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# Resource mobilization application for Non-Governmental Organisations in Kenya: case of health sector

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Resource Mobilization Application for Non-Governmental Organisations in Kenya:

Case of Health Sector

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Thesis Submitted in partial fulfilment of the requirements for the Degree of Master of  
Science in Information Technology (MSc.IT) at  
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Faculty of Information Technology

Strathmore University

Nairobi, Kenya

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.....Doreen Jeruto Koech.....

.....

.....9<sup>th</sup> June 2017.....

## **Approval**

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## **Abstract**

Resource mobilization is a valued component for strengthening Non-Governmental Organizations. NGOs require resources to help them continue providing services to the community. However, these resources are often insufficient to meet the needs and rising costs of running an organisation. The existing resource mobilization techniques have proven to be in-effective as a result of structural differences among the NGOs. Resource Mobilization application allows for the organizations to pool together resources without compromising on their vision and mission. The main components of the application are Naïve Bayesian Algorithm for classification and Geographical Information System for mapping. The Naïve Bayesian Algorithm was selected because it does not have complicated iterative parameter estimation which makes it useful for large datasets. The reliability and space efficiency of the algorithm makes it suitable for classification. The results obtained from the application indicated that Naïve Bayesian algorithm is an appropriate algorithm which can be implemented in resource mobilization. The classification was done based on the input variables obtained from different organizations. The application accuracy was at 94.9495% which indicates that the application is reliable as tool for resource mobilization.

## Table of Contents

Declaration .....	ii
Abstract .....	iii
List of Figures .....	vii
Abbreviations/Acronyms .....	viii
Acknowledgement.....	ix
Dedication .....	x
1.1 Background of the study.....	1
1.1.1 Resource Mapping.....	2
1.2 Statement of the problem.....	3
1.3 Objectives .....	4
1.3.1 General Objective .....	4
1.3.2 Specific Objectives .....	4
1.4 Research Questions .....	5
1.5 Justification.....	5
1.6 Scope .....	5
Chapter 2: Literature Review .....	6
2.1 Introduction .....	6
2.2 Theoretical review .....	6
2.2.1 Resource Mobilization Theory .....	6
2.2.2 New Social Movement Theories.....	8
2.3 Empirical Review .....	9
2.3.1 Factors that influence Resource Mobilization for NGOs in Kenya.....	9
2.3.4 Resource Mobilization Techniques.....	11
2.4 Analysis of Naïve Bayesian Algorithm and Geographical Information Systems ..	16
2.4.1 Naive Bayesian Algorithm.....	16
2.4.2 Geographical Information Systems (GIS) .....	19
2.5 Conceptual Framework.....	20
Chapter 3: Research Methodology .....	22

3.1 Introduction .....	22
3.2 Population and Sampling.....	22
3.3 Data Collection Procedure.....	22
3.4 Data Analysis.....	23
3.5 Research Quality.....	23
3.5.1 Validity .....	23
3.5.2 Objectivity.....	23
3.5.3 Reliability.....	24
3.6 Software Development Methodology.....	24
3.7 Research Design .....	25
3.7.1 System Analysis.....	25
3.7.2 System Design .....	26
3.7.3 System Implementation and Development .....	26
3.7.4 System Testing.....	26
Chapter 4: System Analysis and Design .....	27
4.1 Introduction .....	27
4.2 Results from Questionnaire .....	27
4.3 Requirement Analysis .....	36
4.3.1 User requirements .....	36
4.3.2 Functional Requirements .....	36
4.3.2 Non-Functional Requirements .....	37
4.4 System Architecture .....	38
4.5 Use-case Diagram.....	39
4.6 Sequence Diagram.....	41
4.7 Domain Model.....	42
4.8 Naïve Bayesian Classifier Flowchart .....	43
4.9 Entity Relationship Diagram .....	44
4.10 Database Schema.....	45
Chapter 5: Implementation and Testing .....	46
5.1 Introduction .....	46
5.2 Application Components .....	46

5.2.1 Input File.....	46
5.2.2 Cross Validation Method.....	46
5.3 Application Implementation.....	47
5.4 Application Testing.....	48
5.4.1 Application Testing Results.....	49
5.4.1.1 Login Page.....	49
5.4.1.2 Organization Details Platform.....	49
5.4.1.3 Classification Output.....	50
5.4.2 Acceptance Testing.....	51
Chapter 6: Discussions.....	52
6.1 Introduction.....	52
6.2 Factors influencing resource mobilization for Health Based NGOs in Kenya.....	52
6.3 Existing Resource Mobilization Techniques in use.....	52
6.4 Resource Mobilization Application implementation.....	53
6.5 Resource Mobilization Application Testing and Validation.....	53
6.6 Advantages of using the application compared to the existing systems.....	54
6.7 Disadvantages of using the application.....	54
Chapter 7: Conclusions and Recommendations.....	55
7.1 Conclusion.....	55
7.2 Recommendations.....	55
7.3 Suggestions for Future Research/Work.....	56
References.....	57
Appendices.....	61
Appendix A: Questionnaire.....	61
Appendix B: Data Collection Reference Letter.....	66
Appendix C: Data Analysis Frequency Tables.....	67
Appendix D: UseCase Descriptions.....	69
Table D.1: Initiate Classification.....	69
Table D.2: Receive Feedback.....	70
Table D.3: View Classification Analytics.....	70
Table D.4: Approve User.....	70

## List of Figures

Figure 2.1 Grant Proposal Writing.....	12
Figure 2.2 NGO Partnership Web database database .....	14
Figure 2.3 Growth of individual giving from 2009-2014 .....	15
Figure 2.4 Growth of Individual Giving in 2014 .....	15
Figure 2.5 Naive Bayesian Theorem .....	17
Figure 2.6 Conceptual Framework of the Resource Mobilization Application .....	20
Figure 3.7 Agile Software Development Model .....	25
Figure 4.8 Core Programme area of focus .....	27
Figure 4.9 Resources Available in an organization.....	28
Figure 4.10 Expertise Factor Indicators .....	29
Figure 4.11 Accountability and Transparency Factor.....	30
Figure 4.12 Governance factor indicators .....	31
Figure 4.13 Resource Mobilization Techniques .....	32
Figure 4.14 Effectiveness of the existing Resource Mobilization Techniques.....	33
Figure 4.15 Challenges associated with the existing resource mobilization techniques..	34
Figure 4.16 System User Requirements.....	35
Figure 4.17 Resource Mobilization Application Use Case Diagram .....	39
Figure 4.18 Sequence Diagram .....	41
Figure 4.19 Domain Model .....	43
Figure 4.20 Naïve Bayesian Classifier flowchart.....	43
Figure 4.21 Entity Relationship Diagram .....	44
Figure 4.22 Database Schema .....	45
Figure 5.23 Weka Machine Learning Tool .....	47
Figure 5.24 Naive Bayesian Classifier Implementation.....	48
Figure 5.25 Login Page .....	49
Figure 5.26 Organization Details Page .....	50
Figure5.27 Classification output .....	50



## **Abbreviations/Acronyms**

GIS-Geographical Information Systems

GIU-Graphical User Interface

HENNET- Health NGOs Network

NGO-Non-Governmental Organizations

NSM-New Social Movement

MSF- Médecins Sans Frontières

RMT-Resource Mobilisation Theory

SMOs-Social Movement Organizations

WEKA-Waikato Environment for Knowledge Analysis

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## **Dedication**

This Thesis is dedicated to Deutscher Akademischer Austauschdienst (DAAD) for funding my studies for the two years. It is also dedicated to my Family, friends and colleagues for all the support provided to me. I also dedicate it to my Supervisor Dr.Omwenga and Strathmore university fraternity for all the support during the study period.

## **Chapter 1: Introduction**

### **1.1 Background of the study**

According to Musundi (2015) a resource is any physical or non-physical entity of limited availability that needs to be utilized to obtain a benefit. Organizations require resources in order to carry out their activities. NGOs have always relied on the generosity of donor organizations to support their projects activities through grants and donations. Currently, many NGOs are competing for the same resources whereas these resources are scarce. This has forced some NGOs to end their operations because they are unable to sustain their activities. Resources can be obtained in many ways; some resources are raised in form of cash for example through financial grants from grant making organizations, donations from donors and membership fee. Non-financial resources are raised in form of volunteer work, leasing of equipment and facilities, Skills and capacity building.

The scarcity of resources available for NGOs calls for resource mobilization which is a process whereby resources both financial and non-financial resources are mobilized either externally or internally to support organization activities (Batti, 2014). However, resource mobilization requires a lot of time and skills to seek resources from different sources and the pressure to mobilize resources may lead the organizations to use methods that compromise the values they are fighting for through their work(Batti, 2014).

Some of the resource mobilization approaches used by NGOs in Kenya include Fundraising which can be online fundraising whereby an organization solicits for funds through donations for a worthy cause. Crowd funding is another form of fundraising which has been adopted by non-profit organizations. It is the latest resource mobilization technique which has been adopted by non-profits. It refers to any effort to raise money with donations from a large number of people. It is projected to become a \$90-96 billion dollar industry by 2025, and is being touted as a valuable tool for fundraising for charitable nonprofits(National Council of Nonprofits, 2017).Resource mobilization can also be done in form of partnerships where two or more organizations in the same sector with a common goal agrees join efforts to implement a given project. This resource sharing ranges from an exchange of assets to sharing of governance, decision-making and programme development and delivery. For an effective resource mobilization to be effective, it has been argued that factors such as good governance should be considered. For example, an

organization should have a clear constitution that outlines the rules that govern the actions and activities of the organization. It should also have policies in place that guides operations within the organization. Another factor that influences resource mobilization is the type of networks that the organization involved. Otieno (2012), argues that being part of an international network will enable an organization to mobilize resources from international resource providers. Goals and objectives of an organization can also influence their ability to mobilize resources. Organizations with the same goals and objectives can mobilize resources through partnership.

### **1.1.1 Resource Mapping**

Resource mapping is a system-building process used by different groups at different levels in order to align resources and policies in relation to specific system goals, strategies and expected outcomes. With increased resource scarcity there is need to encourage cross-agency and cross-systems coordination. Resource mapping can help to identify new resources, ensuring that all stakeholders have access to resources they need, avoid duplication of resources, cultivate new partnership and relationships, Provide information to donors and encourage collaboration.

There are several principles of resource mapping; first, mapping focuses on what is already available in a certain place. Secondly, mapping is relationship driven i.e. it will always leads to development of partnership where organizations with common interests working together over a given period of time to accomplish common goals. Lastly, resource mapping embraces the notion to realize vision and meet goals.

### **Resource mapping using Geographical Information Systems (GIS)**

Geographical Information System (GIS) is a computer system which captures, stores, manipulates, queries, analyses and displays geographically referenced data. GIS has been applied in various fields such as political science, Elections, Agriculture, disaster management, Health services and Information Access.

GIS has been used to visualize potential public Library outlets. According to NadzriMohamad *et al.*, (2015) using GIS to visualise users' locations is an effective approach to locate strategic areas for future library branch, mobile and outlet placements.

In their study it was found that the visual representation of the data enables library administrators to make sensible decisions.

GIS has always been used for route optimization in transport logistics in supply management. GIS currently are becoming increasingly in use in other areas of logistics and resource optimization. It has a great growth potential because it is associated with low cost of hardware and the increasing availability of digital mapping data.

Several studies have shown that it is a useful tool for finding the optimal location of water wells. Platz et al., (2014) showed how it can be used to determine favourable locations of groundwater wells in a region of western Jordan. They used the commercial software ArcGIS and implemented exclusively environmental parameters in their work.

From the previous research none of resource mapping study for NGOs has been carried out using GIS in Kenya. In light of this research gap, the outcome for this study encourages NGOs to employ GIS in resource mobilization to locate resources at any given time.

## **1.2 Statement of the problem**

Availability of adequate resources in an organisation has been considered to be an essential component that drives an organisation towards achieving its core mandate. NGOs operations are fully dependant on the availability of resources in order to support its activities. These resources can be financial resources such as funds or non-financial resources such as volunteer time, skills and capacity building. As a result of the increasing population , the number of people who are in need has increased hence the non-profit sector has expanded rapidly and outpaced the growth of the donor base hence the scarcity of resources is experienced (Arasa & Kioko, 2014).Mavoko (2013), considers that the solution to addressing the challenges associated with scarcity of resources revolves around the effective strategies employed by an organization to mobilize resources from donors who are the main benefactors. Some of the resource mobilization techniques used by NGOs include Fundraising, Proposal writing, Social entrepreneurship, soliciting for donations and Gifts. These techniques have been found to be ineffective in some instances as a result of global economic meltdown.

Health NGOs network (HENNET) which is a network for NGOs dealing with health has tried to address the scarcity of resource by bringing together different health-based NGOs with a common vision of a ‘healthy Kenyan society’. The aim of establishing the network was to create platform for resource mobilization(Health NGOs Network, 2016). This initiative has not fully succeeded as a result of structural issues such as differing organisational structure, operational structures, reporting procedures, legal status organisation among others. New methods of resource mobilization such as pooling together of resources by NGOs in the same sector has been seen as a solution that can address the challenges associated with resource mobilization(Mavoko, 2013). This method will work well if there is proper mapping of available resource across the NGOs by using sector –based approach. This study propose the development of a resource mobilisation application which will enable NGOs in health sector to map available resources among themselves based on different parameters. This application will enable different organisations to locate available resources at any given time and be able to make a decision on what could the best approach to acquire this resources from the organisations who have these resources in abundance. The application will also be used to identify organisations who are in need of a given resource and be able to mobilize those who have the same in abundance to offer the excess resources to those who are in need.

### **1.3 Objectives**

#### ***1.3.1 General Objective***

The purpose of this research is to develop a resource mobilization application for health based NGOs in Kenya using Naïve Bayesian classification algorithm to classify organizations based on their structures and real time mapping of available resources.

#### ***1.3.2 Specific Objectives***

- i. To analyze factors that influence resource mobilization for NGOs in Kenya
- ii. To analyze resource mobilization techniques used by NGOs in Kenya
- iii. To develop an application for Resource Mobilization using Naïve Bayesian Algorithm and GIS mapping algorithm for health based NGOs in Kenya.
- iv. To test the proposed Resource Mobilization application.

#### **1.4 Research Questions**

- i. What are the factors that influence resource mobilization for NGOs in Kenya?
- ii. What resource mobilization techniques are used by NGOs in Kenya?
- iii. How can the proposed Resource Mobilization Application be developed?
- iv. How can the effectiveness of the proposed Application be tested?

#### **1.5 Justification**

Health based NGOs provide an excellent case study because there is an existing forum for Health based NGOs therefore it will be easy to collect data and test the prototype. Health is also one of the sustainable Development goals therefore resource providers are very keen in mobilizing resources for health purposes. The adoption of the application will increase visibility, reputation and brand image of the organization hence attracting more resources from the donors, government and other grant making organizations. It will also enhance the expansion and diversification of partner portfolio in form of new donor recruitment, hence attracting more resources and enable the organization to retain donors because the impact in the community will be measurable and visible.

#### **1.6 Scope**

The emphasis of the study is on factors influencing resource mobilization among NGOs, resource mobilization techniques and challenges associated with resource mobilization among NGOs. There are several NGOs operating in Kenya and in several sectors of the economy. However, this study focuses on health based NGOs operating in Nairobi.



## **Chapter 2: Literature Review**

### **2.1 Introduction**

This chapter explores various theories that have been used in resource mobilization. It will also examine the empirical review, analysis of the various methods used in resource mobilization and the conceptual framework.

### **2.2 Theoretical review**

Theoretical review describes the theories that explain why the research problem under study exists. It entails the analysis of the existing theories in area of study in terms of how it has been used and how it will be used in this study.

#### ***2.2.1 Resource Mobilization Theory***

Resource Mobilization Theory (RMT) theory explains social movements by viewing individuals as rational actors that are engaged in instrumental actions that use formal organizations to secure resources and foster mobilization. It is divided in to two parts; first, it explains people joining social movements with rational actor theory. Secondly, it tries to explain the actions of the Social Movement Organizations (SMOs) that are formed by rational actors by viewing the social movement organizations as an organization which functions for self-preservation and to market its products. Rational actor theory states that people will join social movements when the benefit of joining these groups outweighs the cost to that individual (McCarthy & Zald, 1997)

Social movements arise when a selected group has the resources available to mobilize a group (Leslie, 2012). People involve themselves in these groups because they have a need hence they become involved for personal gain of resources. It has been argued that the main purpose of this groups is to amass resources for they own benefit (McCarthy & Zald, 1997) Resource mobilization theory dictates that for such aggregation of resources it requires some organization so as to focus on the understanding of social movements' organizations that are formed.

