Crowdsourcing As A Platform For Monitoring Government Projects

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DECLARATION

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

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DEDICATION

This work is dedicated to my loving parents Mr. and Mrs. Nyaanga whose efforts in education cannot be overlooked. My brothers George and Kevin for their continued support.

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First and foremost I would like to thank the Almighty God for the opportunity he accorded me to undertake this course and bringing me this far especially for the strength in times of despair.

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ABBREVIATIONS AND ACRONYMS

E-government	Electronic government
E-services	Electronic services
ICT	Information Communication Technology
PEV	Post Elections Violence
G2C	Government-to-Citizen
MIT	Massachusetts Institute of Technology
MOPW	Ministry of Public Works
XML	Extensible Markup Language
PHP	Hypertext Processor
API	Application Programming Interface
SUMI	Software Usability Measurement Inventory

DEFINITIONS OF TERMS

Efficiency refers to the degree to which the user can achieve the goals of his interaction with the application in a direct and timely manner.

Affect refers to how much the application captures the user's emotional responses

Helpfulness is the extent to which the application seems to assist the user

Control is the degree to which the user feels he, and not the software, is setting the pace

Learnability is the ease with which a user can get started and learn new features of the product.

ABSTRACT

The study was intended to investigate how government projects are monitored and if citizens can be involved in the monitoring of these projects. The specific objectives of the study were to identify the required parameters for the design and development of a crowdsourcing platform for monitoring government projects, to design and develop a crowdsourcing platform that can enable citizens and the government to interact for effective project monitoring and to evaluate the performance of the developed crowdsourcing platform.

A descriptive survey design was adopted for the study. This method was found appropriate for the study since the study involved collecting data regarding values, behavior, experiences and attitudes of the population under study as well as answering questions on their current status. The target population was officers in the Ministry of Public Works that were involved in project monitoring. The data collection instrument used in this study was a questionnaire and it contained both open and close ended questions. Data analysis was done using descriptive statistics such as frequencies and percentages. Presentation of the findings was in form of tables.

The results revealed that project monitoring was done on a monthly basis which was found to be a very long time to rely on the information for decision making. It also established that project monitoring is carried out solely by government employees and the mode of project monitoring that was used was through site visits.

Based on the findings, the study outlines the development of a mobile application which contains information on government projects. Various components of the government construction projects were developed for ease of gathering information about them. This was to ensure that the citizens and the officers in charge of project monitoring provide vital information concerning the various projects.

Use of maps and photographs was integrated in the application for mapping the projects to their specific locations. The photographs were used for providing visuals of the project at each stage of construction. The results show that citizens and

officers in charge of monitoring projects can use the developed mobile application effectively considering the findings of the usability test that were evaluated using efficiency, affect, control, learnability and helpfulness as the subscales.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Crowdsourcing is a new concept enabled by evolving information and communication technologies (ICT). Crowdsourcing is often based on the framework of group intelligence (Lévy, 1997), the idea that knowledge is the most accurate when it consists of inputs from a distributed population "all of us together are smarter than any one of us individually". The opposite of group intelligence is relying on a single agent, for example, a knowledgeable expert. The concept of group intelligence has been popularized as the wisdom of crowds (Surowiecki, 2004)and crowdsourcing can be defined as a tool to gather group intelligence for certain tasks. Related concepts to crowdsourcing are co-creation (Prahalad & Ramaswamy, 2000), open innovation (Chesbrough, 2003) and user innovation (Von Hippel, 2005).

Today's technology is changing rapidly and governments around the world cannot ignore these changes, but must rather take into consideration when thinking about their strategies for engaging with their constituents. Potentially, crowdsourcing is a key technology enabler for participation in different ways. Crowdsourcing seems to be a promising way to encourage citizens to participate in the governments day-to-day operations and as such it can be a useful tool when it comes to project monitoring. The usefulness of project monitoring can be significantly improved by the use of social media applications that facilitate the collection of data in real-time, organization of the data and redistribution of the data collected from crowds to crowds (Eysenbach & Till, 2001). The government will find it hard to ignore crowdsourcing initiatives if there is stronger group that recognizes with the objectives and it is within the campaigning crowds.

According to (Howe, Crowdsourcing: Why the Power of the Crowd is Driving the Future of Business, 2008), crowdsourcing has developed into the main trend in recent years, fueling innovation and collaboration in research, business, society and government alike Universal businesses like Facebook, Amazon and E-bay could not have developed to cover the developed world at such great speeds without making use of this influential tool that has brought together both the producers and the users of their services. The power of crowdsourcing has demonstrated that open-source applications can successfully compete with propriety software solutions by mobilizing volunteer programmers who have since worked together and come up with amazing products and services. Crowdsourcing application like Wikipedia has revealed that collaborative content development can dwarf the quantity and quality of a traditional encyclopedia and other closed expert group efforts.

(Brabham, 2009b) argues that crowdsourcing is most effective when problems are clearly framed and pertinent data is available, and then crowdsourcing becomes viable. The size or difficulty of a project/problem should not be a barrier to the use of crowdsourcing as a solution. The ability of the crowd to handle complex data should not be underestimated. Many complex projects, such as Linux or Wikipedia, have successfully used crowdsourcing (Brabham, 2009b). Crowdsourcing is at present being used to make and increase collective knowledge, community building, collective creativity and innovation, crowdfunding, cloud labor and civic engagement. Due to the widespread and increased access to the internet, handheld devices e.g. mobile phones and other communication technologies, the use of crowdsourcing for e-government has grown across the planet during the past decade.

This study sought to give an alternative to this kind of approach which is in-house to a more open approach whereby citizens can contribute to in the development and monitoring process of projects. This was done by incorporating crowdsourcing into

the government as a way of bringing the citizens onboard.

1.2. Statement of the Problem

Electronic government (e-government) is a significant tool for government reforms. It is a worldwide drift, with several countries aggressively trying to incorporate e-government strategies using decentralization and networked decision making to achieve their goals (Gowdy, Hilderbrand, Plana, & Campos, 2009). However, it has been noted that citizen engagement has not been fully incorporated into e-government and it is still lagging.

In Kenya, there is limited literature on how crowdsourcing has/can be used as a platform for projects monitoring. This would encourage government-to-citizens (G2C) interaction and as a result, encouraging citizens to play a proactive role in the decision-making process of government projects. The government has not embraced this kind of technology in the development and monitoring of its services and projects. The government still operates in the old traditional way whereby all e-government services (e-services), government projects, government websites, applications and systems that are used within government are developed and monitored in-house by government employees. In addition to all the government projects that are currently running are monitored by government employees.

1.3 Objectives

1.3.1 General objective

The general objective of this study was to develop a crowdsourcing platform for monitoring government projects.

1.3.2 Specific objectives

1. To identify the required parameters for the design and development of a crowdsourcing platform for monitoring government projects.

2. To design and develop a crowdsourcing platform that can enable citizens and the government to interact for effective project monitoring.
3. To evaluate the quality of the developed crowdsourcing platform.

1.4 Research questions

1. What parameters should be considered when developing a crowdsourcing platform for monitoring government projects?
2. How can crowdsourcing be used as a platform for citizens to interact with the government in monitoring of government projects?
3. How will the quality of the developed crowdsourcing platform be assessed to determine if it meets the required specifications?

1.5 Justification

Community-based input/interaction is perceived as a means of successful design and development and monitoring of any application or a product whose goal is user-satisfaction. For users/citizens to wholly accept and utilize a product to its maximum there is a need for them to be involved throughout the development and monitoring process. As a result of this the government needs incorporate citizens in the daily monitoring of the projects that it is undertaking since these projects will have an impact on the citizens in the location where these projects are being done.

Using the current methodology, data capture and data entry is a very time consuming and expensive process. The communication of data from the field to the headquarters is almost nonexistent, and the reporting of the data is limited in its capacity. The justification for this research comes from the need to capture complex data in remote locations, add a GPS coordinate to the data, communicate the spatially enabled data to a central location where the data is readily available to make informed decisions,

and to see spatial patterns in the data to help drive future projects (Spencer, Frizzelle, Page, & Vogler, 2003).

The government can greatly benefit from the penetration of mobile phone use in the country as this has increased tremendously. Therefore there is a need for the government to exploit data technologies that come with the use of mobile phones to provide services such as project monitoring using mobile phone across the country.

1.6 Scope of the Study

The study focused on Government projects that were located in Nairobi County. The study sought to understand the processes involved in the monitoring of Government building Projects. It was worth noting that for the successful completion of any Government project monitoring and evaluation of the project was critical. Through this process the task of monitoring and evaluation was with the project implementing units or teams. The study looked at the underlying issues that the project implementing team addresses. These issues are the milestones that are standard and cross cutting in all projects.

The study dealt with administering questionnaires to Ministry of Public Works project implementing teams who are government employees as they are involved directly with various government projects. The study sought to find out how these employees felt about how projects were handled and how they were regularly monitored. This group gave an oversight on how the projects were being handled currently and their take on venturing into new technologies like crowd sourcing into the monitoring of the projects.

1.7 Assumptions and Limitations

This study assumed that the targeted populations had android mobile phones since it was cheaper to use them and were readily available for testing. Next, it was assumed that the application ran on all android phones, and that there was good mobile network connectivity signal strength.

The research had some limitations which include limited documented literature on how crowdsourcing has been used in monitoring projects for different governments and the research was only done in one Ministry therefore may not be generalized for the entire government.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Within this chapter the underlying theories on crowdsourcing are reviewed. This started by looking at the limited available literature on crowdsourcing (Howe, 2006a) and how it has been implemented in various sections. The literature was used to develop a better and easier understanding of crowdsourcing. The review was guided by design questions that have been explored from related works and corresponding differentiations in literature.

2.2 Theoretical foundations and Conceptual Framework

2.2.1 Crowdsourcing definitions

There are various definitions of crowdsourcing that are available from literature. (Howe J. , 2008) defines crowdsourcing as the process of a company or institution taking a task that is undertaken by its employees and outsourcing it to an undefined large group of people and this is usually through an open call. This can be in the form of group-production, but more often it is undertaken by sole individuals. The fundamental requirement is the taking into consideration the open call set-up and the big network of potential laborers.

(Brabham D. C., 2008) brings a wider explanation of crowdsourcing as a legitimate, complex problem-solving model, more than merely a new format for holding contests and awarding prizes. It is a model that is able to aggregate talent, leverage ingenuity while reducing the costs and time formally needed to solve problems. According to (Kleemann, Voß, & Rieder, 2008) crowdsourcing, takes place when a firm outsources tasks essential for making or sale of its products to the general public over the internet. This is usually done for the purpose of the individuals to take part in the

firm's production process for free or for significantly less than that of contribution is worth to the firm.

