I don't own a property here	03	
			04	
		I am here for a short period	05	
		Other (specify)		
Q5	What do you consider to be the main defining characteristic of Emuhaya people?	Being born here	01	
		Living in Emuhaya for a long time	02	
			03	
		Working in Emuhaya	04	
		Doing business in Emuhaya	05	
		Owning property in Emuhaya	06	
		Having ancestors in Emuhaya	07	
	Other (specify) -----			

Q6	Would you say that there is a strong SENSE OF BELONGING among Emuhaya people?	Yes No	01 02	
Q7	Please explain your answer...	WRITE IN.....		
Q8	Are there common things shared by Emuhaya people (other than physical amenities schools, water points etc)?	Yes No	01 02	
Q9	If Yes/No to Q18, please explain?	WRITE IN.....		
Q10	What do you think is the MAIN uniting factor among people of Emuhaya? (SELECT TWO ANSWERS)	Sharing physical resources Common needs Being a resident Common problems Intermarriages Religion Culture Political inclinations Ethnicity Other (specify) ----	01 02 03 04 05 06 07 08 09 10	
Q11	Do you think those who live in Emuhaya MOST OFTEN do so by their own choice?	Yes No	01 02	
Q12	Do you live in Emuhaya by your own choice?	Yes No	01 02	
Q13	If you answered NO to Q12, what is the main reason why you live in Emuhaya?	I work here/ nearby Cheap rent Stay with friends/ relatives I own a property here	01 02 03 04	

		I have a business here	05	
		Other (specify)	06	
Q14	Are you satisfied with the quality of life you lead in Emuhaya?	Very satisfied	01	
		satisfied	02	
		Neutral	03	
		Dissatisfied	04	
		Very dissatisfied	05	

SOCIAL AMENITIES IN EMUHAYA

Q15 For each of the social amenities available in your community, please indicate their adequacy, accessibility, utilization and condition?

USE THE APPROPRIATE CODES BELOW

	Available amenities	Yes/No?	Adequate?	Accessible?	Condition?	Usage?
	Schools (public)					
	Schools (private, religious, NGO, CBO etc)					
	Health facilities (public)					
	Health facilities (private, religious, NGO, CBO etc)					
	National Government offices					
	County Government offices					
	Security (Police, AP, chief etc)					
	NGO/CBO offices					
	Water points					
	Sanitation/drainage facilities					
	Roads					
	Electricity in home					
	Shops/markets					
	Banks					
	Social Halls					
	Technical training facilities					
	Places of worship					
	Others (specify)					
	CODES=	Yes 1 No 2	1 Adequate 2 Not Adequate	1 Easily accessible 2 Not accessible	1 Good condition 2 Poor condition	1 Fully utilized 2 Not fully utilized

DEVELOPMENT INITIATIVES AND LOCAL PARTICIPATION

Q16	List ONE MAJOR development initiative in your village in Emuhaya known to you (CHOOSE ONE ONLY)	Schools	01		
		Health facilities	02		
		Playgrounds	03		
		Water points	04		
		Toilets	05		
		Drainage	06		
		Roads	07		
		Other (specify) ----	08		
Q17	Who initiated this project?	Local people	01		
		Local leaders	02		
		NGO/CBOs	03		
		Religious organization	04		
		Government of Kenya (GoK)	05		
		County government	06		
		CDF	07		
		Other (specify) ---	08		
Q18	How much were you involved in the starting of this project?	Involved a great deal	01		
		Involved a lot	02		
		Involved a little	03		
		Not involved	04		
		Not involved at all	05		
Q19	Were people in your village consulted when identifying this project?	Yes	01		
		No	02		
		Don't Know	03		
Q20	To what extent is there local involvement in the management of the said project?	Involved a great deal	01		