Resource mobilization theory clearly explains social movements because it explains the actions of individuals by analyzing their social behaviors and it does not force individuals to behave in a certain way. As much as it explains social movements clearly is has some few challenges; one, it entirely focuses on social movement organizations. According to

Beuchler (1993), for Social Movement Organization to form and be effective the individuals within it need to form some sort of collective identity so that they can act with some degree of social cohesion. Resource Mobilization theory focuses on a centralized type of an organization hence it lacks to consider the role of the collective identities that are formed hence difficulty in explaining the activities of many NSMs. The resource mobilization theory of social movements states that social movement arises from long-term changes in a group, available resources and opportunities for combined action.

The resource mobilization theory is based on a perception that resources such as time, money, organization skills are very critical to the success of movement (Eltantawy & Wiest, 2011). In contrast of variables considered by other social movement theories, resource mobilization theory was among the first to recognize the importance of influence of social movements.

According to McCarthy & Zald (1997), resource mobilization theory is based on 5 main principles; One, the actors coherent and are able to weigh the benefits and costs of movement participation, Second, members are recruited through networks, obligation is strengthened by building a collective identity and continuous nurturing of interpersonal relationship, Third, movement organizations are dependent on collection of resources, Fourth, social movements need resources and leadership continuity and Lastly, the type of resources shapes the activities of a movement e.g. access to a TV station increases the use of TV as communication media.

According to Leslie (2012), the assumptions of the resource mobilization theory may be summarised in to costs, mobilization of resources, the organisation or state or society suppressed or repressed and the movement outcomes. First, the participants weighs the costs and benefit of participating in collective actions, Second, mobilisation of resources may take place within or outside the aggrieved group, Third, organisation and mobilisation of resources is very important for the success of the collective action, Fourth, the costs of participating in collective actions are related to the society or the state and Fifth, no direct correspondents between the degree of mobilisation and movement success.

Critic's points out that resource mobilization theory fails to explain social movement communities which are part of a large network of individuals and providing them with various service(McCarthy & Mayer, 2001).It has also been argued that it fails to explain how groups with limited resources can succeed in bringing social change(McCarthy & Mayer, 2001).

Despite its weaknesses resource mobilization theory has been useful because it challenges the outmoded approaches and provides a detailed framework that has served to integrate research hence generating substantial research(Leslie, 2012).

### ***2.2.2 New Social Movement Theories***

It was developed to explain individual participation in new social movements using social constructionism. It states that the NSMs are different than other social movements. Due to the differences between NSMs and traditional social movements, NSMs cannot be adequately explained without using social constructionism.

Buechler (1993) argues that NSMs are different than traditional movements because their main objective is to ensure that there is expansion of structural differentiation of society in to a post-materialistic society into a regression society.

There are several assumptions about resources that have been derived from different theoretical traditions. These are;

- i. A resource has a strategic value-For an NGO, the main value of a resource is its strategic value in terms of how it will help the organization to achieve its mission. It is argued that a poorly used resource has less value even if its market value is high. A previous mistake is considered a resource if it allows learning and improvement of the capacity to accomplish the mission.
- ii. A resource needs to be seen in an opportunity framework.-It is a basic assumption in resource mobilization theory and mobilizing structures theory. If these resources are not used then it has no value. It is essential to find or create an opportunity to use resources.
- iii. Every resource has a cost-To access new resources NGOs need to use existing resources which most them do not have in plenty. If the cost of gain access to the

resource is lower than the value of the resource then the organization grows in its capacity to accomplish its mission otherwise it will shrink.

- iv. Every Resource has demand-Every resource is provided by someone or some institution which will make demands or conditions on the use of resources by the NGO.

### **2.3 Empirical Review**

Empirical review is a form of literature review which is based on observed and measured occurrences. It derives knowledge from actual experiences rather than from theory or belief. This study seeks to analyze the factors that influence resource mobilization for NGOs and the existing resource mobilization approaches used by NGOs in Kenya.

#### ***2.3.1 Factors that influence Resource Mobilization for NGOs in Kenya*** **Governance**

Governance is the process of providing overall vision, mission, purpose and oversight to an organization through structures such as board of directors. Good governance is considered the most important constraint on resource mobilization in developing countries. It implies management of NGOs resources in a way which is transparent, accountable, equitable and responsive to the needs of the people. Good governance is fundamental for NGO accountability and transparency. Corruption is a good example of the effects of poor governance in any organization.

Many NGOs mismanage their resources, quite often this is encouraged by the board who are motivated by their own interests. The presence of management structures and governance in an organizations influences its ability to mobilize resources. Governance instruments such as organic constitutions, policies and guidelines should be in place otherwise potential donors will shy away(Otieno, 2012).

Bradshaw (2007) , argues that there are four models of non-profit governance conceptualized based established versus innovative and unitary versus pluralistic. The first dimension is more oriented towards sustaining continuity within the organisation in an established ways of doing things the latter attempts to reflect whether the model applies to a single organisation or to a network, group of organisations who share common interests and stakeholders. These models are; One, Policy governance model which

focuses on a single organization and it clearly distinguishes the leadership roles of the board and chief Executive officer .Second, Constituent/Representative board model, in this model, there is a direct and clear link between the board and its constituents. The constituents are represented on the governing board and they participate in policy development and planning. Third, Entrepreneurial Board Model, it emphasizes on innovation as a way of focusing on efficiency and effectiveness measure which enables the organization to achieve a maximum return on its investments Fourth, Emergent cellular model, it originates from a network of organizations which allow for flexibility and responsiveness to information. This organizations are made up of cells that can operate on it's on but it can also interact with other cells to produce a more experienced organizational mechanisms.

### **Networking and referral systems**

The type of networks that NGOs engages in influences their ability to mobilize resources. Good networks enables organizations to gain more visibility, gain experience and access new avenues for resource mobilization. Lack of learning from experience and an inability of NGOs to address local structural causes of poverty, deprivation and under-development affects their ability to mobilize resources from those who have in abundance. Majority of NGOs intervene at community level without any community mapping and implement projects without due regard to ongoing community initiatives hence to leading to politics such that one organization has resources and no community presence and another organization can have community presence but no resources.

### **Transparency and Accountability**

Transparency and Accountability refers to the need for NGOs to make available to all stakeholders their operations and to allow continuous monitoring and evaluation of their activities(Okinda, 2013). It serves three purposes: it prevents violation of norms; it reassures the stakeholders that resources are not misused and it may also help to reveal existing problems which might not have been recognized before. Transparency is fostered by consistent, accurate, timely and comprehensive reporting of activities by the implementing organization. Lack of transparency in an NGO deters stakeholders such as

donors, the government and the beneficiaries. It is important for an NGO to enhance transparency in their operations hence creating an avenue for resource mobilization.

### **Legitimacy**

Legitimacy is the need for validation among NGOs. NGOs operations should be in line with public interest. They should not engage in activities that are conflicting with public interest or that are known to be harmful to the well-being of any individual in the society(Okinda, 2013). The level of legitimacy of NGOs influences their ability to mobilize resources because it is through legitimacy that both local and external resource providers would trust that any resource that they will provide will be utilized for a common good(Otieno, 2012).

#### ***2.3.4 Resource Mobilization Techniques***

These are resource mechanisms that are used by NGOs to obtain resources from resource providers. Currently most NGOs in Kenya acquire resources through Partnership, proposal writing, individual giving and Social investments among others.

##### ***2.3.4.1. Grant Proposal writing***

A proposal is a document that helps cultivate an initial professional relationship between an organization and a donor over a project to be implemented. It outlines the plan of the implementing organization about the project, the intention for implementing it, ways to manage it and results to be delivered from it.

The first step in the process of submitting a proposal is to identify a solicitation such as Research Funding Announcements (RFAs), Request for Proposals (RFPs), Proposal Announcements (PA) among many others. Once the Solicitation has been identified and deemed appropriate for the budget process is started.

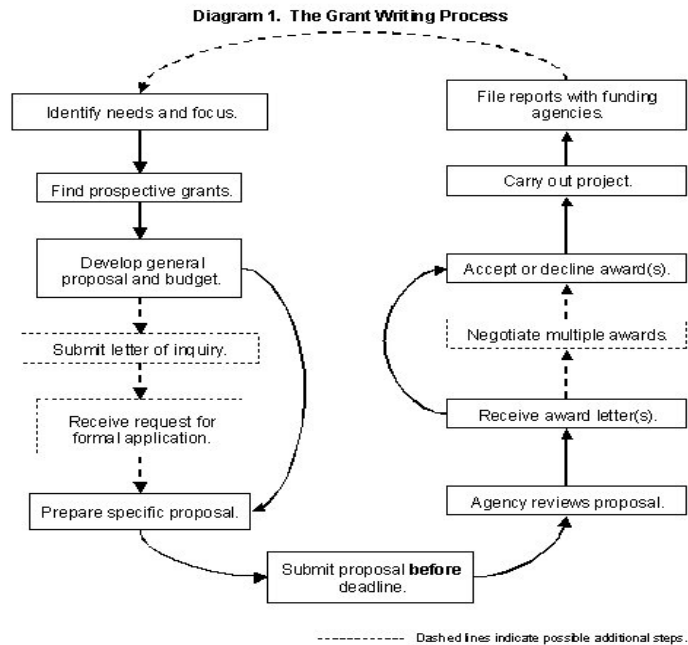


Figure 2.1 Grant Proposal Writing (Writing Center, 2016)

#### 2.3.4.2 Partnership

Partnership is a dynamic relationship among diverse actors, based on mutually agreed objectives, pursued through a shared understanding of the most rational division of labor based on the respective comparative advantages of each partner

Partnership is based on sharing of resources, competencies, risks, costs or benefits. This kind of sharing ranges from an exchange of assets to sharing of governance, decision-making and programme development and delivery(Tennyson & Harrison ,2008).

According to Tennyson &Harrison(2008),there are three stages that NGOs goes through as they move towards formalizing a collaboration:

Pre-convergence condition-In this stage different NGOs organizations works on their quite different attitudes towards liberation and globalization.

Realization stage- in this stage NGOs begin to realize they have to co-exist hence they look for ways on how they can influence each other. More often joint social responsibility projects are executed in this stage.

Collaboration stage- In this stage NGOs realize that they can work with and learn from each other. They enter into co-created business-business relationships. According to Glasbergen& Biermann(2007),different organizations choose to partner for reasons such as enhancing efficiency and effectiveness through a reliance on comparative advantaged,

a rational division of labor and resource mobilization this combination leads to incremental improvements on what the partnership was designed to achieve. Partnership provides a joint integrated resources and solutions required by the nature and scope of the problem which is being addressed at a given point. It also enables organizations to move from a no-win situation among many actors to potential win-win situation. Partnership opens decision making process which promotes a wider operationalization of the public good.

According to H&H Consulting (2012) Partner organizations are more likely to attract resources from businesses if businesses have an expressed interest in the type of work partner organizations do (pharmaceutical companies may be interested to support organizations undertaking health projects) family or employees connected to your organizations are employed by the business or receive services provided by the business (how many organizations actively seek to get this information) make charitable donations to other important community organizations or have economic interests in the community in which partner organization are working.

As much as partnerships is considered beneficial to many organizations, challenges such as inefficiencies have been reported whereby sound and appropriate systems have not been put in place for decision making, communications and management. It proved that inefficient partnerships were not sustainable. Leadership issues have also been experienced whereby partnerships fail because of individual egos which has always got into operation. Partnerships that work best are often those where the leadership is shared and jobs are allocated to those who can do them better or who care about them most rather than the person who is most senior.

A web database of non-governmental organizations from all over Europe who are interested in international project partnerships was developed which enables NGOs to create their own profiles indicating their contact information, references and areas of interests hence informing a wider range of potential partners about their activities. Interested project partners can easily and quickly identify the NGO that suits their needs and requirements. This database has been beneficial to the public and private sector companies who wants to carry out a project in cooperation with NGOs but they do not



have adequate information about all the possibilities(Center for Information Service, Cooperation and Development of NGOs, 2015).

The screenshot shows the top navigation bar of the NGO Partnership website. On the left is the logo for NGO PARTNERSHIP.ORG with the tagline 'Find your NGO partner across Europe'. To the right are links for 'Home', 'About', and 'Contact'. Further right is a 'Your short list' section with a star icon and '(0)'. Below this is a yellow bar with 'Sign-in to your profile' and 'Create your profile' buttons, each with a document icon. The main content area is titled 'Register your non-governmental organisation'. Below this is a note: '\* Indicates required field'. A sub-header reads 'Select categories from the menus below'. There are four dropdown menus: 'Country of registration (only one)', 'Main activities (one or more)', 'Areas (one or more)', and 'Geographic coverage (one or more)'. At the bottom, a paragraph of text instructs users to enter information about their organization into the boxes below, stating that the entered information should give potential partners a clear idea about the scope of their activity, competences, and interests.

Figure 2.2 NGO Partnership Web database database Source (Center for Information Service, Cooperation and Development of NGOs, 2015)

### 2.3.4.3 Individual Giving

Figure 2.3 indicates that MSF has seen the fastest growth in income from individual supporters over the past five years, with income from this source doubling since 2009, as a result of a number of high profile humanitarian responses. Oxfam income from this source has grown by only 11% over this period. World Vision still attracts the largest amount of funding from individuals around the world, totaling over €1.1 billion in 2014 the vast majority of this income is raised from child sponsorships see Figure 2.4.

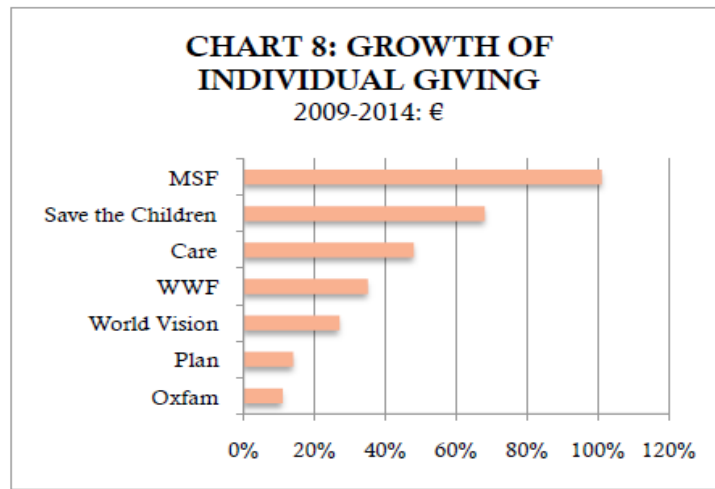


Figure 2.3 Growth of individual giving from 2009-2014 (Baobab Briefing, 2016)

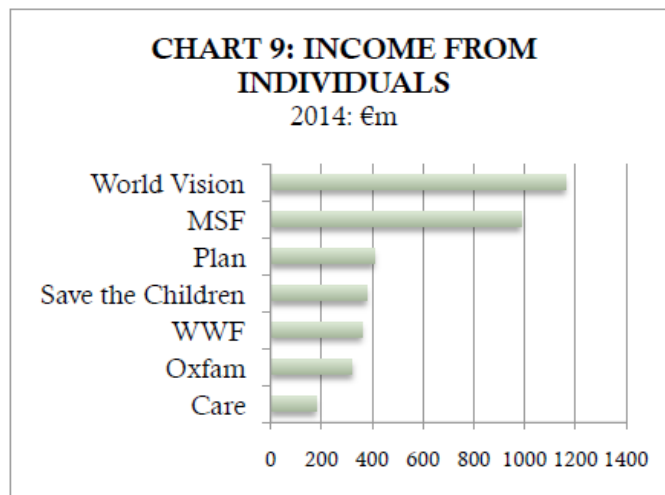


Figure 2.4 Growth of Individual Giving in 2014 (Baobab Briefing, 2016)

#### *2.3.4.4 Social entrepreneurship and Investments*

Organizations often take a more strategic and targeted approach to funding initiatives often through hands-on approach. This can be done in form of employee volunteering of non-core skills such as building houses or core skills such as IT skills, community development programmes, cause-related marketing, or targeted education programmes closely aligned with an organization core programmes.