2.2.2 Basics of crowdsourcing.

Most forms of crowdsourcing rely heavily on the conception of collective intelligence. (Lévy, 1997) gives a definition of collective intelligence as a "form of universally distributed intelligence, constantly enhanced, coordinated in real time, and resulting in the effective mobilization of skills". Internet enables this kind of coordination of intellect, and as a result, as the potentialities of the Internet grow, so do the capabilities for leveraging this intellect. With a spirit to act, collective intelligence and networks can be used in problem solving to tackle even universal concerns.

Crowdsourcing depends on the internet. The speed, reach, anonymity, opportunity for asynchronous engagement, and ability to carry many forms of media content makes the Internet a crucial prerequisite for crowdsourcing. It is possible to take some processed offline with some success, but with internet some aspects of crowdsourcing e.g. the quality, amount, and speed of collaboration, harmonization, and coming up with ideas are greatly improved.

Several interviews and surveys have been carried out at a number of crowdsourcing sites. Each study requires the people in the crowds to explain why they take part (Brabham D. C., 2008). The results from these studies show that there exist different reasons why people choose to participate, both internal and external. However there is no particular motivator that related to all crowdsourcing platforms. For instance, the opportunity to increase ones abilities, build a set of skills for employment, and taking part in solving a difficult problem are some of the aspects that come out of a number of crowdsourcing cases. Nevertheless some people are driven by the financial gain and do not talk about these other motivators.

2.2.3 Types of Crowdsourcing

According to (Howe J. , 2008), an indicative list of crowdsourcing as shown in Figure 2.1 includes Crowdvoting which usually occurs when a website gathers a large group's opinions and judgment on a certain topic. The wisdom of the crowd is based on the idea that a group of people is often more intelligent than an individual. Next, is Crowdfunding which is the process of funding projects by a multitude of people contributing a small amount in order to attain a certain monetary goal. Further, is Crowd purchasing that involves the leverage collective purchasing power to win the best possible deals. Next is Microwork which is a crowdsourcing platform where users do small tasks for low amounts of money. Finally, is Inducement Price Contests a Web-based idea competition or inducement prize contests often consist of generic ideas, cash prizes, and an Internet-based platform to facilitate easy idea generation and discussion.

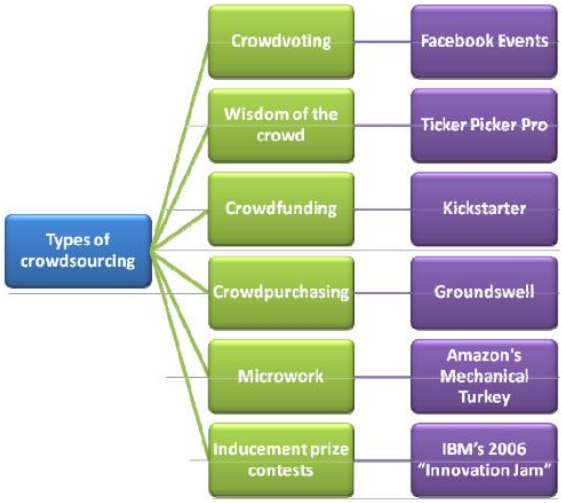

Figure 2.1: Types of crowdsourcing.

Source: Jeff Howe (2008)

2.2.4 Theoretical framework

In their latest study on crowdsourcing, (Malone, Laubacher, & Dellarocas, 2010) developed a conceptual framework of four building blocks for crowdsourcing. They describe the "what", "who", "why", and "how" of collective intelligence approaches. The "what" block according to them differentiates between a "create process" in which a new item is generated and a "decide process" in which the alternatives are selected and evaluated. Contributions by the individuals in the crowd may be independent or dependent on each other. In the case of "creation process" there may be decisions by individuals and decisions by the groups. The "who" block according to Malone *et al* (2010) refers to the crowd, which is represented by an independent mass of people. Participating persons can hold different roles, e.g., author of a document, expert inside a forum/domain, rule creator or information/functionality

mapper. They all are part of the crowd and can collectively optimize the entire process.

The “why” block describes the motivation of participation is founded in “Money”, “Glory” or “Love”. In this thesis the major reason to was to ascertain that the project meets the quality checks that have been put in place. On the one hand, this applies to the quality and relevance of the received information. The “how” block provides what is required to process a multitude of contributions to fulfill its design purpose. Schenk and (Schenk & Guittard, 2011) provide probably the most fundamental distinction of aggregation processes in crowdsourcing: integrative versus selective crowdsourcing. Integrative crowdsourcing creates value by pooling potentially large quantities of complementary input. Selective crowdsourcing creates value by having the crowd providing a set of options from which the result is chosen.

(Corney, Torres-Sanchez, Jagadeesan, & Regli, 2009) defines three elements of crowdsourcing. They first differentiate individual tasks depending on their nature: the first element they define is creation (e.g., the design), secondly, evaluation (e.g., survey), and thirdly organization (e.g., tagging). These elements are categorized according to the capabilities that are required in tackling them. Some of these tasks can be tackled by an individual whilst some tasks may require additional expertise. This element takes both a crowd and a task perspective. The third element that they discuss concerns the nature of reward. This element deals all the stakeholders involved in the process of crowdsourcing. In a number of cases the contribution is voluntary, while in some cases the crowd (or parts of it) is rewarded with payment or rewards.

(Rouse, 2010), argues at crowdsourcing as mainly seen as a business solution and kind of an alternative form of outsourcing. Rouse further proposes an element that consists of three items: first, supplier capabilities/nature of the task, secondly benefits distribution and lastly the motivation forms. The first item describes the complexity

and skills involved in handling a task, the second item capture the “who” is benefiting from the crowdsourcing factor, and the last item takes care of the internal and external motivational factors of the crowd.

(Zwass, 2010) relates crowdsourcing to the concept of co-creation. He defines co-creation as he contribution of both the suppliers and consumers in the creation of a value. He further describes a “typology of co-created value” integrated into a “taxonomic framework of factors of co-creation”. His frameworks then goes further to describe a number of elements that cover many aspects including stakeholders, the characteristics of the task, the process of the co-creation and the co-created value.

Following subsequent investigation of several crowdsourcing initiatives (Sharma, 2010) came up with the crowdsourcing success factor as shown in Figure 2.2. Sharma notes that, the crowdsourcing initiatives are termed successful when there is a sufficient number of the crowd participating in it. The number of the participants depends on how well the crowd was motivated to stay in the project and contribute to it. This in turn is built on Vision and Strategy of the project, Human Capital or workers, the project’s Infrastructure, Linkages and Trust of the community and External environment factors.

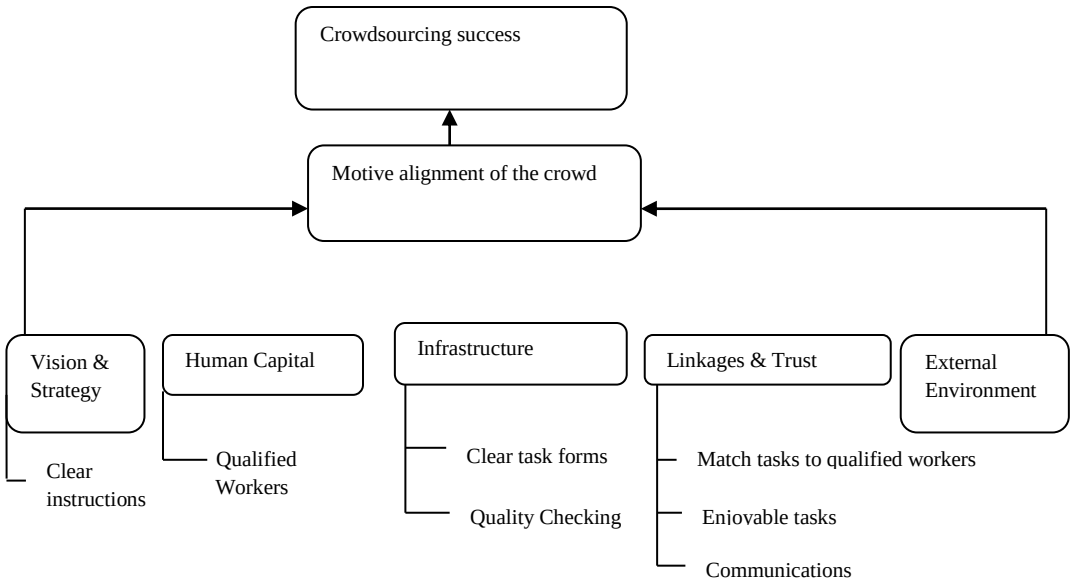

Figure 2.2: Crowdsourcing critical success factors model

Source: (Sharma, 2010)

i) Vision and Strategy

(Kirkpatrick, Wofford, & Baum, 2002) describes vision as, "a principle that represents the shared values which the corporation aspire". (Ireland & Hitt, 1999) emphasizes that vision is an efficient element of business strategy as it provides guidance in the decision making process of the firms. Most crowdsourcing initiatives come into the market with a well-defined set of principle, goals and objectives. The vision is very significant to the crowd and the crowd should perceive the vision as important and well intentioned (Brabham D. C., 2009b). Where necessary, the organization must also be able to attach some incentives to participation (Kittur, Chi, & Soh, 2008). Organizations need to be flexible with their vision putting into account the dynamic nature of the environment in which these initiatives are functioning.

In addition to this, a well presented vision statement might also attract the support of governments, corporate and other stakeholders. Support from the Government boosts the trust factor to any initiative. Additionally, this support assured a wider contribution hence increasing the viability of the initiative thereby ensuring crowd participation.

ii) Human Capital

Human capital is another factor to look at in crowdsourcing. This according to (Kittur, Chi, & Soh, 2008) can be defined as the skills and abilities the crowd possesses. (Carmel, 2003) defines collective characteristics, skills and abilities of the crowd as human capital. This is further described as language skills, managerial skills, national orientation, traditions and level of education by (Carmel, 2003). Therefore, to enable meaningful participation from crowd in the crowdsourcing initiative it is important to develop proper abilities, skills, and expertise in them. In the paper, focus was put on mobile phone and web enabled crowdsourcing initiatives thus skills of using a mobile phone and the using the internet are necessary.

(Alonso, Rose, & & Stewart, 2008) emphasizes that success of crowdsourcing relies on attracting a wide pool of people to contribute crowdsourcing. Where required, skills and abilities of the crowd to participate in the crowdsourcing may be enhanced through training both educational and vocational. However, in an ideal state of affairs, the crowd should have the ability to use the crowdsourcing platform without earlier training and minimum interventions.

iii) Infrastructure

Majority of crowdsourcing platforms are either mobile or web based. These platforms require reliable mobile access for its communication needs to ensure participation from the crowd (Donner, 2009). Therefore, convenience, consistency and quality of

communication technologies (Heeks & Nicholson, 2004) viz. telecom, internet is crucial for crowd participation.