		Involved a lot	02		
		Involved a little	03		
		Not involved	04		
		Not involved at all	05		
		Don't know	06		
Q21	In your capacity as a resident of this village how would you rate your willingness to participate in local development projects?	Very Willing	01		
		Willing	02		
		Neutral	03		
		Not willing	04		
		Very unwilling	05		
		Don't know	06		
Q22	In general, how would you describe the way development projects are managed here in Emuhaya?	Very well managed	01		
		Well managed	02		
		Neutral	03		
		Badly managed	04		
		Very badly managed	05		
		Don't know	06		
Q23	Is there a common sense of networking among these development projects?	Yes	01		
		No	02		
Q24	In your opinion how relevant are the development projects initiated here in addressing the needs of Emuhaya people?	very relevant	01		
		Relevant	02		
		Not relevant	03		
		Not relevant at all	04		
		Don't know	05		
Q25	How much are you attached (experience a sense of belonging) to the development projects that have been initiated here in your village in Emuhaya?	Attached a great deal	01		
		Attached a lot	02		
		Attached a little	03		

		Not Attached	04		
		Not attached at all	05		
		Don't know	06		
Q26	What is the role of local authorities / elders within these projects? Are they supporting community or outside efforts?	WRITE IN.....			

KNOWLEDGE ABOUT EXISTING PROBLEMS/NEEDS

Q27	What is the LEADING problem in your household?	Marital misunderstandings	01		
		Low income/poverty	02		
		Prevalence of disease	03		
		School fees	04		
		Lack of adequate shelter	05		
		Drunkenness	06		
		Drug abuse	07		
		Infidelity	08		
		None >29	09		
		Other (specify) ----	10		
Q28	What is the major cause of this problem	WRITE IN.....			
Q29	In your opinion, please name the LEADING problem in this village?	Inaccessibility during rains	01		
		Insecurity>30	02		
		Lack of electricity	03		
		Prevalence of disease	04		
		General pollution	05		
		Drunkenness	06		
		Drug abuse			

		Inadequate schools	07		
		Inadequate health facilities	08		
		Other (specify) ---	09		
		Don't know	10		
			11		
Q30	If insecurity is a problem, what kind of insecurity/crime is prevalent? petty theft/mugging, house or business burglary, rape	Petty theft /mugging	01		
		House or business burglary	02		
		Rape	03		
		Other (specify)	04		
Q31	In your own opinion, give ONE MAJOR cause of this problem?	WRITE IN.....			
Q32	In your own opinion, give ONE MAJOR SOLUTION to this problem?	WRITE IN....			

CONFLICT RELATED ISSUES

Q33	Mention ONE common cause of conflict in this household?	Marital problems	01		
		Money issues	02		
		Children issues	03		
		Drunkenness	04		
		Drug abuse	05		
		Food issues	06		
		Irresponsibility	07		
		Other (specify) ----	08		
		No conflict	09		
Q34	Mention ONE leading cause of conflict among the people of Emuhaya?	Land issues	01		
		Rent issues	02		
		Insecurity issues	03		
		Tribal animosities	04		

		Administrative matters	05		
		Religious differences	06		
		Political differences	07		
		Other (specify) ----	08		
Q35	Name TWO major parties/groups/clans that are persistently in conflict in this village?	WRITE IN....			
Q36	What is the most common consequence from these conflicts?	Fights	01		
		Destruction of property/houses	02		
		Displacement of residents	03		
		Deaths	04		
		Burning of structures	05		
		Increased insecurity	06		
		Arrests	07		
		Other (specify) ----	08		
Q37	In your own opinion, how can this conflict be overcome?	WRITE IN....			