### **2.4 Analysis of Naïve Bayesian Algorithm and Geographical Information Systems**

This section entails the analysis of Naïve Bayesian algorithm and Geographical Information Systems. These tools will be used to in system development and implementation. This section focuses on their performance and how it has been used in other areas to address resource issue.

#### ***2.4.1 Naive Bayesian Algorithm***

Naïve Bayesian algorithm, is a graphical model for probability relationships among a set of variable features. It consist of two components; First component is mainly a directed acyclic graph whereby the nodes in the graph are called the random variables and the edges between the nodes. The second component is a set of parameters that describe the conditional probability of each variable given its parents(AL-Nabi & Ahmed, 2013). This algorithm describes a system by specifying relationships of conditional dependence between its variables. It provides a way of calculating the posterior probability,  $P(c|x)$ , from  $P(c)$ ,  $P(x)$ , and  $P(x|c)$ . Naive Bayes classifier assume that the effect of the value of a predictor ( $x$ ) on a given class ( $c$ ) is independent of the values of other predictors (Sayad, 2017).

$$P(c | x) = \frac{P(x | c)P(c)}{P(x)}$$

$$P(c | X) = P(x_1 | c) \times P(x_2 | c) \times \dots \times P(x_n | c) \times P(c)$$

Figure 2.5 Naive Bayesian Theorem(Sayad, 2017)

$P(c|x)$  is the posterior probability of class (target) given predictor (attribute).

$P(c)$  is the prior probability of class.

$P(x|c)$  is the likelihood which is the probability of predictor given class.

$P(x)$  is the prior probability of predictor.

Naïve Bayesian classification algorithm is advantageous in that it is fast to train and classify, it is not sensitive to irrelevant features and it has the ability to handle real and discrete data. However, it is also disadvantageous in that it tends to assume independence of features.

### Comparison of Bayesian Network Algorithm with other Classification Algorithms

March 2011 group of researchers did a comparison among many classification algorithm in data mining over Heart Disease Prediction, in the comparison the result showed that the accuracy of Naive Bayesian and decision tree is so close to each other we can say that both of them have same accuracy. The accuracy of the K-NN algorithm was degraded by the presence of noise and the time taken by each algorithm showed that the Bayesian Algorithm was faster (Soni et al., 2011).

In many data mining classification model the decision tree and Bayesian algorithm had similar high predictive performance Bayesian networks can link more variable in complex direct and indirect ways making interpretation more complex while decision trees and provide a simpler and more direct interpretation (Bayat et al.,2009).

SreeMathy & Balamurugan (2012), published a paper which was about a comparison between KNN and Bayesian Classification algorithm on an efficient text classification the comparison showed the Precision of Bayesian algorithm over KNN and SVM algorithm(SreeMathy & Balamurugan, 2012).

Based on the analysis of the three algorithms (K-Nearest Neighbor, Decision Tree and Naïve Bayesian) it was concluded that decision Trees have less error rates and easier compared to KNN and Bayesian. However, Decision trees requires certain knowledge to complete the process accurately. It can also be difficult to include variables on the decision tree.

KNN has less accuracy while Decision tree and Bayesian are equal in terms of accuracy. The accuracy of decision trees can be increased by merging the algorithm with genetic algorithm to make it more powerful. The efficiency of KNN results can be improved by increasing the number of data sets while the efficiency of Bayesian algorithm classifier can be improved by increasing the number of attributes.

Based on time, it is concluded that Naïve Bayes algorithm is faster compared to Decision trees and KNN(AL-Nabi &Ahmed, 2013). Therefore this research seeks to use Naïve Bayes Algorithm.

### **Related Works**

Eberhardt (2015), did a research on the application of Naïve Bayes algorithm in Spam filtering. The algorithm was trained with controlled data that was already defined as spam so that the model could be applied to real-world situation. An analysis of 2 specific optimizations of Naive Bayes text classification and spam filtering was done, so as to identify the differences between them and how they have been used in practice. The study showed that Bayesian filtering can be simply implemented for a reasonably accurate text classifier and it can be modified to make a significant impact on the accuracy of the filter. A research was carried out by Karim & Rahman (2013), to predict whether a client will subscribe for term deposit using decision tree and Naïve Bayes algorithm. A comparative study of performance of those two algorithms was also made. The dataset used in this research was directly related to direct marketing campaigns of a Portuguese banking institution. There were a total of 45,211 records in dataset. Each record had 17 attributes including the last attribute which defined the class label of the record, whether the

customer subscribe to term deposit or not. Using Naïve Bayes, after the training the correctly classified instances were 39,811 which is 88.056% and incorrectly classified instances were 5400 which is 11.944%, hence it was concluded that the training data was good. And after the testing, the correctly classified instances were 3966 which is 87.724% and the incorrectly classified instances were 555 which are 12.276%, hence it was concluded that the model can classify data accurately.

Based on the related works it is evident that Naïve Bayes is fast and accurate and therefore this study will use Naïve algorithm to develop the resource mobilization application.

#### ***2.4.2 Geographical Information Systems (GIS)***

A geographic information system (GIS) allows us to visualize, question, analyze, and interpret data to understand relationships, patterns, and trends. GIS benefits organizations of all sizes and in almost every industry.

#### **Related work on how GIS have been used for resource mapping**

Several studies have shown that GIS is a useful tool for finding the optimal location of water wells. Platz et al,(2014) showed how GIS can be used to determine favourable locations of groundwater wells in a region of western Jordan. They used the commercial software ArcGIS and implemented exclusively environmental parameters in their work.

GIS has been used for mineral Exploration in Nigeria, a research carried out by Amoka & Jatau (2010) whereby Electrical resistivity data were integrated with GIS to delineate a tourmaline deposit in different provinces in north central Nigeria . The GIS software was used to convert the field data to 7 iso-resistivity maps at depths of 5m, 10m, 15m, 20m, 25m, 30m and 40m. The field data were first organized into a Microsoft Excel spread sheet and saved as a database file. The data were then used as input into the GIS software. The results demonstrate the potential of the GIS in speedy and reliable execution of mineral exploration projects.

This study seeks to use geographical Information system to map resources available in each health based NGO in Nairobi so has to enable the participating NGOs to make an informed decision on how to obtain the required resources from the organisations who have in abundance.

## 2.5 Conceptual Framework

The user will be required to enter the organization details for example, the vision, Mission, Annual Budget, Financial systems, Internal Controls among others. This input will be subjected to Naïve Bayes algorithm classifier which will make predictions on which category is the best fit for an organization based on their structural details and prior knowledge. The knowledge base stores the prior knowledge which is termed prior probability that reflects the most probable guess of the outcome without additional information

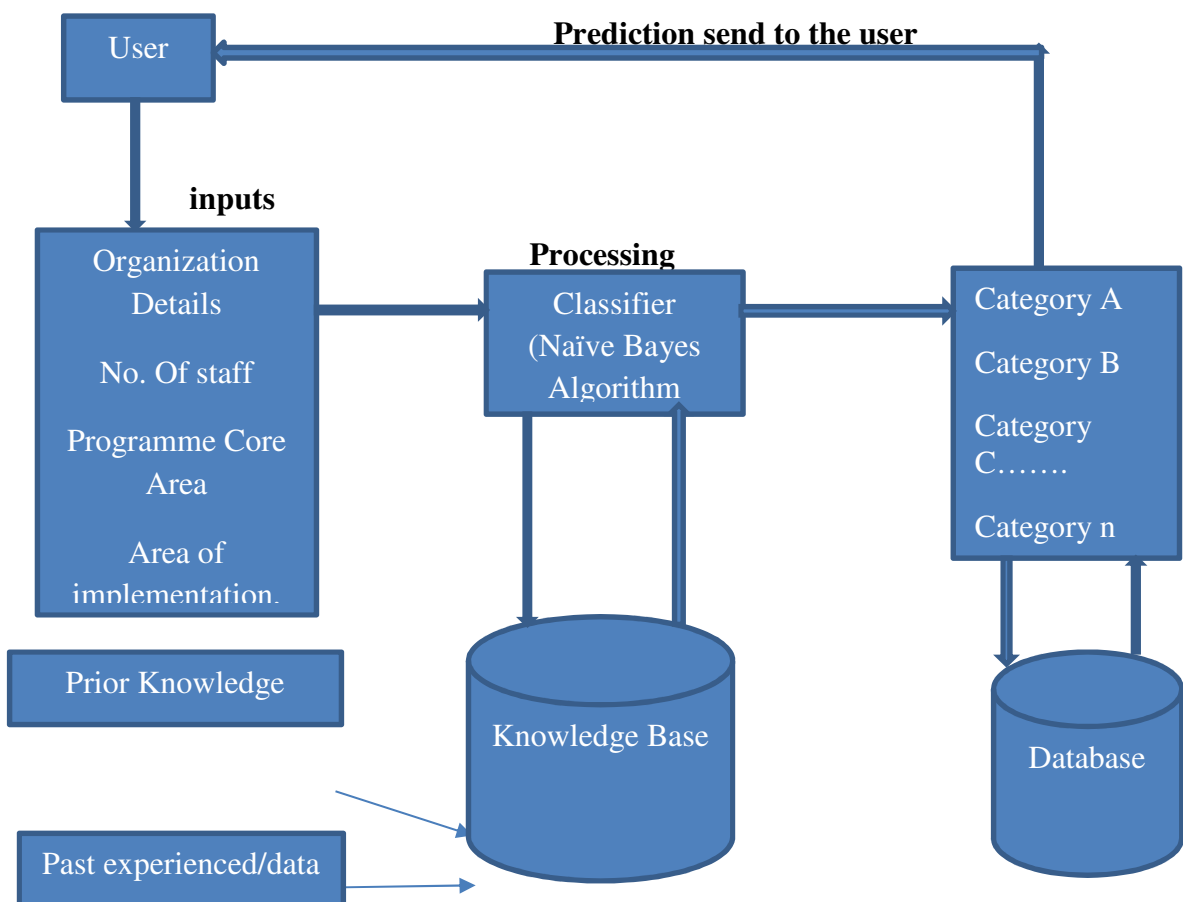


Figure 2.6 Conceptual Framework of the Resource Mobilization Application

**Inputs**-Structural details of an organization for example Number of years in Operation, Model of governance, Core focus Programme Area etc.

**Knowledge Base**-This is where the information is stored in the prediction model in the form of facts and rules.

**Naïve Bayesian Algorithm**- Classifiers the organization based on the structural details provided by the user.

**Database**- After the organization has been classified, the classification output will be stored in the database which will be used to train the model.

**Output**- Predictions output from the classifier based on the information provided by the user. This information will be presented to the user.



## **Chapter 3: Research Methodology**

### **3.1 Introduction**

Research is a scientific and systematic search for pertinent facts on specific area of interest in order to generate new knowledge or validate existing knowledge. A research can be explorative, experimental or descriptive therefore it can take either qualitative or quantitative approach or a combination of the two. It is guided by the proposed research questions outlined in chapter 1. It outlines the research site, research design that was used, sample population under study, data collection, analysis methods and the research quality.

### **3.2 Population and Sampling**

This research targeted Non-governmental organizations who are implementing health based projects in Nairobi County and they are members of Health NGO network (HENNET). According to Health NGOs Network,(2016)there are a total of 60 NGOs implementing health programmes in Nairobi county.

This research adopted purposive sampling strategy. Purposive sampling is a non-probability sampling strategy in which the researcher selects respondents who are considered to be typical of the wider population(Kothari,2014).This strategy was adopted to target resource mobilization officers in all the 60 health based NGOs in Nairobi county because they have the required information that will meet the objectives of the research.

### **3.3 Data Collection Procedure**

Data refers to all the information a researcher gathers for the research (Mugenda & Mugenda, 2003).It can be classified as primary or secondary data. Primary data refers to the first-hand information that a researcher obtains from a variable of interests for a specific purpose while secondary data refers to the information obtained from sources that already exist(Sekaran & Bougie, 2016).

Primary data was obtained using a questionnaire. Questionnaires were carried out to collect information about the factors that affect resource mobilization and information about the need of the system and user requirements from the respondents of the research. Questionnaires were adopted because data can be analyzed more scientifically and objectively than other forms of data collection(Kothari, 2014). Secondary data on the other

hand was gathered from Journals, Internet and other existing literature because they are easily accessible and easily available

### **3.4 Data Analysis**

Once data had been collected and assembled, automated computer analysis tools were used to analyze the data. More specifically, SPSS tool was used in this research because it is capable of handling a large amount of data and it can perform all the data analyses at any given scenario. In validation of the research objectives, user and system requirements directed content analysis was used the analyzed data was represented in form of tables, graphs and charts.

### **3.5 Research Quality**

The quality of data can be perceived in terms of objectivity, reliability, and validity of data. It is the measure of the degree at which the research was carried out correctly. Validity, reliability and objectivity were used in this research to test the quality aspect of research.

#### **3.5.1 Validity**

According to Janetzko(2008), validity concerns the degree to which a research instrument measures what is supposed to measure. Research questions were used to determine which data is to be collected and how to group them to ensure that it addresses the research objectives. Responses of the questions given were analyzed to determine whether the system would be of value to the users and to establish what features are more important to the user.

#### **3.5.2 Objectivity**

Objectivity addresses the question if the data collection is independent of the persons involved in data collection and independent of the devices used. Objectivity was achieved by sending the questionnaire electronically to different organizations. A letter of introduction was provided by the university during data collection which was presented to the relevant authorities in order to conduct research. The confidentiality of the data collected and the anonymity of the respondents was maintained.

### **3.5.3 Reliability**

Reliability informs about the extent to which repeated use of a measure leads to consistency. There are two types of reliability tests; test-retest reliability is a measure of the consistency of results from one point in time to another, parallel-test reliability expresses the consistency of results obtained via different data collection methods.

Test-retest reliability was used in this research to measure the level to which the information gathered was collected in a trustworthy manner. This was achieved by issuing respondents with a pilot questionnaire and questions were refined based on the pilot test. The refined questionnaire was issued again to the respondents. The correlation between the questionnaires was checked and this gave a go ahead with the study. This approach was used because it ensures that the procedures and data collection instruments used to gather the information are consistent enough and it can produce the same repeatedly.

### **3.6 Software Development Methodology**

This research adopted agile software development methodology. Agile methodology promotes an iterative mechanism for producing software, and they further increase the iterative nature of the software lifecycle by tightening design-code-test loop (Sabale & Dani, 2012).

Figure 3.7 illustrates the phases that were followed in this study in order to achieve its objectives. The first phase was requirement specifications, it entailed a complete and comprehensive description of the software which was developed. This is where both functional and non-functional requirements were defined. The second phase was architecture and design phase, this is where the plan for the solution was defined. It entailed defining the algorithm design, software architecture design, database conceptual schema and logical diagram design. The third phase was Implementation/development phase which entailed the realization of the requirements and design specifications into an executable program through programming and deployment. The fourth phase was the testing and feedback phase, it entailed checking that the proposed software meets the requirements and specification and it accomplished the required objectives.

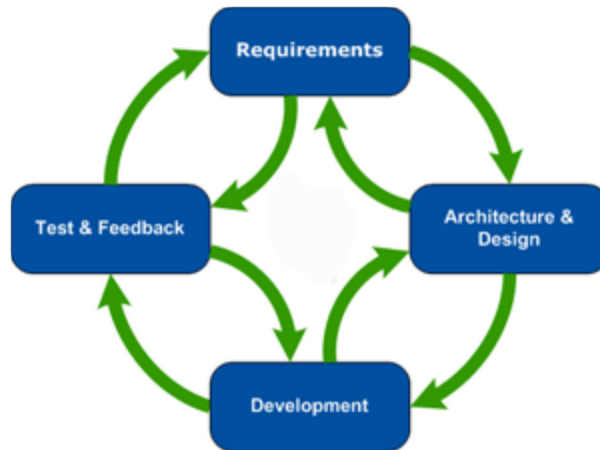


Figure 3.7 Agile Software Development Model (Mualuko, 2016)

### 3.7 Research Design

This study adopted both quantitative and qualitative research approach. Qualitative approach objective was to get factual information through truthful reporting, and firsthand experience from different NGOs. It was used to understand factors that influence resource mobilization among NGOs which were then used to classify the organizations into various classes based on their organizational structures. Quantitative research was used to find out the number of people who thought it would be a good idea to map resources available in any organization at any given time.