Additionally, adequate funding focused towards enabling infrastructure can improve the participation of the crowd significantly thus ensuring accomplishment of the initiative (Schneider, 2009) (Heeks & Nicholson, 2004)observe that research and development are essential elements of the infrastructure as this leads to the improvement of the human capital.

iv) Linkages and Trust

Proper growth of linkages is seen by managers as a mode to reduce their costs of undertaking a business (Ireland & Hitt, 1999). (Carmel, 2003) defines the concept of linkages as something which emerges between individuals, between work groups, between firms or between nations due to geographic, cultural, linguistic, or ethnic connections. With proper linkages, knowledge transfer becomes easier thus sharing of best practices and business models becomes manageable and well-organized. Knowledge transfer also enables easy implementation of viable crowdsourcing initiatives which the crowd can easily relate with. It also helps in pulling together the needed resources to come up with the initiative. Proper linkages might add a significant trust aspect to the crowdsourcing initiative (Brabham D. C., 2009b).

v) External Environment

The setting comprising of the governance support, business environment, economic environment, living environment and risk profiles (Farrell, 2006); (Oshri, Kotlarsky, & Willcocks, 2009) are important factors of the achievement crowdsourcing. Government support often encourages entrepreneurs to start-up initiatives focused on socio-economic growth of the society. Tasks linked with crowdsourcing ought to be well-matched with existing business practices and cultural norms. It’s important to pay attention to the potential risks viz. security risks, regulatory risks (Oshri,

Kotlarsky, & Willcocks, 2009) in the macroeconomic setting. These factors are important in affecting the motive alignment of the crowd in the direction of the long term objective of crowdsourcing.

vi) Motive Alignment of the Crowd

In the model the unified theory of acceptance and use of technology (Viswanath, Morris, Davis, & Fred, 2003) motive alignment of the crowd has been used to assess the reception of crowdsourcing by the crowd. It is exceptionally crucial that the motives of the crowd are associated to long term objectives of crowdsourcing as it ensures their participation.

2.2.5 Critique of the literature review.

To further clarify the concept of crowdsourcing, many researchers (Brabham D. C., 2009b) (Schenk & Guittard, 2011); (Zhao & Zhu, 2012)contrast this notion with similar concepts, such as open innovation, outsourcing, peer production and open source. Within these concepts, one often discussed in relation to crowdsourcing is open innovation, which embraces two other subconcepts: user innovation and co-creation (Aitamurto, Leiponen, & Tee, 2011). (Marjanovic, Fry, & Chataway, 2012) classify both crowdsourcing and open innovation as belonging to the same paradigm, where organizations harvest knowledge and expertise from the outside, opposite to closed innovation. However, (Schenk & Guittard, 2011) stress two important differences between crowdsourcing and open innovation. The first one is that open innovation only focuses on innovation processes, while crowdsourcing can be used for varied types of tasks. Second, organizations explicitly interact with other firms and their customers in open innovation, but rely on members of the crowd in crowdsourcing activities (Zhao & Zhu, 2012).

As noted in the previous section, demands to use external agents are similar between crowdsourcing and outsourcing. As a result, some researchers, such as (Howe, 2006a)

and (Rouse, 2010), consider crowdsourcing as a form of outsourcing. However, the differences between these concepts can still be clearly identified. One major difference lies in the manner of who performs the activities. Actors performing tasks in crowdsourcing are members in the crowd, while they are supplier firms in outsourcing (Schenk & Guittard, 2011). This leads to the second difference of how to manage these actors. Compared to official contracts with some preselected suppliers in outsourcing (Zhao & Zhu, 2012), crowdsourcing uses an open call and any member in the crowd can participate to the project (Howe, 2006a). Finally, motivation for task performers in crowdsourcing is not only based on financial incentives as in outsourcing but diversity, including both intrinsic (e.g. love of community) and extrinsic motivation (e.g. financial incentives) (Kaufmann, Schulze, & Veit, 2011).

It is also necessary to distinguish crowdsourcing from open source, although both concepts rely on the power of the community to accomplish tasks. (Brabham D. C., 2009b) suggests distinguishing these two concepts in terms of how the activities can be managed and performed. In crowdsourcing, organizations need to manage their workflows and quality control, whereas in open source, these activities are driven by the community. Examining how activities are performed, (Zhao & Zhu, 2012) note that crowdsourcing outcomes can be achieved either independently or collaboratively, but outcomes from open source can only be achieved through collaboration. Motivation of community is another difference between these two concepts. Most of the time, members in open source communities perform tasks based on intrinsic motivation (Brabham D. C., 2008), whereas both intrinsic and extrinsic motivations can be found in crowdsourcing (Kaufmann, Schulze, & Veit, 2011).

Furthermore, unlike open source, crowdsourcing clearly has ownership or intellectual properties right, and does not restrict to software (Schenk & Guittard, 2011). (Sharma, 2010) notes that, the crowdsourcing initiatives are termed successful when

there is a sufficient number of the crowd participating in it. The number of the participants depends on how well the crowd was motivated to stay in the project and contribute to it. This in turn is built on Vision and Strategy of the project, Human Capital or workers, the project's Infrastructure, Linkages and Trust of the community and External environment factors.

A few researchers equalize crowdsourcing to the concept of peer production (Huberman, Romero, & Wu, 2009). These researchers believe that peer production sites, like Youtube, can be seen as crowdsourcing because contents on these sites are created by anonymous individuals in the crowd (Wu, Wilkinson, & Huberman, 2009). However, other researchers argue that crowdsourcing is completely different from peer production. (Estellés-Arolas & González-Ladrón-de-Guevara, 2012)suggest that crowdsourcing tasks need clear objectives.

As a result, Youtube, in which an individual can upload any video, is not crowdsourcing. In addition, peer production mainly relies on intrinsic motivation, such as social attention (Huberman, Romero, & Wu, 2009), whereas as previously mentioned, motivations to participant in crowdsourcing activities are varied.

To summary the above discussion, this study adopts the four questions proposed by (Malone, Laubacher, & Dellarocas, 2010) what needs to be performed, who is performing the task, why people do this, and how the task is being done. The study also adopts the critical success factors by (Sharma, 2010) which include on Vision and Strategy of the project, Human Capital or workers, the project's Infrastructure, Linkages and Trust of the community and External environment factors.

2.2.6 Systems Development

i) Introduction to android

Android is a relatively new platform. It is produced by Google, Inc., and its first release was presented in 2007 (Meier, 2010) Android is installed on many different mobile devices and its users can download Android apps and other content through Google Play service, which replaced the old Android Market (Bishop, 2012).

(Google, 2012) claims that "Android powers millions of phones, tablets and other devices." Phones and tablets are mobile devices that can have Android applications installed on them. These applications are written in Java programming language and they are called mobile device applications or apps. Development techniques for apps are structured sets of Java code focused on implementing particular task that provides content for a mobile device application. Although Java programming language includes a broad variety of topics, this thesis focuses on development techniques required for successful implementation of Android Mobile EMU Portal. The following paragraphs analyze research efforts that addressed these techniques in the past.

ii) Android Fundamentals

Many authors described Android application development fundamentals, which include setting up Android development environment on the machine, AndroidManifest.xml file, Activities, Intents, and XML layouts. (Jackson, 2011) outlines "three major components of an Android development environment: Java, Eclipse, Android" and provides instructions on how to download and install necessary files to establish this environment. (Felker, 2011) does not explicitly state the components but rather points out that Java JDK, Android SDK, Eclipse IDE, and Android ADT need to be installed and configured on a machine. The steps provided

by these two authors are standard. They appear in many books written on Android development and are also presented on official Android website

(Ableson, Sen, & King, 2011) present "four primary components of Android applications": Activity, Service, BroadcastReceiver, and ContentProvider. It is noted that "a particular Android application might not contain all of these elements, but will have at least one of these elements" (Ableson, Sen, & King, 2011). Since activity displays a UI (user interface) and responds to system and user initiated events it is used very frequently for Android applications. These Activities are declared in AndroidManifest.xml file, which provides "the foundation for any Android application" (Murphy, 2010). Activities present their views through XML layouts and "communicate" with each other through Intents. Clear understanding of these concepts and Java programming language is a prerequisite to start implementing the development techniques used in Android applications.

iii) Android Application Development Methodologies

Agile Methodology: Agile Development Model is based on iterative development, wherein the entire software development life-cycle is broken down into smaller iterations (or parts). The project scope and requirements are clearly laid down, at the start of the development process. This type of model is best suited for large size projects as it helps to minimize the overall risk and lets the project adapt to changes quickly.

Waterfall Methodology: Waterfall Development Model is best suited for projects where in the project requirements are static and would not change over the period of time during the software development life-cycle (SDLC). This development approach divides the overall project into sequential phases. In this process, the development is seen as flowing steadily downwards (like a waterfall) through various phases. Emphasis is on planning, time schedules, target dates, budgets and implementation of an entire system at one time.

Extreme Programming: Extreme Programming (XP) is a software development methodology which aims at improving software quality and responsiveness to changing customer requirements. As a type of agile software development, it attempts at having multiple short development cycles, rather than one long one which helps in reducing the cost of change or modification. This methodology is best suited for agile development process wherein large size projects are broken down into smaller units to facilitate the over-all development process.

Rapid Action Development:

Rapid Action Development Model (RAD) is best suited for projects that are very urgent and need quick delivery. We at, Android Mobile Development do follow Rapid Application Development Model for projects that need urgent delivery, the main objective of Rapid Application Development is to avoid extensive pre-planning, generally allowing software to be written much faster and making it easier to adapt to changing requirements.

Mobile Application Development Guide

Mobinex (2010) provided a guide to mobile application development methodologies which indicates the various phases to be included in the methodologies as shown in figure 3

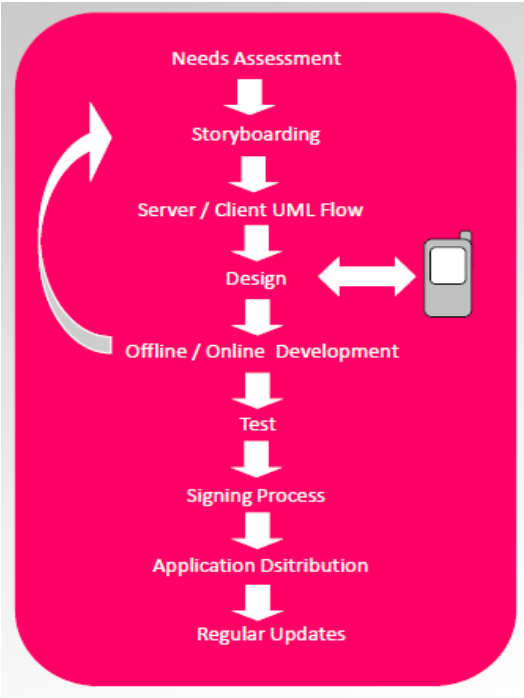

Figure 2. 3: Mobile Application Development Methodology Guide

Source Mobinex, (2010)

Needs Assessment

This phase should put forward the scenarios about how the application would be used in real life

In this phase the following questions would to be answered:

- ✓ Which user features, functions would be developed for which segment?
- ✓ Which services would be integrated to the application?
- ✓ How would the segmented users use the application in real time?
- ✓ What are the usability scenarios for the application? (While walking, in the car, busy environment, working environment, etc)
- ✓ Define Offline/Online information?
- ✓ Which platforms would be supported?
- ✓ Decide application distribution method?