CULTURAL ASPECTS

Q38	Do you have any information about the origins of your clan/culture?	Yes	01		
		No>40	02		
Q39	If you answered yes for the previous question, provide your understanding of your clan/culture origins?	WRITE IN....			
Q40	Does your clan organize and hold cultural events?	Yes	01		
		No>44	02		

Q41	If you answered yes for the previous question, how often are cultural events held in your community?	Quarterly	01		
		Every 6 months	02		
		Annually	03		
Q42	To what extent do you participate in the cultural events?	Involved a great deal	01		
		Involved a lot	02		
		Involved a little	03		
		Not involved	04		
		Not involved at all	05		
		Don' t know	06		
Q43	What MAIN cultural aspects of your clan are showcased during this event	WRITE IN.....			
Q44	Are cultural practices similar across Emuhaya	Yes>48	01		
		No	02		
Q45	How would you rate the extent of their differences	No Extent	01		
		Low Extent	02		
		Moderate Extent	03		
		Great Extent	04		
		Very Great Extent	05		
Q46	What determines the rate of cultural difference in Emuhaya	Geography	01		
		Clans	02		
		Other factors	03		
Q47	If you selected other factors for Q46 explain	WRITE IN.....			
Q48	Is there a unique cultural practice that is common only to your clan	WRITE IN....			
Q49	To what extent does your community observe these cultural values/systems?	Greatly practiced	01		
		Averagely practiced	02		
		Rarely practiced	03		
		Never practiced	04		

Q50	How is this cultural information preserved within the community	WRITE IN....			
Q51	How was this cultural information passed over to you and others before you?	WRITE IN....			
Q52	Do you think Emuhaya cultural practices are changing with time?	Yes	01		
		No>54	02		
Q53	If you answered yes in Q52, how would you rate the extent of change in your culture over time?	No Extent	01		
		Low Extent	02		
		Moderate Extent	03		
		Large Extent	04		
		Very Large Extent	05		
Q54	Do you think it is worthwhile preserving your cultural information	Yes	01		
		No>56	02		
Q55	If yes what is the importance of culture to your clan?	WRITE IN.....			
Q56	If no please explain your response.	WRITE IN.....			
Q57	Do you think there has been any culture lost within your community over the years?	Yes	01		
		No>59	02		
Q58	If your answer to Q57 is yes, please explain	WRITE IN.....			
Q59	Do you think that it is necessary to change some cultural practices to enhance the rate of community development in Emuhaya?	Yes	01		
		No>61	02		
Q60	If you answered yes in Q59, please explain or give examples	WRITE IN.....			
Q61	Do you think there is an opportunity to exploit your culture for the development of tourism activities within your community?	Yes	01		
		No>63	02		

Q62	If yes IN Q61, what cultural activities and resources can be exploited for tourism	WRITE IN....
Q63	If no please explain your response	WRITE IN ...

TECHNOLOGY PERCEPTION

Q64	Do you own a mobile phone?	Yes No>67	01 02		
Q65	If you answered yes in Q64, is your current phone a smart phone?	Yes No	01 02		
Q66	How do you typically use your mobile phone?	Send text Make calls Data services Combination of the above	01 02 03 04		
Q67	Are you computer literate?	Yes No > Q73	01 02		
Q68	If you answered yes in Q67, do you know about the internet	Yes No	01 02		
Q69	If you answered yes in Q68, how often do you access the internet	Hourly Daily Weekly Monthly Annually	01 02 03 04 05		
Q70	To what extent do you participate in the social media?	Involved a great deal Involved a lot Involved a little Not involved	01 02 03 04		

		Not involved at all	05		
		Don't know > Q72	06		
Q71	What are the typical activities you carry out on social media	WRITE IN.....			
Q72	Do you think there is an opportunity to utilize technology in culture preservation	Yes	01		
		No>76	02		
Q73	Do you have an idea/suggestions of any ways that technology can be used to preserve culture?	WRITE IN....			
Q74	Given an opportunity to participate in culture preservation using mobile and web technologies would you be willing to learn and actively participate in this process	Yes	01		
		No>76	02		
Q75	If you answered no in Q75 please explain	WRITE IN			
Q76	Would you be in support of your community's cultural information being collected and freely made available to everyone through mobile and web technologies?	Yes	01		
		No	02		
Q77	If yes please explain your response.	WRITE IN.....			
Q78	If no please explain your response	WRITE IN.....			

Thank you for participating in this culture survey. All the information collected will be used purely for academic purposes and published freely for all to use.