#### 3.7.1 System Analysis

Object oriented analysis approach was used in this study because it was able to represent complex relationships and to represent data and data processing with a consistent notation, which allows an easier blending of analysis and design in an evolutionary process (Valacich & Joey, 2016). This study focused on use case modelling and class modelling to explore the approaches used in system analysis. In object oriented system development life cycle, use-case modelling is developed in the analysis phase. It is done in the early stages of system development so as to help the system developers to bring out a clear understanding of the functional requirements of the system without considering the implementation of the same requirements. A use case model consists of use cases and actors. An actor is an entity that interacts with the system and use case denotes a sequence of interrelated activities initiated by an actor in order to achieve a given objective (Hoffer et al., 2002).

### ***3.7.2 System Design***

Object oriented techniques were used to refine the requirements analysed during the system analysis phase and specific objects were designed. This research used domain model to illustrate objects that share the same attributes and how they relate to each other. Entity relationship diagram was used to show the relationships between different entities and also to show how data were organised. This will enable the researcher to develop entities and their attributes in a relation database(Hoffer et al., 2002).

### ***3.7.3 System Implementation and Development***

This research used Java Net beans IDE Version 8.02 to designer the Graphical User Interface (GUI) to be used by the user to input organization details. MYSQL relational database was used for data storage and WEKA version 3.8 was used to develop and train the naïve Bayesian algorithm because it is open source and it can be easily integrated with Eclipse IDE.MYSQL relational database was used because it is open source and cross platform.

### ***3.7.4 System Testing***

This study used acceptance testing to verify if application was able to recommend and organization with similar characteristics with what the user had entered to the system and also indicate the available resources. Usability testing was also used to ensure that the system is meets user requirements.it was used to test ease of use, user friendliness, system efficiency, and error tolerability of the proposed solution.

## Chapter 4: System Analysis and Design

### 4.1 Introduction

This chapter details data analysis, system analysis and system design structure of the research mobilization application. Data analysis focuses on the data collected from the sample population using the data collection tools mentioned in chapter 3. The system analysis focuses on the analysis of the system based on the data collected. To achieve the system analysis, Use cases and sequences diagrams were drawn to illustrate the interaction of actors with the proposed system Design architecture was achieved by drawing the domain model, Entity Relationship Diagram and a Database schema.

### 4.2 Results from Questionnaire

An online based questionnaire was administered to 60 Resource Mobilization officers in all the 60 health based NGOs in Nairobi County. Out of the total questionnaires issued out, 53 questionnaires were returned and 7 were not returned. The findings were represented inform of graphs and charts as illustrated below.

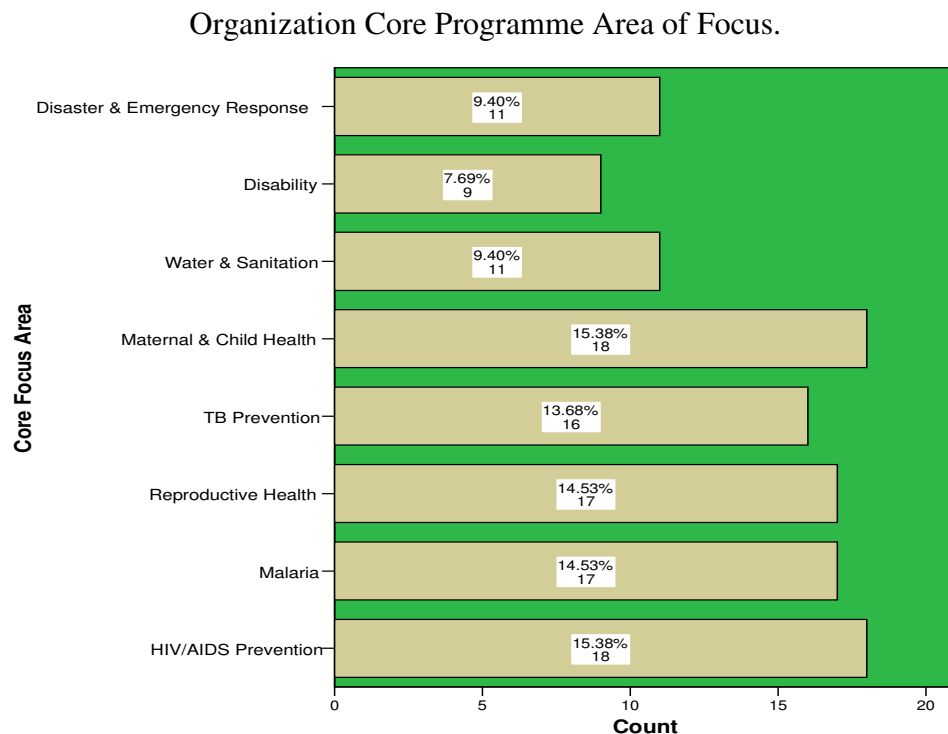


Figure 4.8 Core Programme area of focus

Figure 4.8 illustrates the core programmes focus area for all the 60 organisations which were interviewed. From this findings we can see that majority of this organisations deals

with Maternal and Child health. Based on this findings the application user should prompt users to indicate their core programmes area.

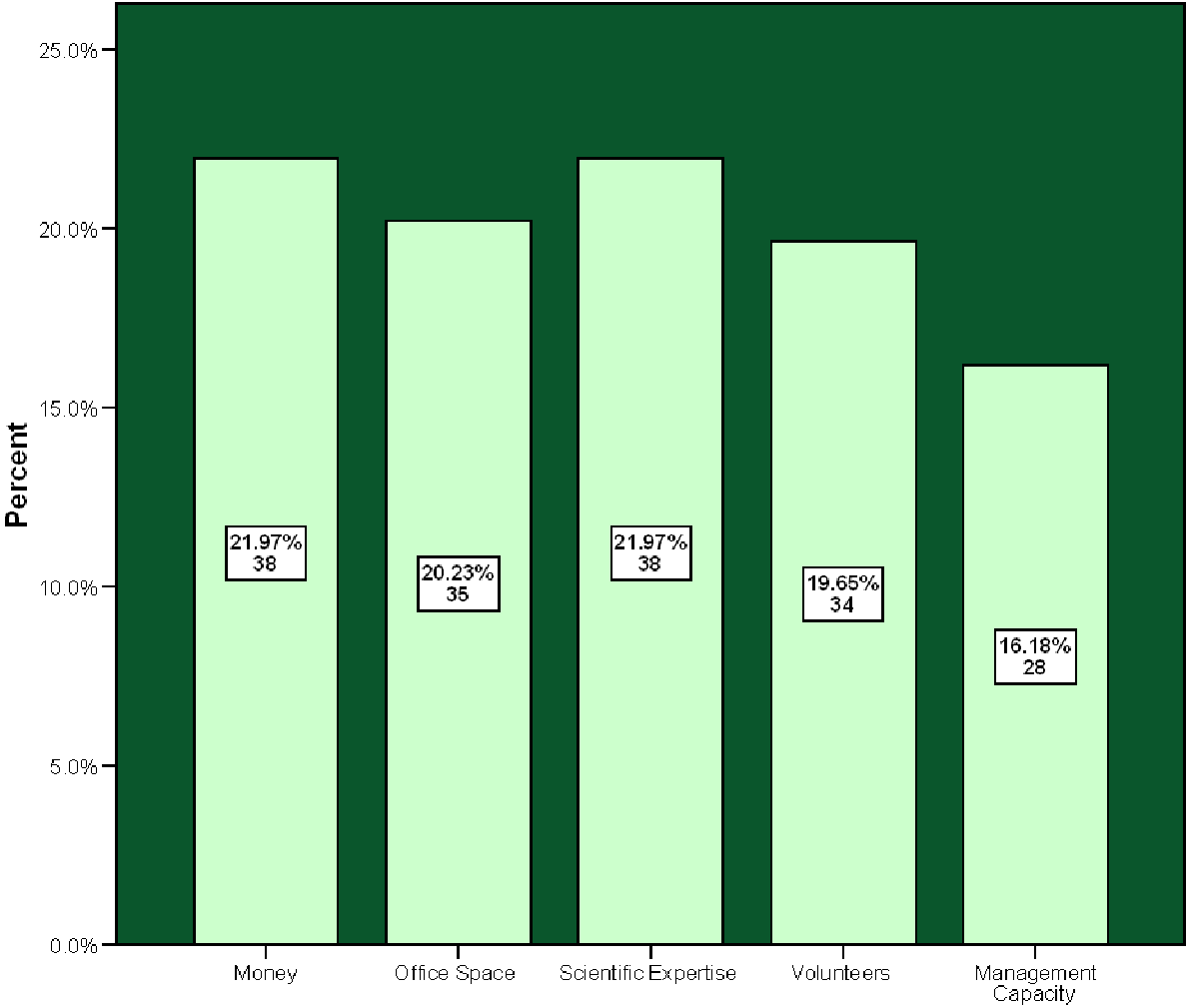


Figure 4.9 Resources Available in an organization

Figure 4.9 illustrates resources available in all the organisations interviewed. Majority of them indicated that they had monetary and scientific expertise resources in their organisations and a smaller percentage indicated that they had Office Space, Volunteers and Management Capacity. These findings will aid in resource mapping to ensure that different organisations are aware of resources available in another organisation within the same sector.

## Factors influencing Resource Mobilization for Non-Governmental Organizations in Kenya

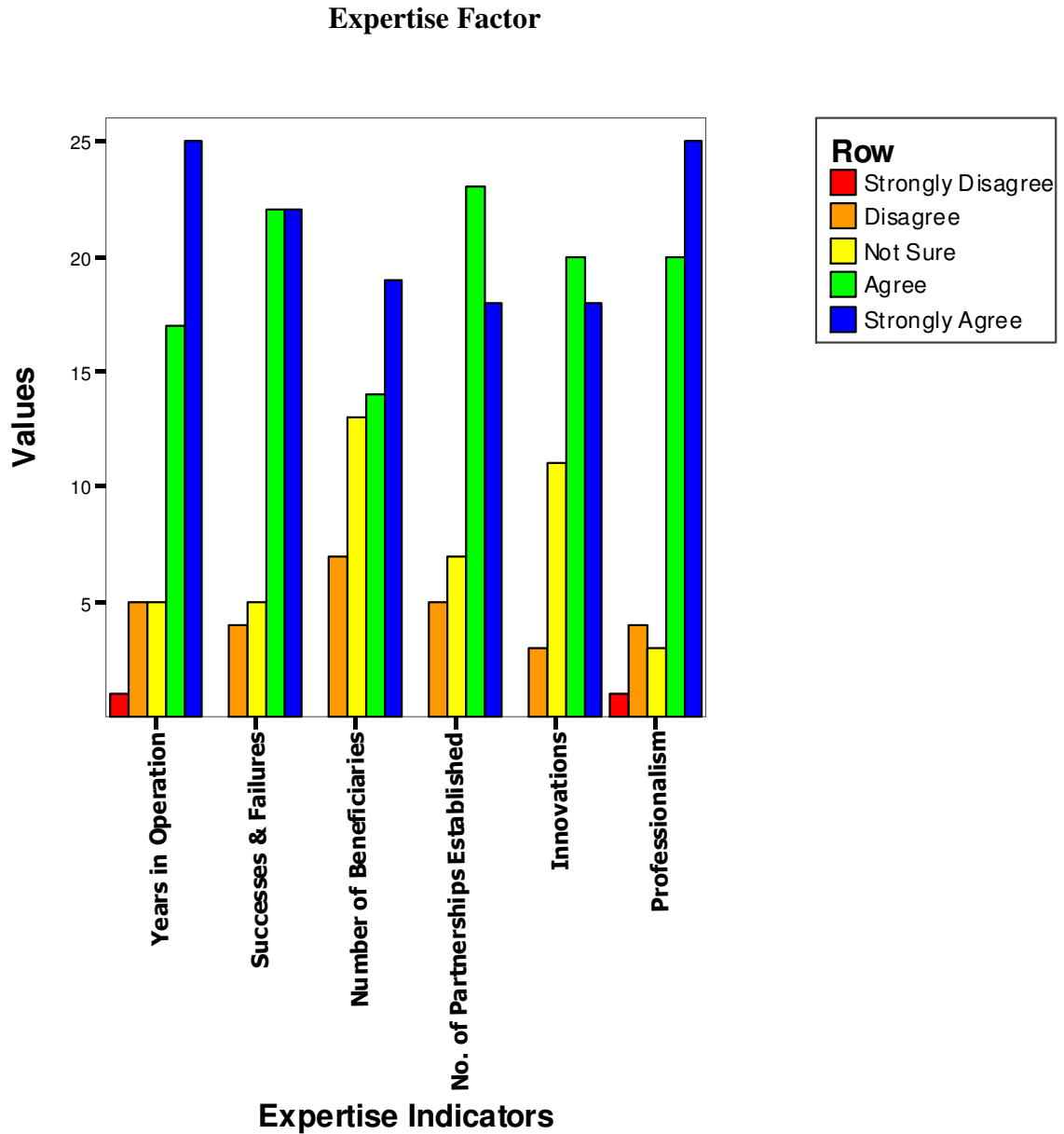


Figure 4.10 Expertise Factor Indicators

Figure 4.10 shows that majority of the respondents interviewed agrees that years of active operation, successes, failures, number of beneficiaries, number of partnerships established, innovations and professionalism can be used to measure the level of expertise in an organization. See Appendix C for Frequency Tables.



### Accountability and Transparency Factor

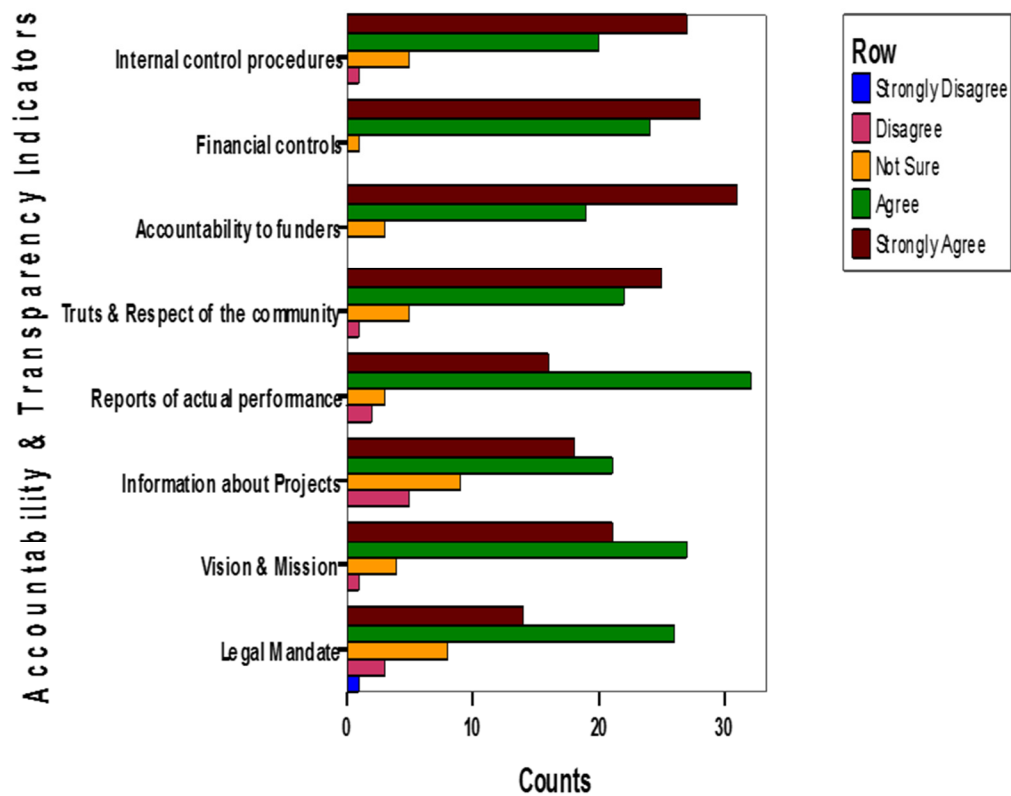


Figure 4.11 Accountability and Transparency Factor

Figure 4.11 shows that majority of the respondents interviewed agrees that legal mandate of an organisation, the vision & mission, Information about projects, reports of actual performance, trust and respect of the community, accountability to funders, financial controls and internal control procedure are the key indicators that can be used to measure accountability and transparency of an organisation. Accountability and transparency in an organisation is a very important factor that needs to be considered in resource mobilization and there the application will prompt user to confirm if they are accountable to donors as an organisation.