Storyboarding

This is used to determine the interface and other structural characteristics and the workflow of the application. It would answer the following questions:

- ✓ How would be the flow chart of the application?
- ✓ What kind of information would be included in which page?
- ✓ Which model would be used for content presentation?
- ✓ In which page, which content, buttons would be used?

In this phase, the following items have to be determined:

- ✓ The structures of the pages in application
- ✓ Navigations of the buttons and pages
- ✓ Flow of the pages in application scope

Server / Client UML Flow

The operations on data resources and their usage. Definition of the resources that would provide the dynamic data.

Design

This is the visual design of the application interface. It would answer the following questions:

- ✓ What would be the "Brand Name" for the application? (Name of the application, Brand Name, Brand Image, etc.)
- ✓ How the segments would be designed?
- ✓ What are the visual and audio media that would be used in the application?
- ✓ What type of mobile would be used for this application?

Offline / Online Development

Flow phase from offline application to online version by integrated the dynamic data's.

- ✓ What are the success criteria for application performance?
- ✓ Which delivery method would be used for this application? (download)

Testing phase of the developed application

It would answer the following questions:

- ✓ What would be the Test Cases (Writing test cases should start at the beginning of the development and would evolve in each step.)
- ✓ Does the application fulfill the established performance requirements?
- ✓ Which problems have occurred during test?
- ✓ Which problems can occur during application delivery?

Signing Process: The process of encoding a digital certificate into the application

- ✓ Does the application meet the certain criteria such as functionality, visuality and/or usability?
- ✓ In which mobile platform, the signing process would be operated?
- ✓ Does any changes in functionality, visuality and/or usability in the application, after the signing process?

Application Distribution: Application delivery to the segmented users

- ✓ How would the application be delivered? (WAP download etc.)
- ✓ How to avoid the difficulties during the application delivery?

Regular Updates

The organization structure required to do the periodic content updates of the application.

- ✓ What would be the application update period?
- ✓ Who would be responsible for updates?
- ✓ What is needed for application update?

iv) Interactive maps as an instrument of effective project monitoring and tracking

These are maps that mix electronic networks, satellite images and tracking and they are now emerging as key instrument for improved project monitoring. Mapping has turned out to be a leading technique for crowdsourcing initiatives in several areas as it has the ability to integrate all forms and types of information and communication channels as well as putting the aggregated data in ways that can be understood even by non-experts without difficulties. Interactive maps heavily lies on volunteered

geographic information. (Goodchild, 2007) defines volunteered geographic information as the harnessing of tools to create, assemble, and disseminate geographic data provided voluntarily by individuals. (Newsam, 2010) refers to volunteered geographic information as "the growing collections of geographically relevant information provided voluntarily by individuals".

Like any other interactive systems, the production of such data is the result of a collaborative community effort that rests upon users' altruism and willingness to help. Users come from very varied backgrounds. They can be map enthusiasts, GIS-experts casual users or even open-source users. They all contribute during their spare time. The reasons for contributing are very diverse. According to (Goodchild, 2007), some of these reasons include being extending and exercising one's knowledge in GIS, sharing one's local knowledge of an area, a desire to be part of a community, a motivation to produce and being able to use open-source data or simply having fun being outdoors and exploring new (or well-known) areas while surveying with a GPS-device.

2.2.7 Conceptual framework

Based on the theoretical literature the study established that for crowdsourcing platform to be successful factors to take into consideration include vision and strategy, human capital, infrastructure, linkages and trust, the external environment and the motive alignment of the crowd as shown in Figure 2.4.

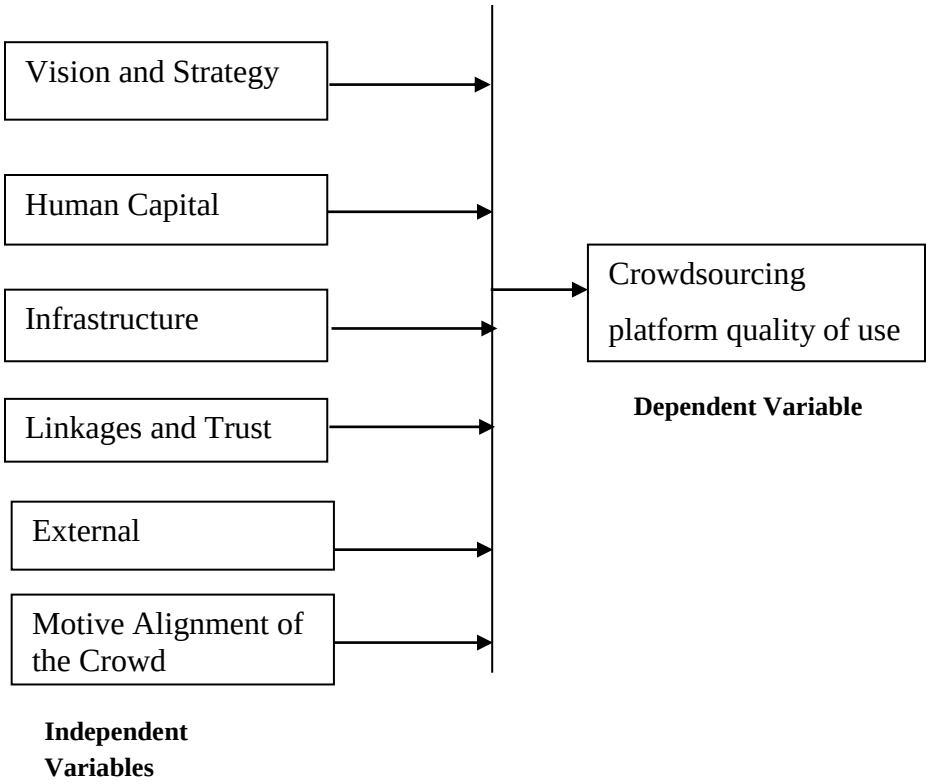

Figure 2.4: Schematic of the conceptual framework.

Source: Author

2.3 Literature Summary

A review of the literature revealed factors that should considered for successful crowdsourcing this included vision and strategy, human capital, infrastructure, linkages and trust, the external environment and the motive alignment of the crowd. The chapter also discussed the various methods of mobile application development this gave an insight into the method that was used for developing the crowdsourcing platform. Interactive maps were also discussed in this chapter as they formed a critical component in the platform that was developed. The next chapter discussed the materials and methods that were used for the study

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CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Introduction

This chapter outlines the method that was used for the study and adopts the following structure: research design, population and sample, population description, data collection methods, research procedures and data analysis and methods.

3.2 Research Design

The study used a descriptive research design that involves collecting data from members of a population in order to describe the current status of the subject under study with respect to one or more variables. The study cut across the entire staff in the Ministry of Public Works. The major emphasis of a descriptive study is to determine the frequency of occurrence or the extent to which variables are related (Mugenda & A.G, 1999).

Descriptive study is concerned with finding out the what, where and how of a phenomenon. Descriptive research has been chosen because it enables the researcher to generalise the findings to a larger population.According (Mugenda & A.G, 1999) it is important and appropriate to use data where subjects are observed in either natural set ups without manipulating the environment. It can be used when collecting information about people's attitudes and opinions and it is also an efficient way to obtain information needed to describe the attitudes, opinions and views of citizens' participation in monitoring of projects in the ministry.

3.3 Target Population

Target population in statistics is the specific population about which information is desired. According to (Ngechu.M., 2004) a population is a well-defined set of people,

services, elements, and events, group of things or households that are being investigated. This definition ensures that population of interest is homogeneous. Population studies are more representative because everyone has equal chance to be included in the final sample that is drawn according to (Mugenda & A.G, 1999).The target population for this study was professionals in the Ministry of Public Works targeting specifically the officers who are involved directly in the monitoring of projects that are undertaken in the ministry.

3.4 Sample Frame

The population was all the workers in the Ministry Public Works Headquarters, a total of 500 workers comprising architects , quantity surveyors, structural engineers, electrical engineers, mechanical engineers, Accountants, Human Resource Development Officers, Economists, Record Management officers, Procurement Officers, Administrators, ICTO's, Secretaries, Clerical Officers as well as support staff, all distributed within headquarters. The study targeted workers in this ministry as they are presumed to be directly involved in monitoring of government projects. One of the major functions of this government Ministry is development and maintenance of government buildings.

3.5 Sample Size and Sampling Technique

(Ng'ang'a, Kosgei, & Gathuthi, 2009) defined sample as a set of individuals selected from the target population that is intended to represent the total population. A sample can also be defined as the individuals, group of cases or events that represent a portion of the target population. According to (Ng'ang'a, Kosgei, & Gathuthi, 2009) scholars have argued that a sample of 30 respondents or more can be considered for large sample and less than 30 for smaller sample.

(Kumar, 2005) also suggests that for descriptive research 10 to 20% of the accessible population can be used for the sample. Similarly, quoting (Kerlinger, 1978) it was noted that 10% of the total population of the target population is large enough provided it allows for reliable data analysis by cross-tabulation, provides desired level of accuracy in estimate to population and allows for testing for significance difference between estimates (Ng'ang'a, Kosgei, & Gathuthi, 2009). The sample size in this study was based on a 20% of the total population of officers in the Ministry of Public Works resulting to a sample size of one hundred and two (102). This sample is to be taken for the officers who are based in the headquarters in Nairobi.

The study employed a purposive sampling. The selection processwas at the decretion of the researcher on the type of the respondent based on available information (Chandran, 2004). (Mugenda & Mugenda, 2003) suggests that the criteria for choice of cases must be specified. The researcher used this method for pre testing of the reseach instrument and selection of the departments to be considered for the study. This method of sampling ensures a balance of group sizes when multiple groups are to be selected. The researcher purposely selected Architectural, Quanitites, Electrical, Mechanical, Structural and admninistration departments. The rationale was that these departmentents were the ones that were mainly involved in monitoring of projects in the Ministry. Table 3.1 shows the breakdown of the sample that was used.