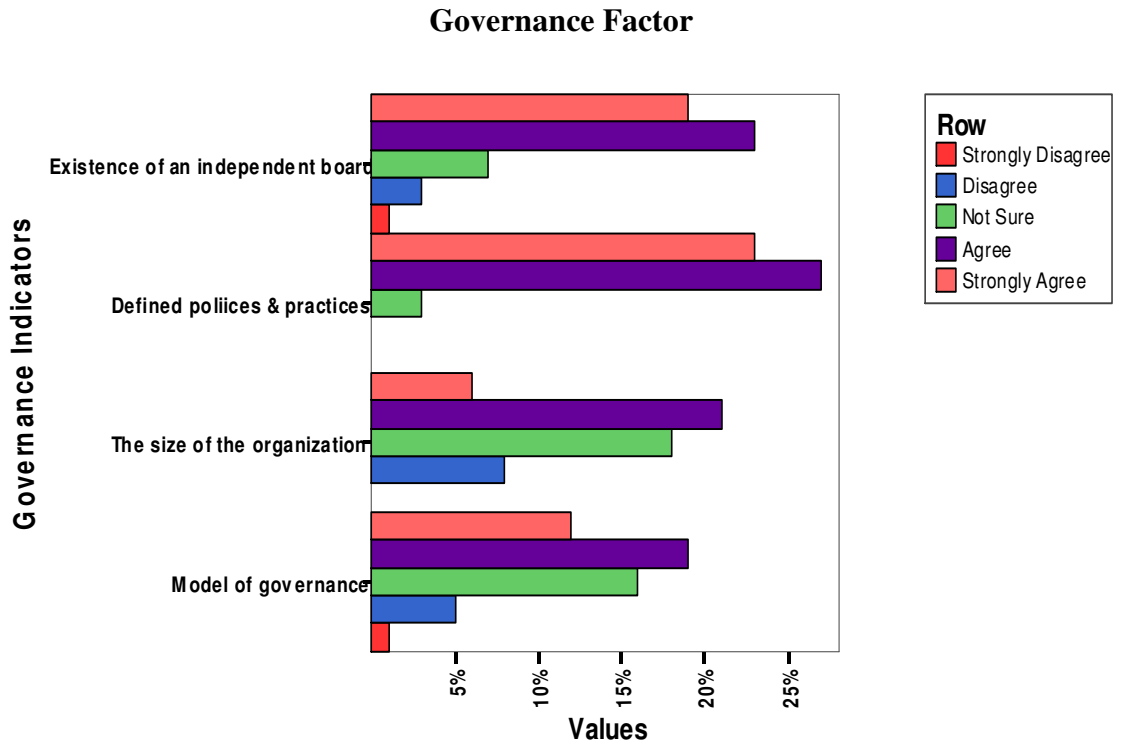


Figure 4.12 Governance factor indicators

Figure 4.12 indicates that a large percentage of the interviewed respondents strongly agree that organization governance influences its ability to mobilize resources and the key indicators such as model of governance, the size of the organization, defined policies and existence of an independent board can be used to measure the existence of governance in an organization. This responses indicates that the application should prompt user to fill in some information in regards to their governance.

## Existing Resource Mobilization Techniques used by NGOs in Kenya

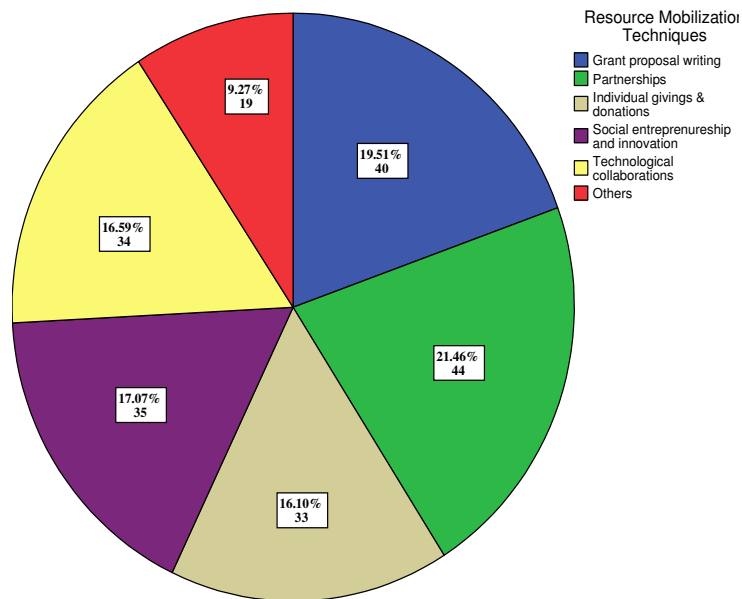


Figure 4.13 Resource Mobilization Techniques

Figure 4.13 indicates that majority of the respondents interviewed indicated that Partnerships, Social entrepreneurship and grant proposal writing are the main resource mobilization techniques used by NGOs in Kenya. The resource mobilization application should be able to output the most recommended resource mobilization technique preferred by any organization at any given time.

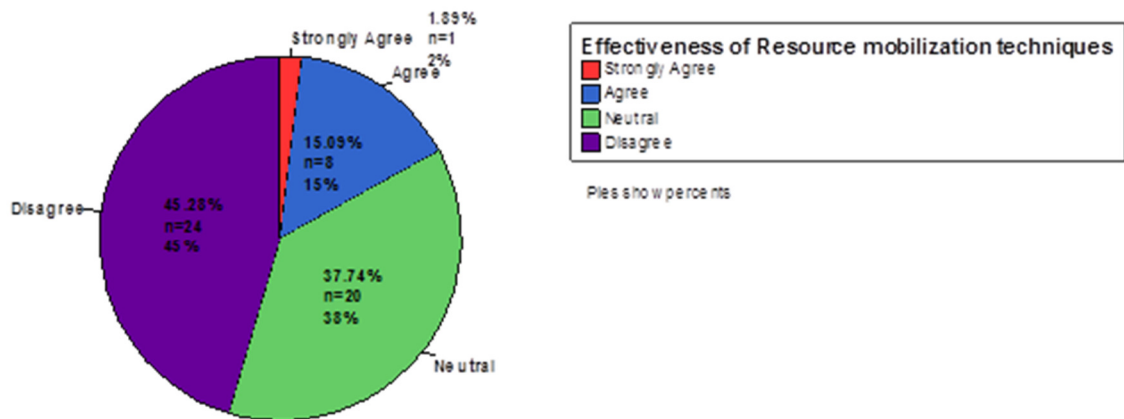


Figure 4.14 Effectiveness of the existing Resource Mobilization Techniques.

Figure 4.14 indicates that majority of respondents interviewed said that the existing resource mobilization techniques are not effective. The existing techniques are not effective and therefore proposed Resource Mobilization Application will play an important role in resource mobilization among Non-Governmental Organizations.

### Challenges of Using Existing Techniques

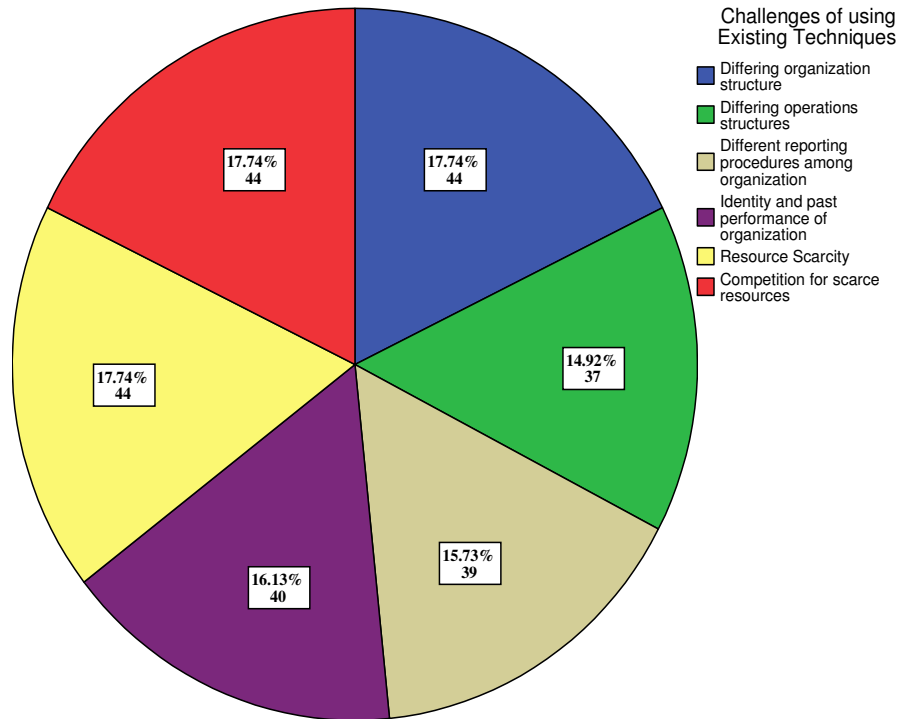


Figure 4.15 Challenges associated with the existing resource mobilization techniques

Figure 4.15 indicates that majority of the respondents interviewed cited that differing organization structures, resource scarcity and competition for scarce resources are the major challenges that are faced when using the existing resource mobilization techniques. The Resource Mobilization Application should be able to classify organizations based on their organization structures.

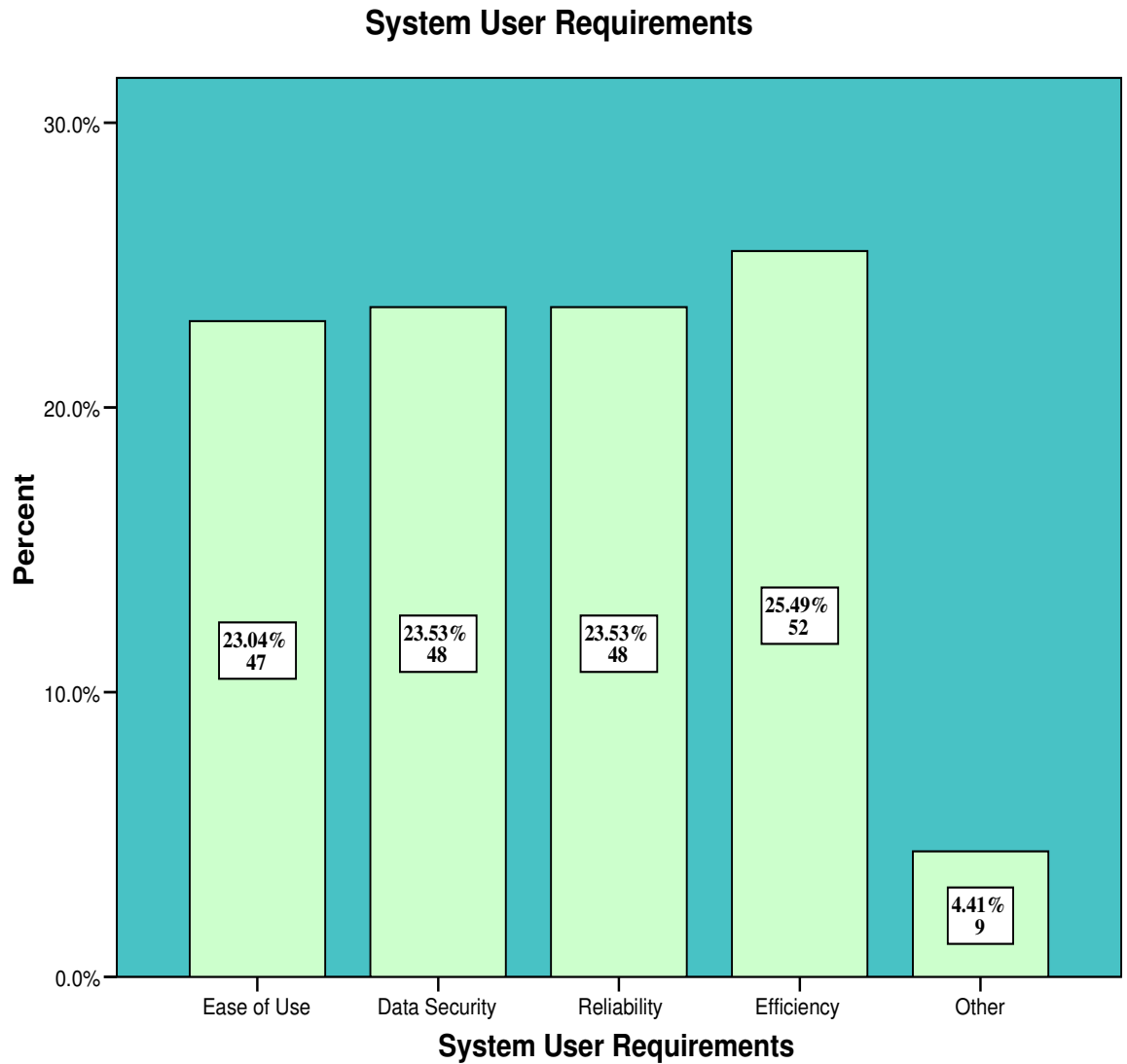


Figure 4.16 System User Requirements

Figure 4.16 indicates that majority of the respondents are concerned with the efficiency of the application, some are more concerned with security of data that will be stored in the application. It was also seen that some respondents would like to have an application which is reliable and easy to use and a small percentage of the respondents were more concerned with other requirements such as scalability and compatibility of the application with the existing systems.

### **4.3 Requirement Analysis**

It entails a detailed description of services and features that should be addressed by the proposed Resource Mobilization Application based on the research objectives and user requirement. This can be divided into functional and non-functional requirements.

#### ***4.3.1 User requirements***

These describes the needs that the user requires from the system. These requirements were obtained from the interviewed that was carried out during data collection. They Include:

- i. The application should be efficient. The respondents interviewed said that the existing resource mobilization techniques are inefficient.
- ii. The application should be able to classify an organization correctly based on the information provided and be able to indicate the resources available in the recommended organization.
- iii. The application should be user friendly i.e. it should be easy to navigate
- iv. The application should allow only authorized users to use the system so as to fulfil data security requirement requested by users

#### ***4.3.2 Functional Requirements***

These are functions that the system should perform. They include:

- i. The application should allow a user to enter basic information about their organization
- ii. The application should classify the organization based on the information provided using Naïve Bayesian Algorithm
- iii. The application should return the correct classification of the organization based on the information provided by the user
- iv. The application should recommend the best possible organization to mobilize resources with and indicate the type of resources that they have at a particular time.

### ***4.3.2 Non-Functional Requirements***

These are qualities that a system should exhibit to ensure that it is user friendly and secure.

- i. Any user who wishes to sue the system needs authentication using a unique username and password.
- ii. Error reporting mechanism. The application should allow a user to report a bug and get feedback when it is fixed.
- iii. The application should be reliable-Provide the correct information always.
- iv. The application should be available-it should be available all the time.
- v. Usability-23.4% of the respondents interviewed said that they wanted a system that is easy to use.
- vi. Performance- 25.9% of the respondents interviewed said that they wanted a system that is efficient and effective.
- vii. Scalability- 4.4% of the respondents interviewed said that system should be scalable to allow growth and changes in the sector.



#### 4.4 System Architecture

Figure 4.23 illustrates Resource mobilization Application system architecture. The process begins when the attributes of an organization are stored in the database. The application converts the attributes into values which are considered independent variables. The values are then normalized so that it can handle the variation of values that will be entered by the user. These values are then used to train and test the Naive Bayesian algorithm. The naïve Bayesian algorithm classifies the organization and gives a recommendation to the users. The user will be able to view the resources available in that organization as well.

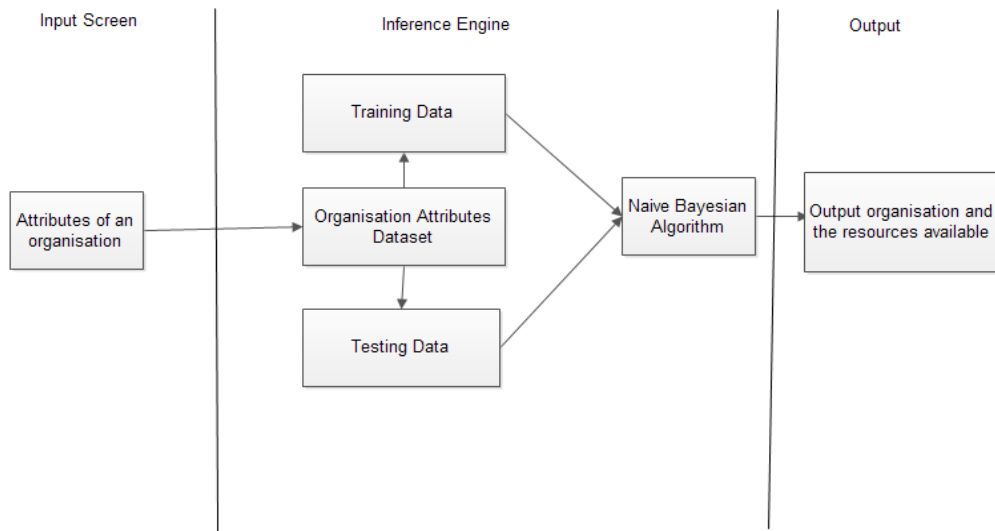


Figure 4.23 Resource Mobilization Application System Architecture

**Input Screen-** This is a graphical user interface designed using Java Net Beans IDE, the user will be required to enter the attributes of their organisation. This information will be stored in MYSQL database.

**Inference Engine-** The organisation attributes are loaded from CSV file and split into Training and test datasets. The properties of the training dataset are summarized so that probabilities can be calculated and predictions made. The summaries of the dataset will be used to generate a single predictions. Predictions will be generated using a given test

dataset and summarize training data. And finally the accuracy of predictions made for a test dataset will be evaluated as the percentage out of all predictions made.

Output-Predictions results that will be presented to the user in this case the name of organisation.

#### 4.5 Use-case Diagram

The use case diagram for the application is illustrated in Figure 4.17

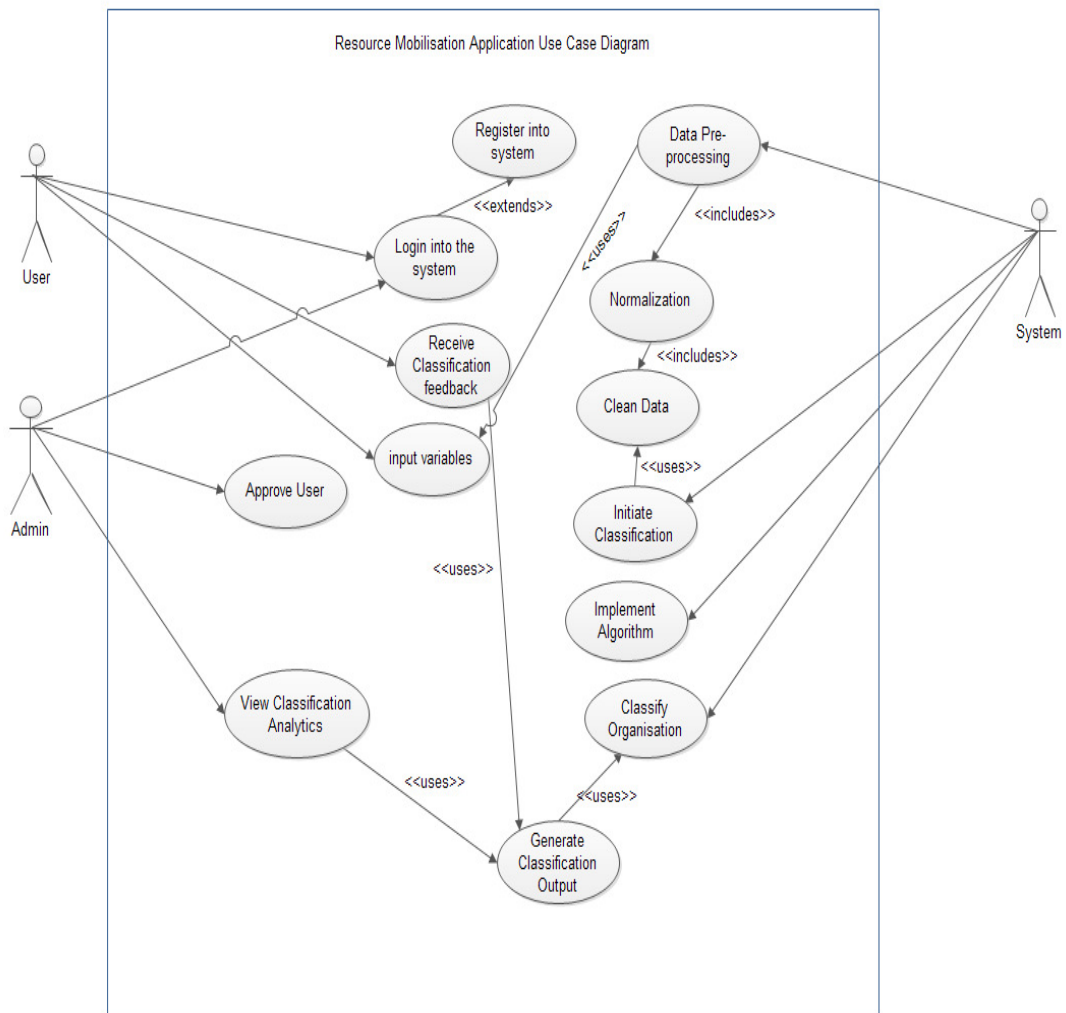


Figure 4.17 Resource Mobilization Application Use Case Diagram

The use case diagram captures the interactions of the actors with the application. The user is required to provide input variables to initiate the classification process.

Use case	Input Variables
Primary Actors	User (Resource Mobilization Officer)
Precondition	Log in is successful
Post Condition	The information obtained about an organization are saved
Main Success Scenario	<ol style="list-style-type: none"> <li>1. User enters username and password</li> <li>2. System Verifies and logs user in the system</li> <li>3. System presents user with interface to enter the required information</li> <li>4. User enters required information about the organization that is required for classification</li> <li>5. System saves the details</li> <li>6. User clicks on Classify button</li> </ol>

Table 4.1 Input Variables Use Case Description

See Appendix D for more Use Case descriptions.

### 4.6 Sequence Diagram

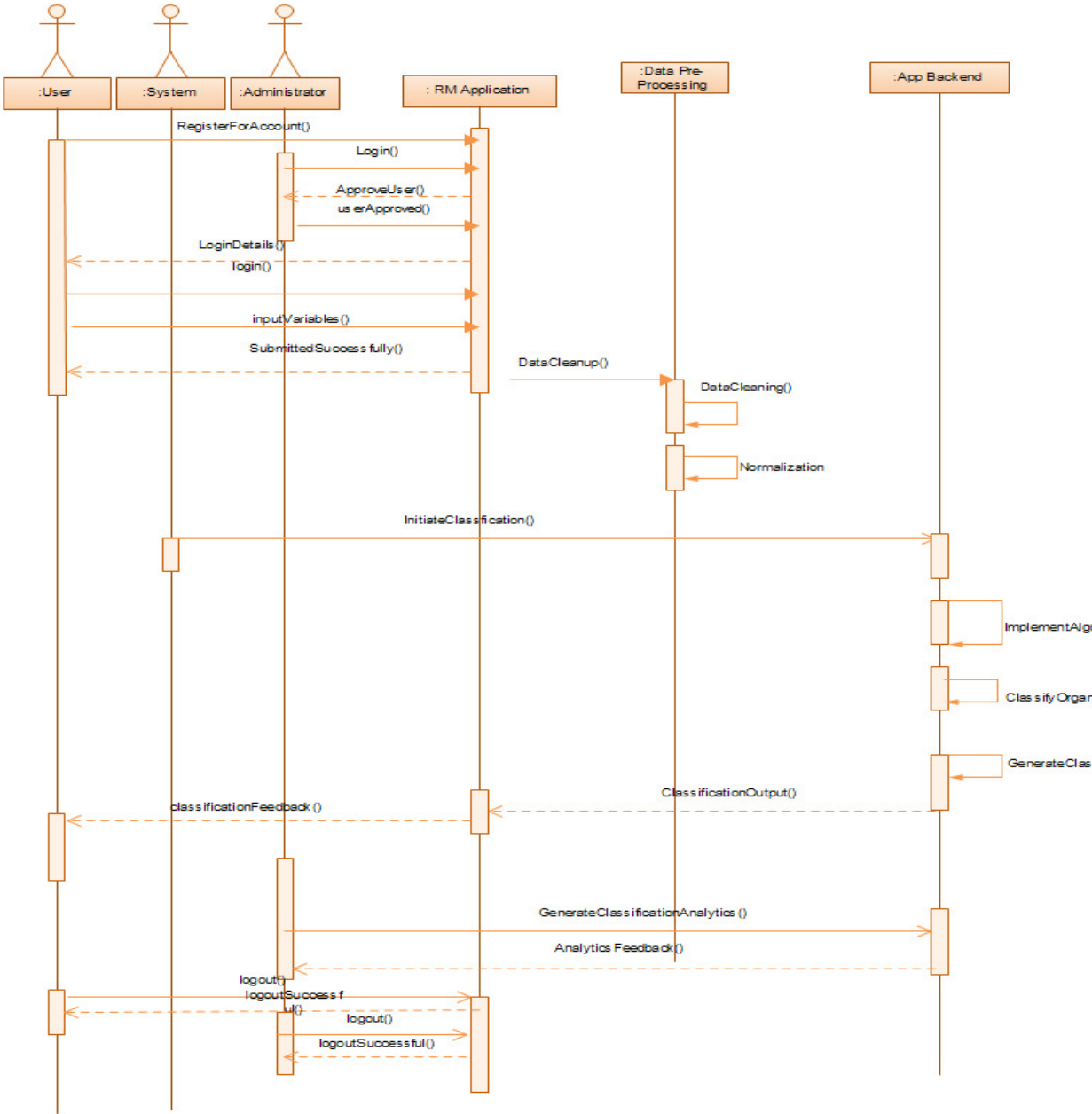


Figure 4.18 Sequence Diagram

Figure 4.18 illustrates the sequence of activities that are followed. The user will be required to register on the system. The administrator will have to approve the new registered user. If the registration is approved the user will be provided with login credentials otherwise the administrator will send an email to the user with information on why they have not been accepted on the system. The user will proceed to the login page. He/she will be requested to enter organization details/variables using the provided text field. The user will then submit the information. Once the data has been received it will be cleaned to remove noise and duplications. Once is cleaned and ready to be used, the system will initiate the classification process. The system will implement Naive Bayesian algorithm, it will then classify the organization based on the training data stored in the knowledge base. When n the organization has been successfully classified, classification details will be presented to the user who will be able to make decision on how they would like to collaborate with the recommended organization so that they can share resource together.

**4.7 Domain Model**

Domain model makes use to the class diagram without methods. It contains the contents of the domain model, the association between the models and the attributes of the classes.

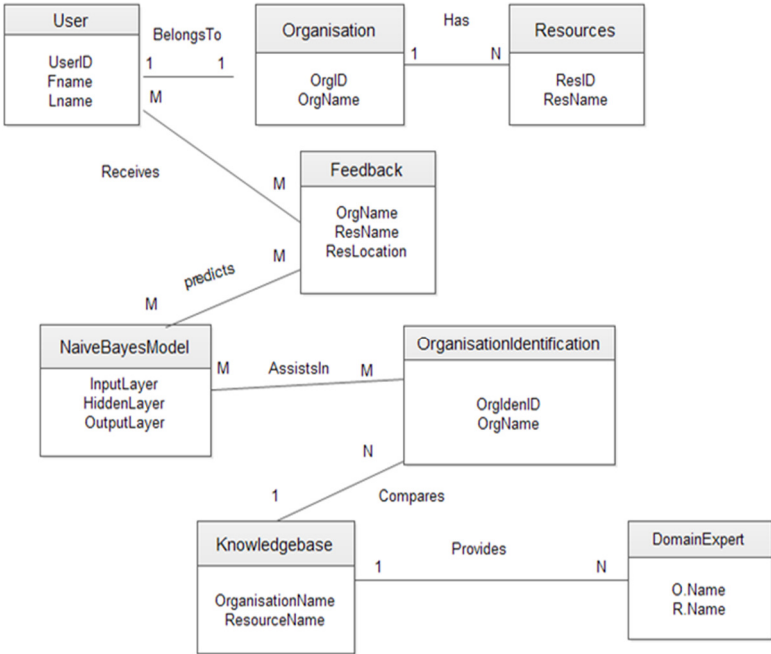


Figure 4.19 Domain Model

Figure 4.19 illustrates the domain model of the Resource Mobilization Application. The user enters the organization details, the details are then converted into values to be used as the input to the Naïve Bayes algorithm model. The naïve Bayes algorithm is presented with training data and test data will be used to test and train the model. The classification of the organizations is done based on the new data provided to the Naive Bayes classification model.

#### 4.8 Naïve Bayesian Classifier Flowchart

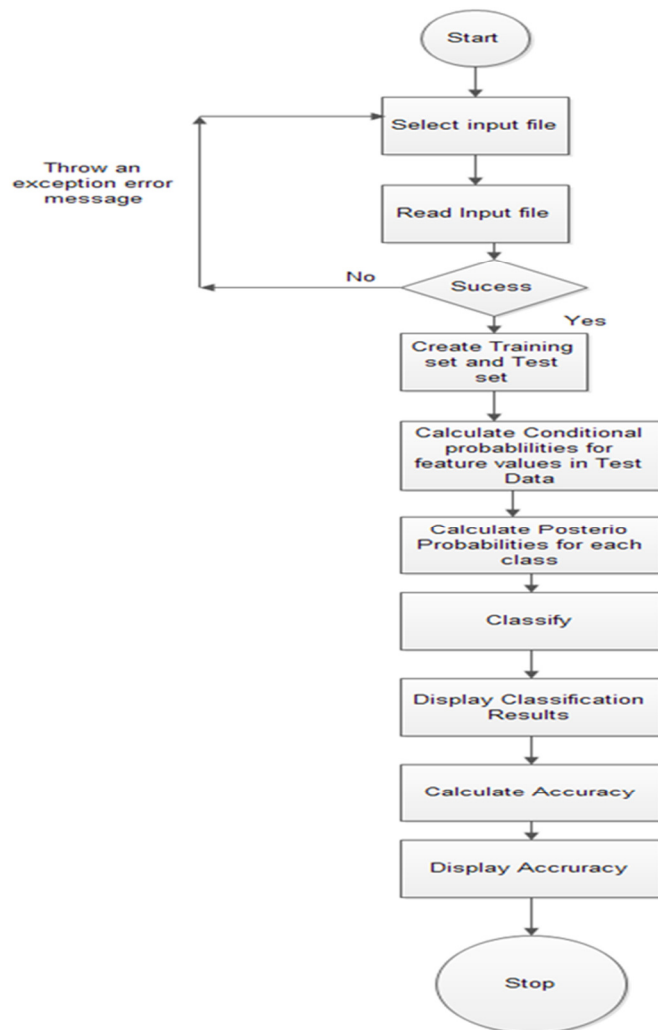


Figure 4.20 Naïve Bayesian Classifier flowchart

Figure 4.20 illustrates the flow of processes within the Naïve Bayesian algorithm .It illustrates the sequence of steps and decisions that will be taken by the algorithm in classifying the organization.