Table 3. 1: Sample size

Department	Total Population	10% of Total Population	Target Sample(20% of total population)
Architectural	88	9	18
Quantities	44	4	9
Electrical	53	5	11
Mechanical	93	9	19
Structural	54	5	11
Administration	168	17	34
TOTAL	**500**	**49**	**102**

3.6 Data Collection Instruments

The main data collection instrument that was adopted by the researcher was questionnaires. Data was collected using a semi-structured questionnaire served on respondents through drop and pick methods; the questionnaires were open and closed to allow for varied response. The method was chosen because it saves time and cost. The exercise was expected to obtain core information and supplementary information through further probing of the respondents and by reading relevant publications of other firms in the industry.

3.7 Pilot Survey

A pilot study was carried out to pre-test data collection instrument i.e. questionnaires. The pilot study was done at the ministry of public works, where 10 questionnaires were distributed to the respondents in the ministry. This was to help in testing validity and reliability of data collected.

3.8 Data Collection Procedure

Quantitative data is data that can be subjected to quantitative analysis whereas qualitative data is data concerning attitudes, opinions and behavior (Kothari, 2004). The research gathered quantitative on the factors to consider in the design of a crowdsourcing platform. (Dawson, 2009) points out that if one is carrying out a research that is leaning towards being quantitative, surveys in the form of questionnaires or interviews are ideal. According to (Dawson, 2009) surveys enable the researcher to obtain a snapshot of data on the phenomenon that enables inferences to be made from this data about relationships that exist between elements of the real world situation.

Questionnaires were used to collect data as they were quick to administer, respondents had time to check facts and think about their answers leading to more accurate information, they supported anonymity of the researcher and supported the collection of quantitative data (Walliman, 2010). Data was collected using a semi-structured questionnaire served on respondents through drop and pick methods. The questionnaires were open-and closed-ended to allow for varied response. Use of questionnaires saves both on costs and time. Each item in the questionnaire was developed to address a specific objective or research question of the study. The questionnaire was pre-tested using ten respondents who were selected using convenience and accessibility. The questionnaires were administered to the respondents directly who were given a week to fill them and thereafter collected for further processing and analysis.

3.9 Data Processing and Analysis

Data processing is described as reducing of accumilated data into summarizes, development of patterns and application of statistical inferences (Cooper & Schindler, 2013). (Ng'ang'a, Kosgei, & Gathuthi, 2009) outlines procedures that can

be used in data processing:Editing which refers to detection of errors or ommissions and correcting them if possible to acquire maximum information by checking for inconsistencies, missing information, non uniformity, and illeligibility. Editing was done to improve data quality standards. Coding is defined as assigning of numbers or symbols to the responses. This allows the research to categorize the data. Data entry is described as conversion of information to a form for viewing and manipulation. The coding is dependant on the measurement scale used and how one intends to communicate the findings. (Kumar, 2005) states that the measurement scale can result in reponse in the form of quantitative, categorical and descriptive. The quantitative and categorical response can be assigned numerical values as codes. While descriptive involves identifying main themes from responses also known as content analysis and assign codes to the themes.

Organizing data that is using pre- determined format for classification, and tabulation according to the research questions and objective and how the data will be analyzed, interpreted and reported. This also involve summarizing data by tabulating the number or frequency of response from the instrument. The summarized information was entered in the Statistical Package for Socials Scientist (SPSS) version 17 for Windows.

SPSS eased analysis by providing a brief summmary of statistical findings that facilitates in comparison, and interpretation.Descriptive statistics can also be used to measure and describe the data obtained. This summarizes the data to ease understanding and interpretation of the data. Other summary measures include percentages and cross tabulation is a technique where different categories for different variables of data are compared (Cooper & Schindler, 2013).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Response Rates

The study covered personal characteristic and work related issues. One hundred and two (102) questionnaires were distributed to the respondents out of 58.8% returned the questionnaires while 41.2 % were non responsive. (Mugenda & Mugenda, 2003) considers 50% response rate to be sufficient for data analysis and interpretation.Therefore, the response rate of for this study was adequate for data analysis and interpretation.

4.2 Identification of the Required Parameters to Design and Develop a Crowdsourcing Platform for Monitoring Government Projects

4.2.1 Human Capital

The factors that were considered under the human capital parameter were profession, age, education level, gender, work experience of the respondent, and the department where the respondent worked. As concerns the profession factor, the results indicated that majority of the respondent were architects at a response rate of 31.7% (Figure 4.1). Electrical engineers and civil engineer constituted 13.3 and 10.0%, respectively while quantity surveyors, structural engineers and mechanical engineers each had a response rate of 8.3%. (Alonso, Rose, & & Stewart, 2008) emphasis that crowd participation in crowdsourcing may be enhanced through educational and vocational training. Figure 4.1 shows that the respondents with the highest response rates where professionals from the technical departments in the ministry. This could be attributed

to the fact that these are the core departments that are involved with project monitoring.

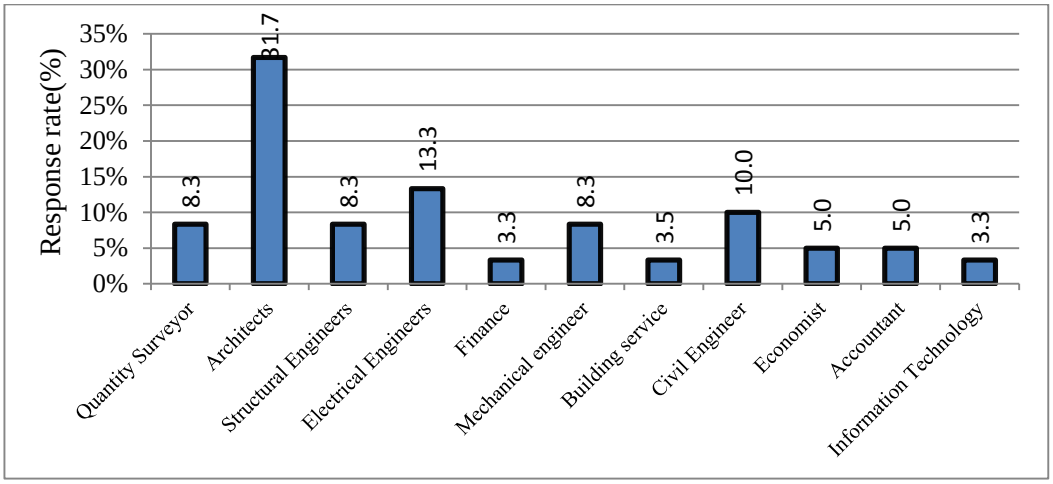

Figure 4.1: Response rates for various professionals working in the Ministry of Public Works.

The response rate based on age indicate that 43.3% of the respondents were between the age bracket of 20–30 years while 41.7% were between 31–40 years (Figure 4.2). A low response rate of 15.0% corresponded to an age bracket of over 41 years. This implies that majority of the respondents were young officers.

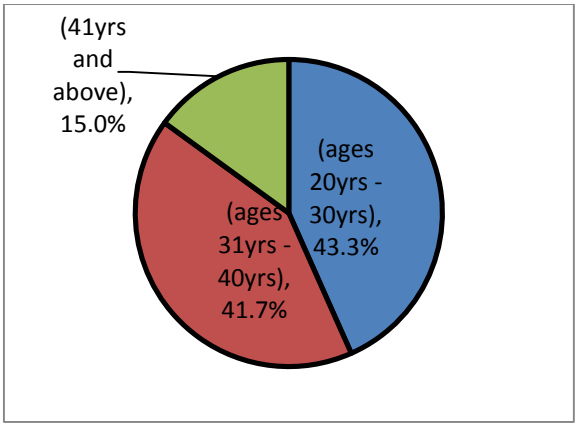

Figure 4.2: Response rates based on age.

With regards to the level of education, 68.3% of the respondents were found to be university graduates with a first degree (Figure 4.3). The results also show that the response rate for those with masters degree was 13.3% whereas diploma, technical course and higher diploma had 11.7, 5.0 and 1.7%, respectively. This result indicates that the staffs at the Ministry of Public Works were qualified in their respective areas of specialization.

The response rate based on gender revealed that majority (80.0%) of the respondents were male (Figure 4.4). This implied that there were fewer female respondents in the technical departments as compared the males. This result indicates that there are fewer females who are involved in project monitoring. The composition of gender slightly fails to meet the national threshold for any gender not exceeding two third of any gender in public institutions.

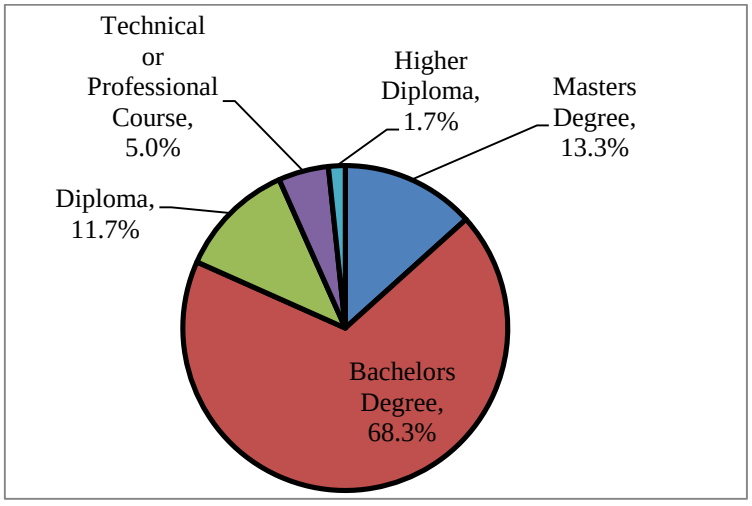

Figure 4.3: Response rate based on level of education.

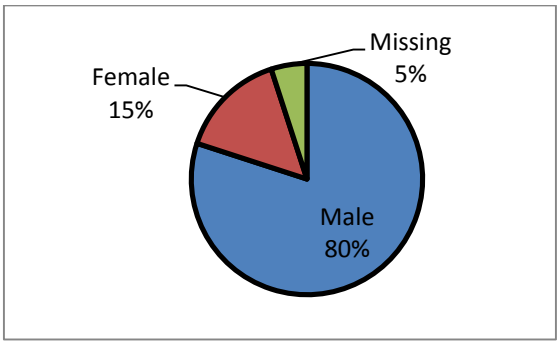

Figure 4.4: Response rate based on gender.

Further, the results show that majority (63.3%) of the respondent had a work experience of less than 5 years (Figure 4.5). This is because most of the respondents were young and were below 30 years of age. In addition, the results show that 20.0% of the respondent had work experience of 6–10 years whereas those with work experience between 11–15 years, and above 15 years had response rates of 3.3 and 13.3%, respectively.

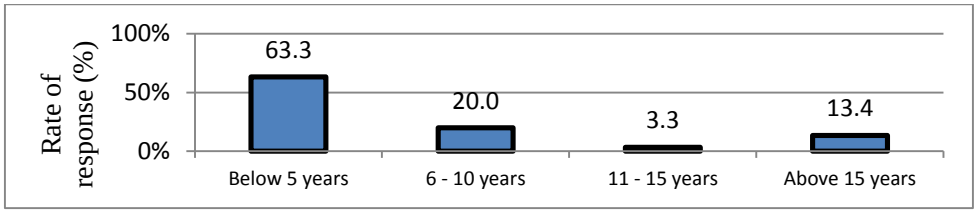

Figure 4.5: Response rates based on work experience.

The response rate based on the department in which one works is presented in Figure 4.6. The results indicate that that the architectural department accounted for the majority of the response at 30.0%. The electrical and mechanical departments had 25.0% while the structural department had 19.3%. The administration, quantity and contracts had 16.2%, and 9.3%, respectively. This implied that the professionals that were in the architectural, electrical and mechanical and structural departments were the ones responsible for project monitoring in the ministry.

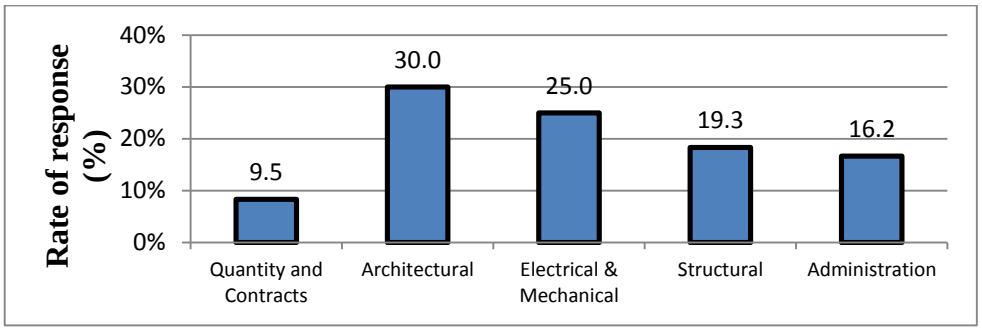

Figure 4.6: Response rates based on the department in which one works.

4.2.2 Vision and Strategy

The vision and strategy parameter comprise three factors namely: responsibility of project monitoring, project monitoring and frequency of project monitoring. The results of the study show that the main professionals responsible for project monitoring were architects with a response rate of 27.0% (Figure 4.3). Electrical and mechanical engineers had a rate of 19.2% while structural engineers and quantity surveyors had rates of 18.0% and 18.6%, respectively. On the other hand, central planning and citizen had response rates of 14.4 and 2.4%, respectively. This response as illustrated in Figure 4.3 could be attributed to the fact that the Ministry's mandate was construction projects. (Ireland & Hitt, 1999) states that vision is an efficient element of business strategy as it provides guidance in the decision making process of the firms. Thus, construction designs were needed and expertise on the various aspects of the projects required the involvement of the architects.

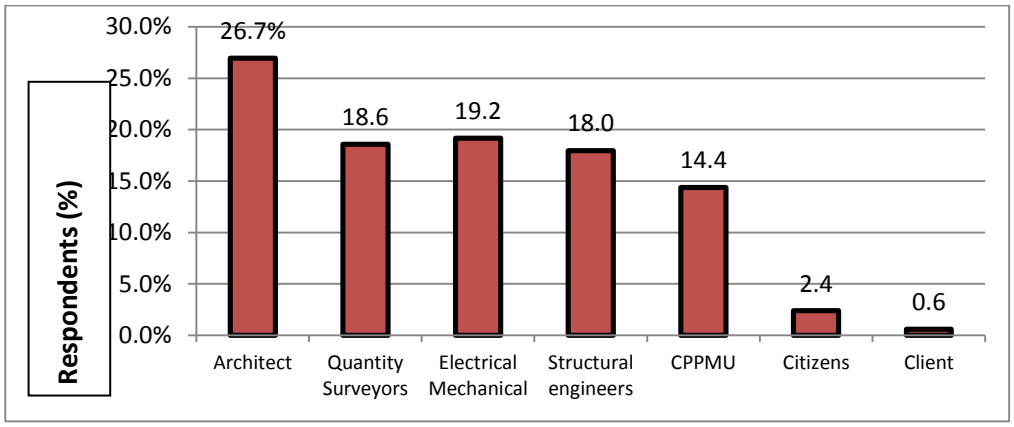

Figure 4.3: Response rates based on responsibility of project monitoring for various professionals

The study further sort to establish whether or not professionals monitored projects. It was found out that 81.7% of the respondents indicated that project monitoring was part of their duties and responsibilities; a small proportion (18.3%) did not monitor projects (Figure 4.4). According to (Brabham D. C., 2009b) vision is significant and the crowd should perceive vision as important and well intentioned.

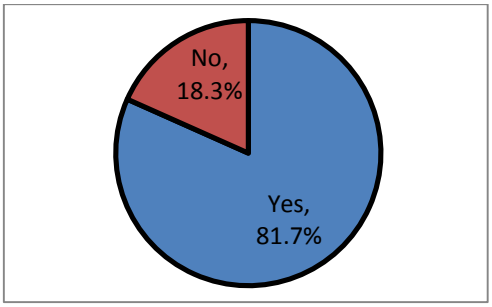

Figure 4.4: Response rates based on project monitoring

Reasons for project monitoring were also evaluated and the results reveal that 33.3% of the respondents indicated projects were monitored to check if they met the specification and quality checks as designed by the various professional (Figure 4.5). Conversely, 20.0% noted projects were monitored to ascertain the site, while 11.7 and

8.3% indicated that they monitored to evaluate the costs and supervision, respectively. It was also noted that 26.7% of the respondents did not provide reasons for project monitoring indicating perhaps that they may not be involved in.

The study further sort to establish the frequency of projects monitoring. Majority (36.7%) of the respondent indicated that they monitor on a monthly basis while 20% monitored the projects on weekly basis (Figure 4.6). The results show that project monitoring should be undertaken frequently as it is critical for the smooth execution of any project.

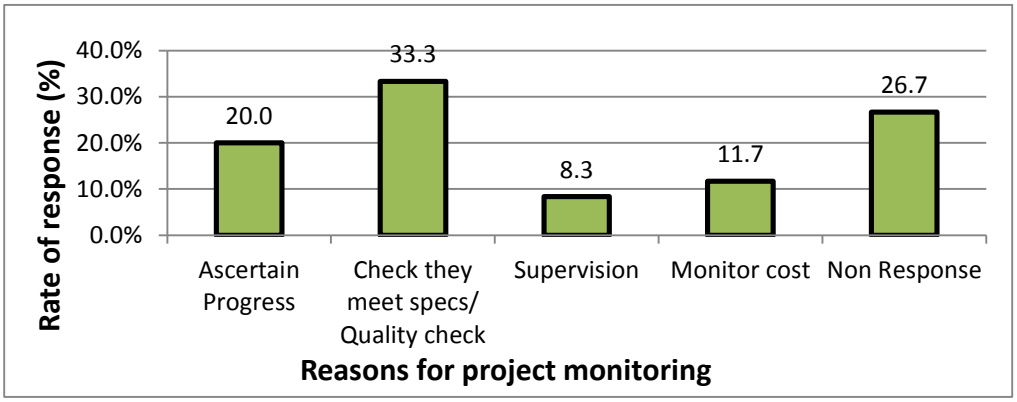

Figure 4.5: Response rates based on reasons for monitoring projects

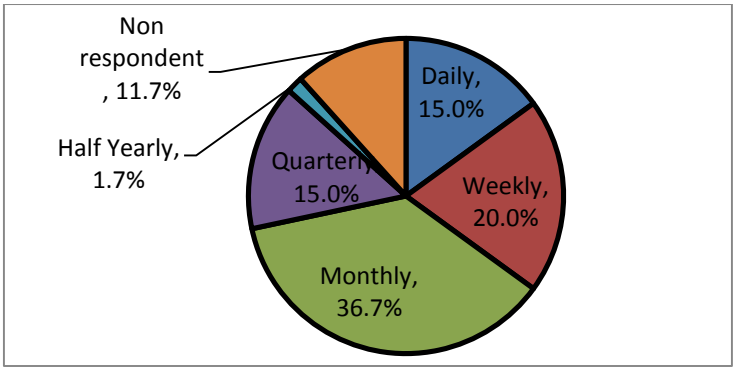

Figure 4.6: Response rates based on frequency of project monitoring

4.2.3 Infrastructure

The infrastructure considered for project monitoring included use mobile phones, online platforms, use of maps, and data storage facilities. Figure 4.7 present the response rates based on the frequency of use of mobile phones for project monitoring. The results show that 45.0% of the respondents used their mobile phones more than 15 times per day to monitor projects while 21.0% used phones less than 5 times per day. The results further show that 11.7 and 10.0% of the respondents used mobile phones between 6-10 times and 11-15, respectively, to monitor projects. (Donner, 2009) indicates that crowdsourcing platforms require reliable mobile access for its communication needs to ensure participation from the crowd.

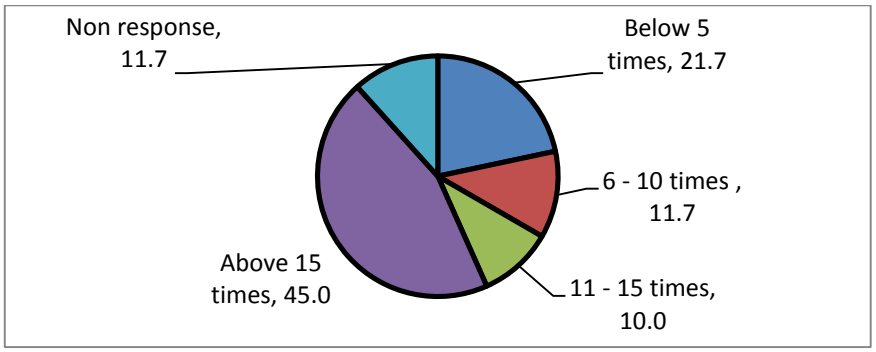

Figure 4.7: Response rates on frequency of use of mobile phone in project monitoring

In addition, the study sort to establish the persons spoken to when using mobile phones in project monitoring (Table 4.1).The results show that 25.0% of the respondents contact both the project team and the contractor while 17.1% contacted the foreman. The results further show that 10.7% of the respondents contacted the client and 7.1% the citizens. Only 3.3% of the respondents contact the Ministry of Public Works officer and Clerks of Works.