**4.9 Entity Relationship Diagram**

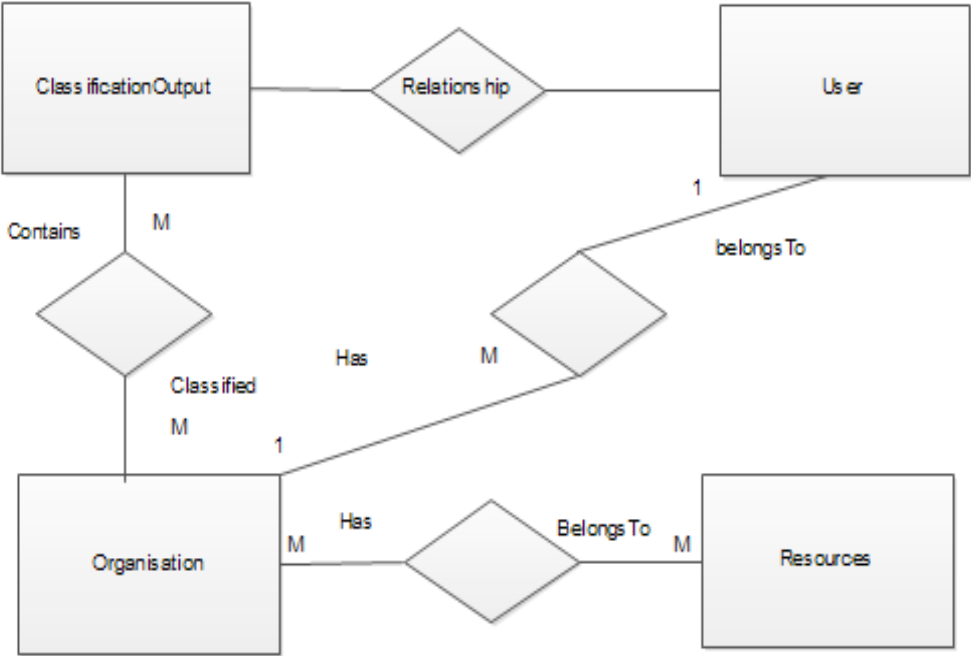


Figure 4.21 Entity Relationship Diagram

Figure 4.21 indicates the relationship between four entities, Classification Output, User, Organization and Resources. Many Organizations have Many Resources and resources belongs to many organizations. One to many users belongs to an organizations and many organizations can be classified in many classifications

### 4.10 Database Schema

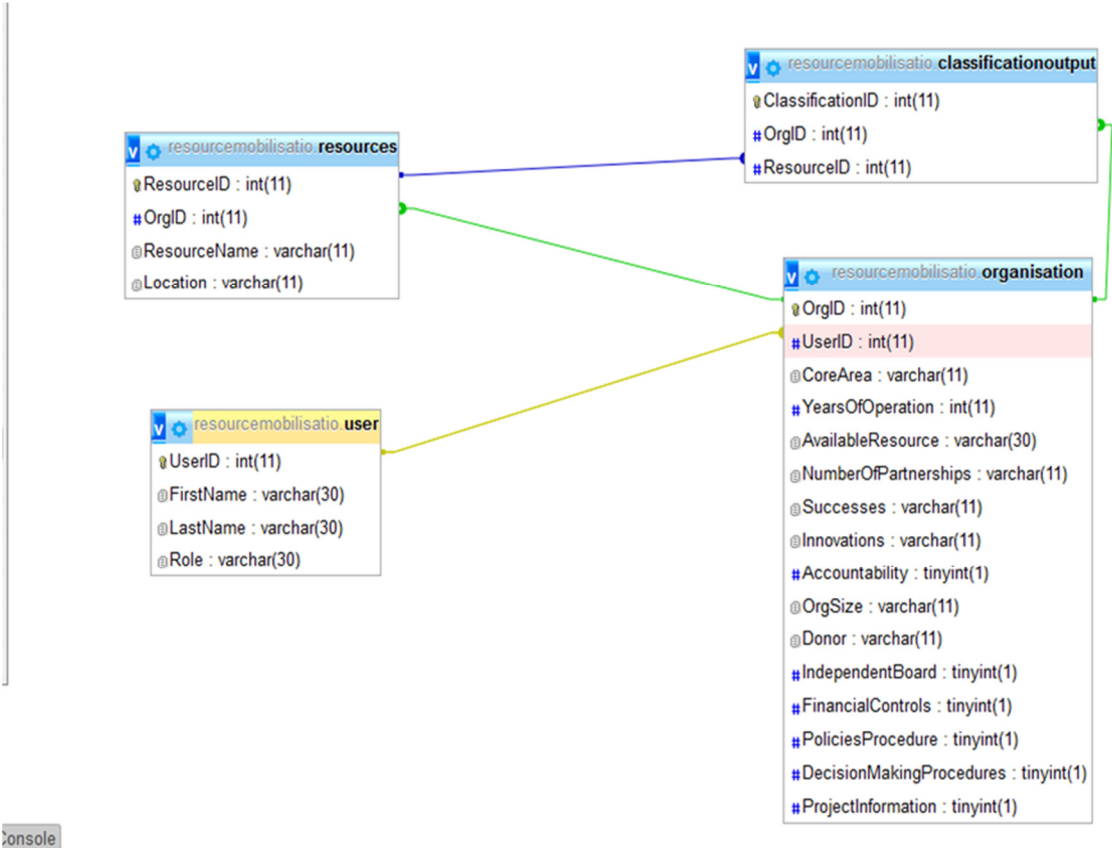


Figure 4.22 Database Schema

Figure 4.22 represents the logical view of the entire database. It shows how data is organized and how the relations among different tables are associated. It also shows all the constraints that have been applied to the data.



## **Chapter 5: Implementation and Testing**

### **5.1 Introduction**

This chapter entails the implementation and testing of the proposed Resource Mobilization Application. The implementation phase explores the different components of the system, how they implemented, how they interact and how they function. The testing phase entails testing the usability and functionality of the system with an aim of checking if the system meets the objectives of the proposed solution. The proposed application comprises the user interface which makes up the front end and the Naïve Bayes algorithm which makes up the back-end of the system. Java NetBeans IDE was used to create the User interface and WEKA was used to develop the algorithm. The application was implemented by creating a dataset of the Health based Non-Governmental Organizations. Data was collected from 60 organizations. The information was preprocessed to remove the noise elements contained in the collected data. The attributes of interest were identified and stored in the database. Naïve Bayesian algorithm was used to implement the classification of the organization. Once the classification was finalized the recommended organization was presented to the user and the available resources in that particular organization.

### **5.2 Application Components**

#### **5.2.1 Input File**

Naïve Bayes classifier is designed for categorical and it is generalized to read any dataset with categorical data. The input file should factor in the following structure for the file to be read correctly.

- i. The input file is should be a Microsoft excel file with .csv format
- ii. The feature values are categorical and not continuous data(Numerical)
- iii. The first column in the data is the class then followed by the feature values
- iv. The first row in the dataset should be the feature names

#### **5.2.2 Cross Validation Method**

The system is designed to implement the algorithm using three cross validation methods i.e. Holdout method, K-fold Cross Validation, and Leave-one-out cross Validation.

**Holdout Method:** Dataset is split into half creating the training set and the test set

**K-fold Cross Validation:** In the k-fold method the dataset is split into k different sets.

**Leave-one-out Validation:** The algorithm is carried out n times where n is the number of instances on the data set. For each run, one of the instances is used as the test data and the remaining instances are used as the training.

### 5.3 Application Implementation

**Input file:**User was requested to input the data in .csv format

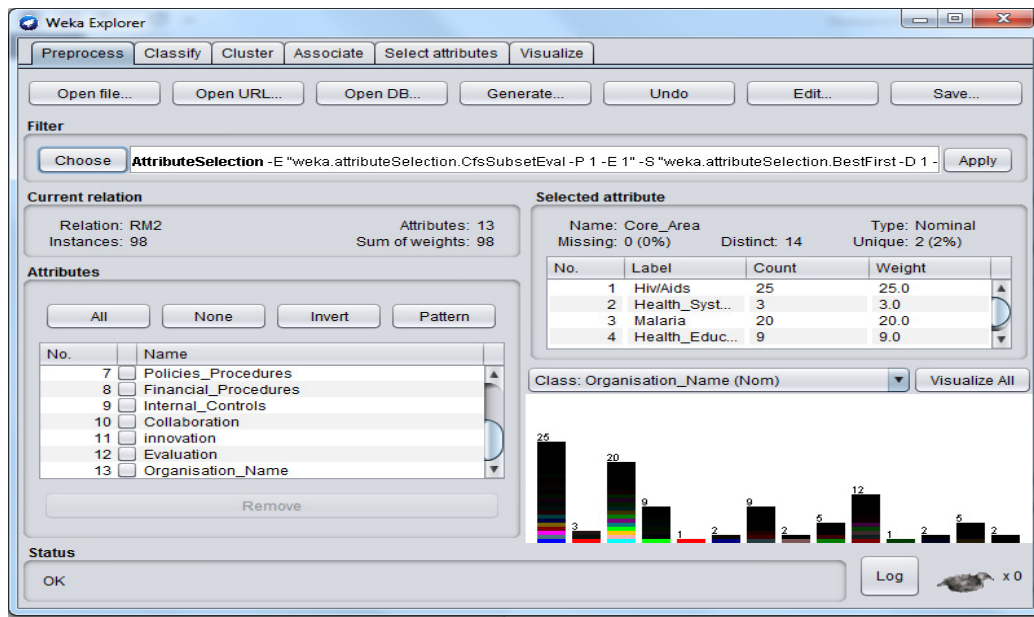


Figure 5.23 Weka Machine Learning Tool

**Select Cross Validation Method:** Based on the Validation method selected by the user the training set and the test set were created for training and validation of the classifier.

**Calculate Prior Probabilities of Each Class:** The prior probability of each class was calculated by dividing the number of data instances by the total number of instances in the training

**Calculate Conditional Probabilities:** The conditional probabilities for each value in the test data were calculated by counting the instances with the feature value in a particular class and dividing it by the count of instances. This was done for each class in the data set.

**Classification:** The class with the highest probability was assigned as the class for the test data.

**Accuracy Calculations:**The accuracy of the classifier was calculated by dividing the number of correct classifications by the total number of classification.

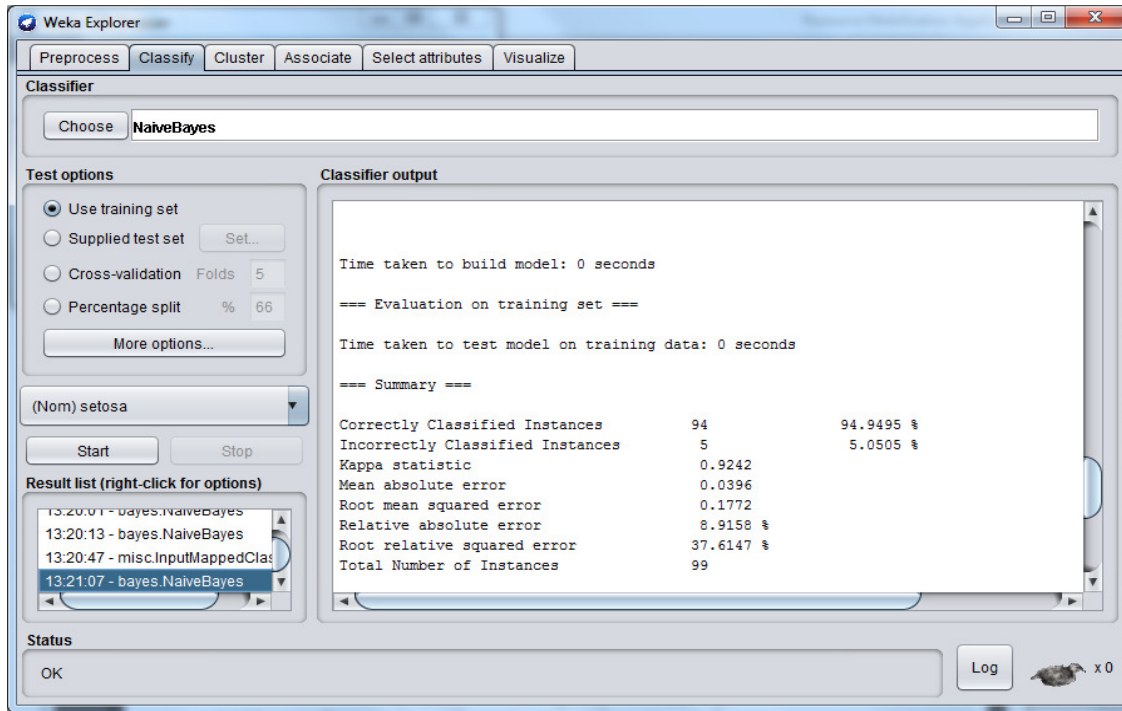


Figure 5.24 Naive Bayesian Classifier Implementation Output

## 5.4 Application Testing

This entails testing the functionality and reliability of the application of the proposed Application. Several parameters were used to test the application

Test	Inspection Check	Priority
Functionality	Does the application validate the data entered by the user	High
Functionality	Does the users who enter different set of organisation details are able to get separate results from another user	High
Reliability	Does the recommended organisations have similar features with what the user was looking for?	Medium

### 5.4.1 Application Testing Results

Application successfully validated user input to ensure that only allowed formats are entered on the application. The following table illustrates the results obtained during the testing process

Test Class	Test Results	Comment
Functionality	pass	Organisation classified into a class based on its features
Reliability	Pass	The organisations classified into a given category are existing and the available resources indicated are real

#### 5.4.1.1 Login Page

User will be required to login to the application. This will ensure that only authorised users are allowed to use the system. This will achieve the Data security requirement that respondents interviewed would like to see in the application.

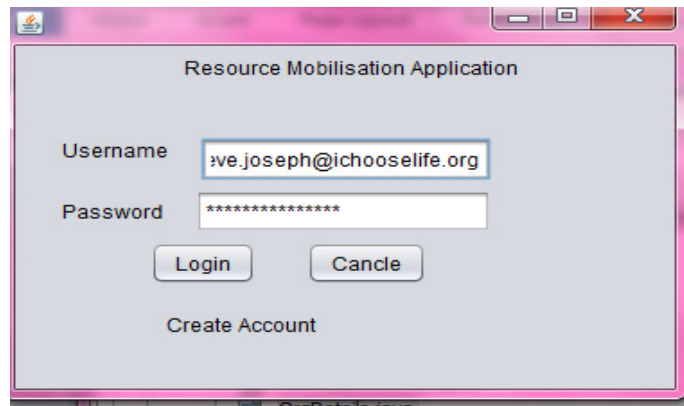


Figure 5.25 Login Page

#### 5.4.1.2 Organization Details Platform

After a successful login user will be requested to fill in the form below which will be used for classification purposes. The information will be saved on the database. The data will be cleaned and presented to WEKA classification tool for classification.

**RESOURCE MOBILIZATION APPLICATION**

What programme area is of interest to you

In which beneficiary county would you like to be involved and cooperate with a partner?

Which resources are you keen on

For how long have you been in operation?

Is the organization legally registered and is the documentation of current legal registration readily available (or posted) in the office?  
 Yes  No

Is the organizational and reporting structure clearly documented and disseminated?  Yes  No

Are there written organization policies and procedures that support operational needs (e.g., travel, procurement, fixed assets, security, etc.)?  
 Yes  No

How often are the financial procedures formally reviewed/updated?  Yes  No

Are there written policies on internal controls that are regularly reviewed and updated, and staff are trained on?  
 Yes  No

Does the organization have collaborative agreements with relevant stakeholders?  Yes  No

Does the organization provide regular updates on program results and solicit feedback from the community?  Yes  No

Does the organization develop plans to address the challenges, test results, and implement effective practices?  Yes  No

Figure 5.26 Organization Details Page

### 5.4.1.3 Classification Output

After a successful classification, the output will be generated and presented to the user as illustrated in figure 5.27

**Classification Output**

Recommended Organisation:

Resources Available:

Figure 5.27 Classification output

### ***5.4.2 Acceptance Testing***

Checking whether the key aspects of the system requirements were met.

Test Class	Inspection Check	Priority
Usability	Is the Application easy to use and Navigate?	High
Usability	Is the Performance of the application satisfactory?	High
Usability	Are you satisfied with the application output?	High

## **Chapter 6: Discussions**

### **6.1 Introduction**

The findings obtained during the research formed the basis on which resource mobilization application was developed. The application was tested to ensure that all the user, functional requirements and non-functional requirements have been met. This chapter analyses the findings in relation to the research objectives.