Table 4. 1: The person spoken to when mobile phones are used to monitor projects.

Person spoken to	No. of respondents	Response rate (%) (No. of response/140*100)
People on the ground	17	12.1
Project team	35	25.0
Contractor	35	25.0
Foreman	24	17.1
Citizen	10	7.1
Client	15	10.7
Ministry of works officer	2	1.4
Clerk of works	2	1.4
TOTAL	**140**	**100.0**

The impact of use of mobile phones in project monitoring was also assessed and while it was noted that the use of mobile phones was critical, the study revealed that majority (81.7%) of the respondents indicated that the use of the phones improved project monitoring and timely delivery of information (Figure 4.8). (Heeks & Nicholson, 2004) observes that use of mobile phone in crowdsourcing has a significant impact on convenience and availability of information.

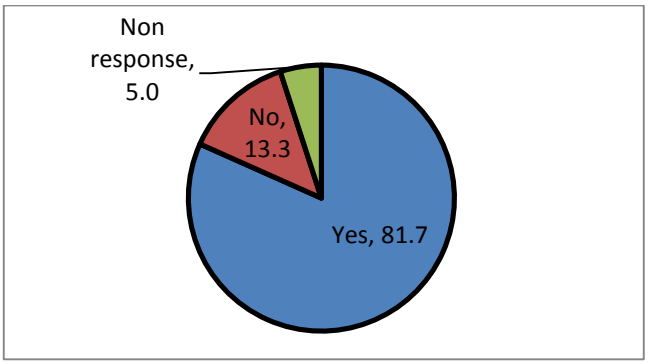

Figure 4.8: Response rates based on the impact of use of mobile phone in project monitoring

Upon further investigation on the impact of mobile phone 76.1% of the respondents indicated that using mobile phones enables one to obtain instant information on a project while 21.7% of the respondents noted that it aided in project coordination (Figure 4.9). Only 2.2% of the respondents pointed out that they used mobile phones for sorting out challenges before meetings were constituted as shown in Figure 4.9.

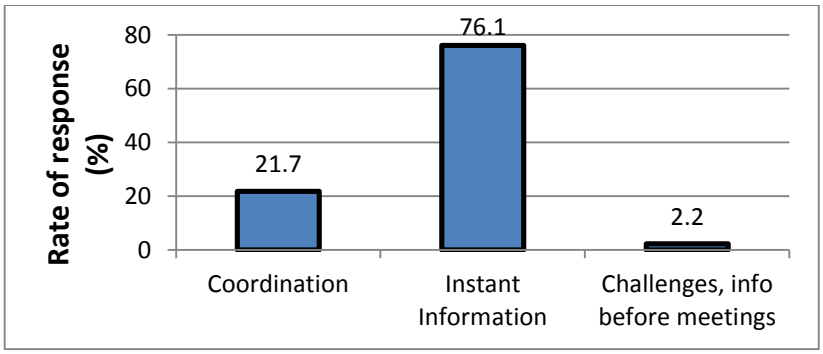

Figure 4.9: Response rates based on the reasons for use of mobile phones in project monitoring

Online based project monitoring was also evaluated and the results show that only 16.4% of the respondents did use this method (Figure 4.10). (Donner, 2009) observes that most crowdsourcing platforms are web based and hence online platforms can be used to enhance participation in crowdsourcing.

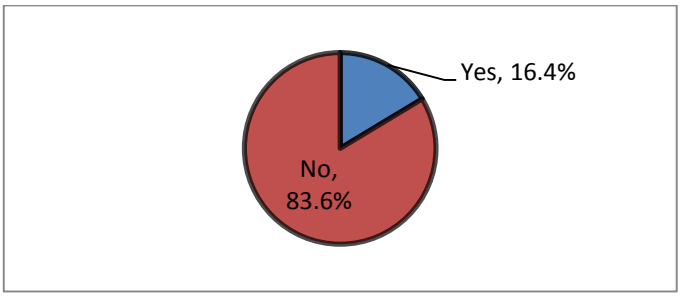

Figure 4.10: Response rates based on online project monitoring

The study sort to find out how the projects to be monitored were located. The response rates show that 35.6% of the respondents locate projects in the Ministry of Public Works using other Government Ministries. This was closely followed by Counties as at 28.8% (Table 4.2). The findings also show that 21.2% of the respondents identify the location of projects using districts and 12.5% used provinces. Only 1.9% of the respondents stated that they used divisions to locate projects in the Ministry

Table 4. 2: Response rate based on how respondents locate projects

Location	Frequency	Response rate (%)
Provinces	13	12.5
Counties	30	28.8
Districts	22	21.2
Divisions	2	1.9
Other ministries	37	35.6

As noted above each project was located in a specific location and there was need for probing on the effectiveness of the use of geographical maps to site projects. On the effectiveness of the use of geographical maps in project monitoring 81.0% of the respondents consider it to be effective (Figure 4.11).The results further show that

only 33.3% of the respondents had knowledge on interactive maps (Figure 4.12).It was noted that 70.6% of the respondents cited Google maps as an example of interactive maps while 23.5% cited topographical maps (Figure 4.13). Google earth was cited by 5.9% as an example of interactive map used.

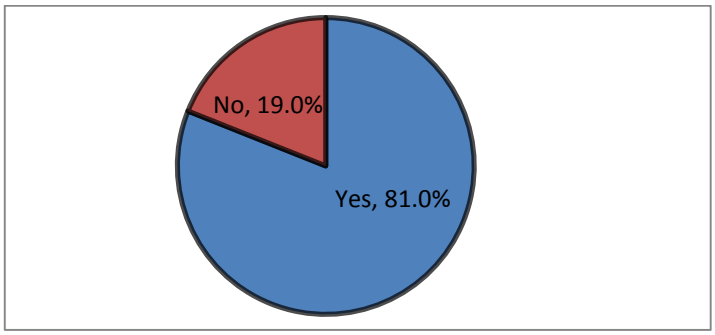

Figure 4.11: Response rates based on efficiency of using maps in project monitoring

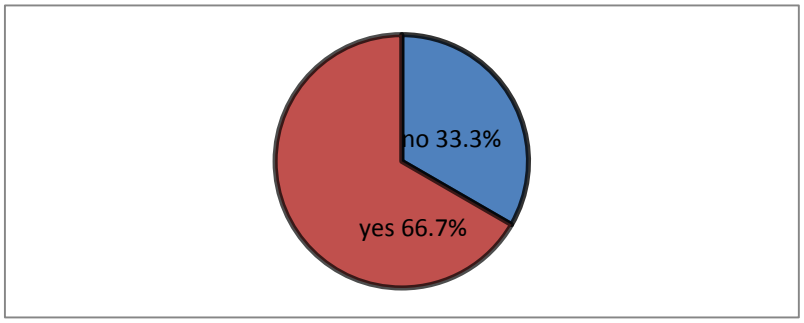

Figure 4.12: Response rates based on knowledge of interactive maps

On assessment of the use of interactive maps to site projects, 36.7% of the respondents acknowledged that interactive maps can be used to locate projects while 25.0% did not acknowledge (Figure 4.14). However, 33.8% of the respondents were undecided.

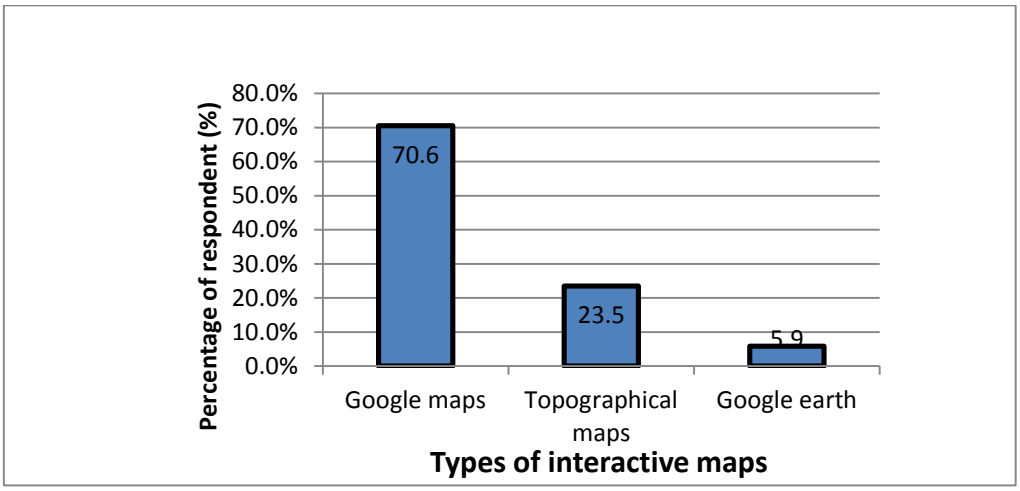

Figure 4.12: Response rates based on examples of interactive maps

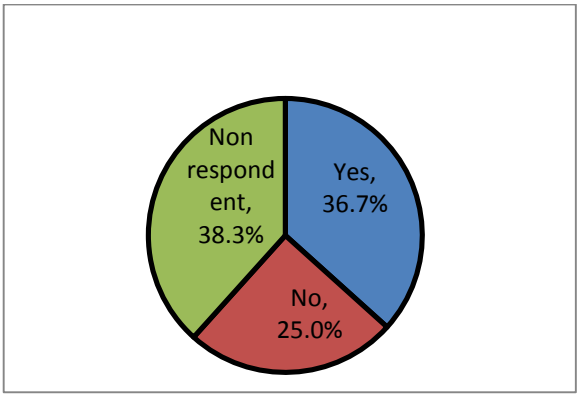

Figure 4.13: Response rates based on acknowledgement of the use of interactive maps for projects location

On the method used to monitor projects, 24.8% of the respondents stated that they go for site visits while 21.5% indicated that they get reports from the clerk of works (Figure 4.15). In addition, 20.1%, 17.8% and 15.4% of the respondents indicated that they use the site minutes from monthly progress meetings, report from the project manager and report from the contractor to located projects, respectively.