### **6.2 Factors influencing resource mobilization for Health Based NGOs in Kenya**

The first objective was to determine the factors that influence resource mobilization for health Based NGOs in Kenya. From the study findings, the interviewed respondents indicated that presence of good governance in an organization influences their ability to mobilize resources. This is in harmony with Otieno(2012) who argued that bad governance makes potential donors shy away. From study findings, the respondents indicated that level of accountability and transparency and Legitimacy of an organization influences their ability to mobilize resources. This concur with Okinda (2013) who argued that organizations should allow stakeholders to continuously monitor and evaluate their activities as well as not involving themselves in activities that goes against public interests.

### **6.3 Existing Resource Mobilization Techniques in use**

The second objective was to analyze the existing resource mobilization techniques used by NGOs in Kenya. From the study findings, it was found that most of the respondents indicated that they Partnerships technique to acquire resources from other organizations, conform with H&H Consulting(2012),who argues that partner organizations are more likely to attract resources from businesses if businesses have an expressed interest in the type of work partner organizations do. The respondents also indicated that Grants Proposal writing and Social Entrepreneurship resource mobilization techniques are common among NGOs in Kenya.

The research findings also showed that respondents face challenges when using the existing techniques. Most of the respondents indicated that they were having challenges such as different structures among organizations, different operation structures,

Competition for the scarce resources, resource scarcity and lack of knowledge of what kind of resources are being held in another organization. This is in harmony with Mavoko (2013), who argued that the existing resource mobilization techniques are inefficient as a result of issues such as differing structures among NGOs, differing operation structures, competition for the scarce resources and being unaware of resources available in other organizations. Based on these findings the resource mobilization application will help to resolve the issue of differing structures by ensuring that organizations are classified based on their structures. It will also help in resource mapping such that each organization will be aware of resources available in another organization

#### **6.4 Resource Mobilization Application implementation**

The third objective was to develop a resource mobilization application using Naïve Bayesian algorithm to classify organizations based on their structures and use GIS to map available resources per organization. The research findings showed that the respondents find it necessary to develop a resource mobilization application which will be very helpful in solving the inefficiencies of the existing resource mobilization techniques. The results obtained from the application indicated that Naïve Bayesian algorithm was an appropriate algorithm that can be implemented in resource mobilization. The classification was done based on organization attributes identified as true inputs that influence the process of resource mobilization. A dataset of 13 attributes and 99 instances was used to train the algorithm. After the training the correctly classified instances were 94 which is 94.9495% and incorrectly classified instances were 5 which is 5.0505%, hence it was concluded that Naïve Bayesian algorithm was a reliable tool for organization classification in a process of resource mobilization. The accuracy of the results obtained agrees with Karim & Rahman(2013), argument that Naïve Bayesian algorithms are fast and accurate.

#### **6.5 Resource Mobilization Application Testing and Validation**

The last objective was to carry out testing of the Resource Mobilization Application. The application was tested by presenting a user with a list of questions in regards to their organization. Based on user input, classification process was initiated. A classification output was presented to the user as illustrated in figure 5.27. The results confirmed that the application was a reliable tool for resource mobilization.



### **6.6 Advantages of using the application compared to the existing systems**

Resource mobilization application is a web based application that classifies organizations based on their structures and able to map the available resources per organization at any given time as opposed to the existing resource mobilization techniques which does not provide information about how an organization has been structured as well as what kind of resources are they holding at any given time.

### **6.7 Disadvantages of using the application**

Resource mobilization application is a web based application and therefore users will be required to connect to internet so that they can use it. It will be difficult to access the application when you have internet connectivity challenges.

## **Chapter 7: Conclusions and Recommendations**

### **7.1 Conclusion**

The study reveals the need of a resource mobilization application for Health based NGOs. From the research findings most respondents face challenges using the existing resource mobilization techniques. Some of the challenges cited include differing organizational structures, differing operation structures, and different reporting structures among organizations, identity and past performance of an organization, resource scarcity and completion for the scarce resources. The above challenges led to the development of a resource mobilisation application that will be able to classify organizations based on their organizational structures, operation structures and identity and past performance of an organization. During the system development agile software methodology was used. It enables frequent releases for example a classifier was developed and tested then the user interface was created and the two platforms were integrated together. The usability tests that were performed helped to improve on the system because user feedback were considered as requested. If this system is adopted it will help Health based NGOs to mobilize resources together hence resolving the complex issue of scarce resources. This will enable a large number of NGOs to access resources from other NGOs in the same sector or even in a different sector.

### **7.2 Recommendations**

The following are recommendations done from the findings of the study.

- i. The study recommends adoption of the application for resource mobilization for health based NGOs.
- ii. Differing organizational structures among NGOs should be considered a major factor that needs to be addressed for the purpose of resource mobilization in a bid to curb the issue of resource scarcity.
- iii. The applicability of the resource mobilization application should be extended within the larger NGO sector and not only restricted to Health Based NGOs

### **7.3 Suggestions for Future Research/Work**

The researcher intends to expand the application to other NGOs sectors such as Secure Livelihoods, Disaster Responses, Voluntary work force and Agriculture among others. In secure livelihoods it would inform the organizations on which projects should be implemented in certain communities based on the resource available and to identify organizations who are already implementing other projects within the community of interest. In disaster responses it would easy to map the resources need to address any disaster at any given time. Secondly, a mobile based application should be developed to be used in platforms such as Android, Windows and IOS for it to be convenient for all users.

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## **Appendices**

### **Appendix A: Questionnaire**

This is the questionnaire that was used to collect data from Health based NGOs based in Nairobi County,

#### **Resource Mobilization Application for Non-Governmental Organizations Questionnaire**

This questionnaire is part of study conducted by Doreen Jeruto Koech as part of the requirements for the award of a degree of Master of Science in Information Technology at Strathmore University. The main objective of this research is to come up with a Resource Mobilization Application for Non-Governmental Organizations (NGOs). The knowledge that we will gain from your responses will aid in the development of the application. The information requested will be used for academic purposes only and will be treated in strict confidence.

Kind Regards,

Doreen Koech

#### **SECTION A: Organization Details**

1. Which is your core focus area? Tick all that Apply

- |                                                          |                                                    |
|----------------------------------------------------------|----------------------------------------------------|
| <input type="checkbox"/> Hiv/ AIDs Prevention            | <input type="checkbox"/> Maternal and Child Health |
| <input type="checkbox"/> Malaria                         | <input type="checkbox"/> Water and Sanitation      |
| <input type="checkbox"/> Reproductive Health             | <input type="checkbox"/> Disability                |
| <input type="checkbox"/> TB Prevention                   |                                                    |
| <input type="checkbox"/> Disaster and Emergency Response |                                                    |

2. What kind of resources do you have in your organization? Tick (✓) all that apply

- Money**
- Office Space**
- Scientific Expertise**
- Volunteers**



**Management Capacity**

**SECTION B: Factors influencing Resource Mobilisation for Non-Governmental Organisations in Kenya**

**The Influence of Expertise on Resource Mobilisation for Health Based NGOs**

3. To what extent do you agree that the following indicators in relation to Expertise factor influences resource mobilization? Indicate your response on a scale of 1-5 where: 1-Strongly Disagree; 2-Disagree, 3-Not Sure: 4-Agree; 5-Strongly Agree.

Indicator	1	2	3	4	5
1. No. of years in Operation					
2. Successes and Failures					
3. Number of Beneficiaries					
4. Number of Partnerships established					
5. Innovations					
6. Professionalism					

**The Influence of Accountability and Transparency of an organisation factor on Resource Mobilisation for Non-Governmental Organisations**

4. To what extent do you agree that the following indicators in relation to Accountability and Transparency factor influences resource mobilisation? Indicate your response on a scale of 1-5 where: 1-Strongly Disagree; 2-Disagree, 3-Not Sure: 4-Agree; 5-Strongly Agree. Please use(x) where applicable

Indicator	1	2	3	4	5
Legal mandate of an organisation					
Vision and mission of an organisation					
Decision making procedures					
Availability of Information about projects, plans and activities					
Regular reports of actual performance					

Trust and respect of the community					
Accountability to funders					
Financial controls in place					
Internal control procedures;					

**The Influence of Governance factor on Resource Mobilization or Non-Governmental Organisations**

5. To what extent do you agree that the following indicators in relation to governance factor influences resource mobilization? Indicate your response on a scale of 1-5 where: 1-Strongly Disagree; 2-Disagree, 3-Not Sure: 4-Agree; 5-Strongly Agree. Please use(x) where applicable

Indicator	1	2	3	4	5
Model of governance					
The size of the organization					
Well defined policies and practices					
Existence of an independent Board					

**The Influence of Donor Requirements and Policies on Resource Mobilisation for Non-Governmental Organisations**

6. To what extent do you agree that the following indicators in relation to Donor Requirements and Policies factor influences resource mobilization? Indicate your response on a scale of 1-5 where: 1-Strongly Disagree; 2-Disagree, 3-Not Sure: 4-Agree; 5-Strongly Agree. Please use(x) where applicable

Indicator	1	2	3	4	5
Donor Restrictions on use of resources					
Administrative and Financial Conditions					
Funding Predictability					
Disclosure of Information Requirements					

SECTION C: Existing Resource Mobilisation Techniques in use

7. What kind of resource mobilization techniques are being used in your organization?

Tick all that apply

- Grants Proposal Writing
- Partnership
- Individual Giving and Donations
- Social Entrepreneurship and Investment
- Technological Collaboration

Others.....

8. The Resource Mobilisation Techniques mentioned above (Question No.8) are effective

Choose only one option

- Strongly agree
- Agree
- Neutral
- Disagree

9: What are the challenges faced when using the above mentioned resource mobilization techniques?

Tick all that apply

- Differing Organisational Structures
- Differing Operation Structures
- Different Reporting procedures among organisations
- Identity and Past Performance of the organisation

Resource Scarcity

Competition for the scarce resources

SECTION D: System Requirements

10. Which of the following features/requirements would you want to see in a Resource Mobilization Mobile Application? Tick all that apply

Ease of use

Data Security

Reliability

Efficiency

Any other

.....  
.....  
.....  
  
.....  
.....  
.....

Thank you for your Support

## Appendix B: Data Collection Reference Letter

This is the introductory letter obtained from Strathmore University which was used to introduce the student during data collection in Chapter 3.



### FACULTY OF INFORMATION TECHNOLOGY

Our Ref.: FIT/MSIT/RL/17/45

25<sup>th</sup> March, 2017

To whom it may Concern:

**Re: Doreen Jeruto Kcoch - 049806**

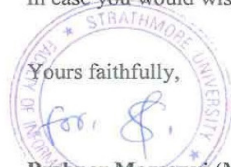
This is to confirm that the above named is a student at Strathmore University pursuing *Master of Science in Information Systems (MSc.IT)* since May 2015.

Doreen is a research scholar who is currently in her 2<sup>nd</sup> (final year) of study and is doing a research pertaining her master's degree which is entitled: **Resource mobilization Application for Non - Governmental Organization: Case of Health – Based.**

This research being a mandatory requirement towards successful completion of her studies, it would be great if you accord Doreen the necessary support that she may need from your organization to enable her complete this task.

Any assistance accorded her shall be highly appreciated.

In case you would wish to clarify any issues with us, please feel free to do so.



**Brebner Momanyi (Mr.)**  
**Administrator, Faculty of Information Technology**  
[bmomanyi@strathmore.edu](mailto:bmomanyi@strathmore.edu)

### Appendix C: Data Analysis Frequency Tables

These are the frequency tables for Expertise Factor Indicators (See Figure 4.10) obtained from SPSS data analysis tool

#### Expertise Factor Indicators

##### No. Of Years in Operation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.9	1.9	1.9
	Disagree	5	9.4	9.4	11.3
	Not Sure	5	9.4	9.4	20.8
	Agree	17	32.1	32.1	52.8
	Strongly Agree	25	47.2	47.2	100.0
	Total	53	100.0	100.0	

##### Successes & Failures

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	4	7.5	7.5	7.5
	Not Sure	5	9.4	9.4	17.0
	Agree	22	41.5	41.5	58.5
	Strongly Agree	22	41.5	41.5	100.0
	Total	53	100.0	100.0	

##### Number of Beneficiaries

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	7	13.2	13.2	13.2
	Not Sure	13	24.5	24.5	37.7
	Agree	14	26.4	26.4	64.2
	Strongly Agree	19	35.8	35.8	100.0
	Total	53	100.0	100.0	

##### Number of Partnerships Established

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	5	9.4	9.4	9.4
	Not Sure	7	13.2	13.2	22.6
	Agree	23	43.4	43.4	66.0
	Strongly Agree	18	34.0	34.0	100.0
	Total	53	100.0	100.0	

**Innovations**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	3	5.7	5.8	5.8
	Not Sure	11	20.8	21.2	26.9
	Agree	20	37.7	38.5	65.4
	Strongly Agree	18	34.0	34.6	100.0
	Total	52	98.1	100.0	
Missing	System	1	1.9		
Total		53	100.0		

**Professionalism**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.9	1.9	1.9
	Disagree	4	7.5	7.5	9.4
	Not Sure	3	5.7	5.7	15.1
	Agree	20	37.7	37.7	52.8
	Strongly Agree	25	47.2	47.2	100.0
	Total	53	100.0	100.0	

### Appendix D: UseCase Descriptions

These are the Use descriptions for Resource Mobilization Application Use Cases as shown in Figure 4.17

**Table D.1: Initiate Classification, Data Pre-Processing, and Implement Algorithm, classify organization, Generate Classification**

<b>Use Case</b>	Initiate Classification, Data Pre-Processing, and Implement Algorithm, classify organization, Generate Classification
<b>Primary Actor</b>	System
<b>Pre-condition</b>	Organization details were successfully saved/captured
<b>Post Condition</b>	The organization was accurately classified
<b>Main Success Scenario</b>	The system is associated with several use cases involved in classification of an organization based on its structure.
	<p><b>Initiate classification</b>-This use case entails identifying the attributes that would be used as inputs for the Naïve Bayesian Algorithm. It would also be used to identify the expected output</p> <p><b>Data Pre-processing</b>- The variables entered by the user needs to be cleaned to remove features which will not be required for classification. The clean data will then be normalized to remove redundancies.</p> <p><b>Implement Algorithm:</b> For this use case, the system implemented the Naives Bayesian algorithm. This algorithm was used because of it is faster to build and it can be modified with the new training data without having to rebuild.</p> <p><b>Classify Organization:</b> The system was provided with a set of training data for It to learn the environment and the expectations. New test data was presented to the system to validate if the system was performing the classification correctly.</p> <p><b>Generate Classification output:</b> Present the classification of the organization based on the new details were provided to the application.</p>



**Table D.2: Receive Feedback**

<b>Use Case</b>	<b>Receive Feedback</b>
<b>Primary Actor</b>	User
<b>Pre-condition</b>	The organization was successfully classified by the system
<b>Post Condition</b>	Recommend a list of organization to mobilize resources with
<b>Main Success Scenario</b>	<ol style="list-style-type: none"><li>1. Request for organization classification</li><li>2. Return the results of the classification</li><li>3. View the results obtained</li><li>4. Display the resources available in each of the organizations</li><li>5. Exit the System.</li></ol>

**Table D.3: View Classification Analytics**

<b>Use Case</b>	<b>View Classification Analytics</b>
<b>Primary Actor</b>	System Administrator
<b>Pre-condition</b>	Login Successful, Classification output generated successfully
<b>Post Condition</b>	Administrator views the data classified
<b>Main Success Scenario</b>	<ol style="list-style-type: none"><li>1. Administrator filters the details he/she would want to view</li><li>2. Analytics report is sent to the admin</li></ol>

**Table D.4: Approve User**

<b>Use Case</b>	Approve User
<b>Primary Actor</b>	System Administrator
<b>Pre-condition</b>	Log in Successful
<b>Post Condition</b>	Approve user or Reject
<b>Main Success Scenario</b>	<ol style="list-style-type: none"><li>1. Check new user details</li><li>2. Approve or reject user</li></ol>