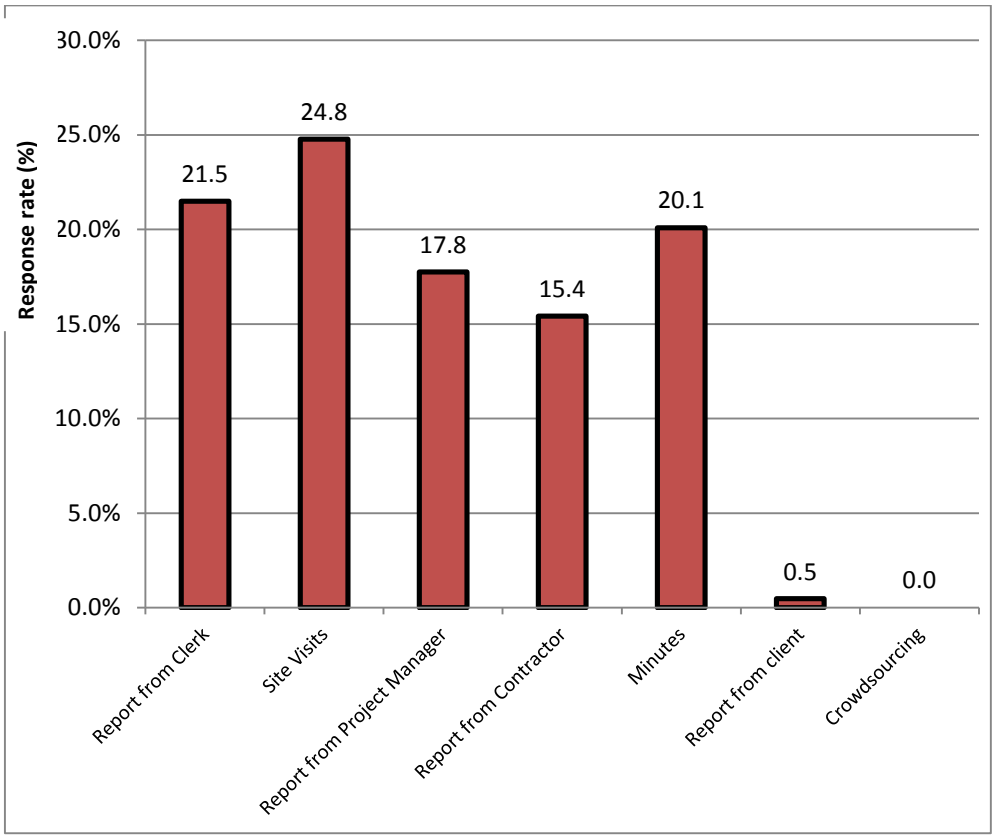

Figure 4.14: Response rates based on methods of used to monitor projects.

The response rate based on storage of project data in a central repository in the Ministry of Public Works is presented in Figure 4.16. The results show that 85.0% of the respondents indicated that data was stored in the central repository while 6.7% indicated that data was not stored in a central repository. The results further showed that 69.2% of the respondents used a manual type repository for storage while 13.5 and 17.3% used electronic and hybrid repositories, respectively.

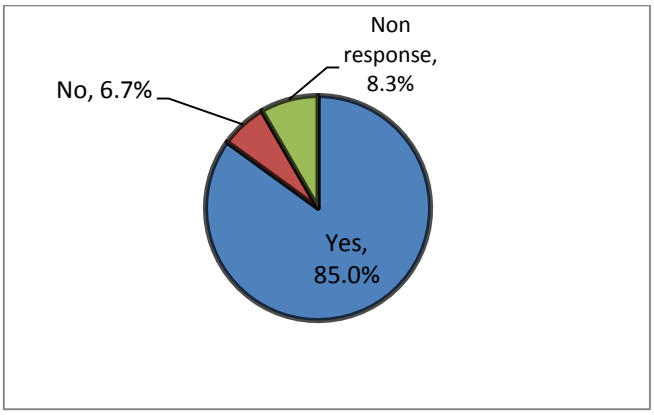

Figure 4.15: Response rates based on storage of project data

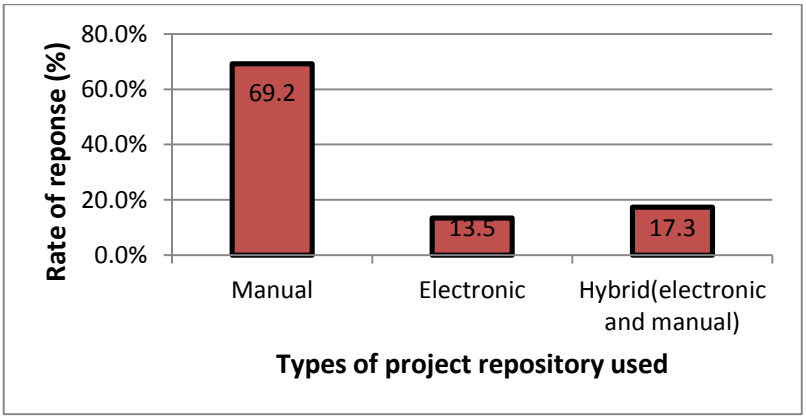

Figure 4.16: Response rates based on the type of repository used for data storage

4.2.4 Linkages and Trust

The study sort to find out who among the workers was best suited to give feedback on linkages and trust during project monitoring. It was found that 41.3% of the respondent indicated that the project team was best suited for this task while 20.7% indicated that workers on the site were the best suited (Figure 4.18). In addition, 14.9, 6.6 and 2.5% of the respondents indicated that the contractors, citizens and client could provide feedback on linkages and trust, respectively.

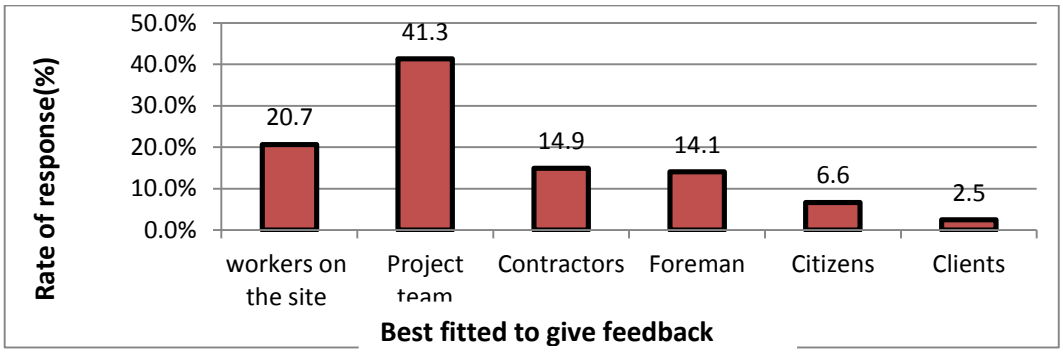

Figure 4.17: Response rates indicating who among the workers are best suited to give feedback

The respondents were required to indicate parameters they note to be critical during project monitoring. It was noted that various factors were critical for the monitoring of projects and to establish the periodical project status reports as indicated in Table 4.3. The corresponding response rates for the factor are also presented in the table. The frequency of the respondents is as shown in the Table 4.3, 18.7% of the respondents, indicated that they check on the status or level of completion of the project whereas 15.0% of the respondent check on the amount certified or paid to the contractor.

Table 4. 3: Parameters checked while undertaking project monitoring

Parameter	Frequency	Response rate (%)
County of the project	13	4.4
Name of the project	19	6.5
Contractor name	21	7.1
Project location	20	6.8
Level/Status of completion	55	18.7
Labour on site	30	10.2
Amount certified	44	15.0
Material on comment	33	11.2
Equipment on site	32	10.9
Challenges	26	8.9
Outcomes, impact	1	0.3
Total	**294**	**100.00**

4.2.5 External Environment

The challenges faced during project monitoring were also evaluated and the results show that 38.0% of the respondents indicated that the changes in specifications and standards with the current market rate was the major challenge (Figure 4.18). This was closely followed by changes in weather which was at 30.0%. Approvals from the local authorities and the client and procurement regulations had 18.3 and 13.4%, respectively. (Oshri, Kotlarsky, & Willcocks, 2009) observes that it is important to pay attention to the potential risks (viz., security risks, regulatory risks, governance support and business environment) as these factors are important in affecting the motive alignment of the crowd in the direction of the long term objective of crowdsourcing.

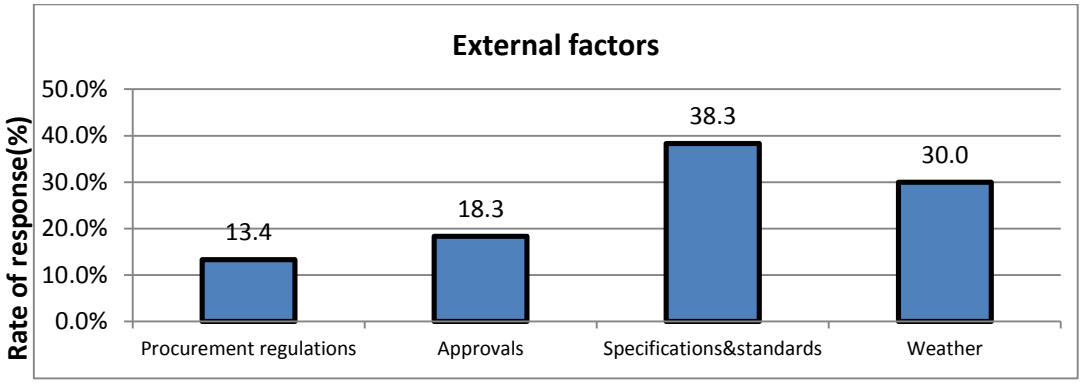

Figure 4.18: Response rates based on challenges faced during project monitoring

4.2.6 Motive Alignment of the Crowd

The respondents were also asked to indicate whether they get project feedback from citizens. The results revealed that 50.0% of them got feedback from the citizens while 50.0% did not get feedback (Figure 4.20). It is prudent to note that it is important for the citizens to provide project feedback, the information provided by citizens was critical and meaningful to both the project implementation team involved monitoring the project.

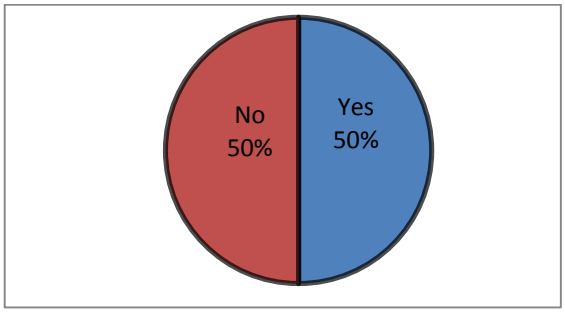

Figure 4. 19: Response rates based on feedback from citizens

The results further show that the most critical information was the level of completion/status of the project and the challenges experienced in the projects were both represented by 17.2% as shown in Table 4.4. This was closely followed by the information on county in which the project is located which was presented by 11.5% of the respondents, whereas information on number of workers on site was represented by 9.2% of the respondents. The name of the project, contractors name, location of the project and equipment on site was represented by 8.1% of the respondents. However, material on site and impact or outcome to the community was represented by 5.6% and 2.3% of the respondents respectively.

Table 4. 4: Type of feedback from the citizens

Information Given	No. of respondents	% response rate (no. of response/87*100)
County	10	11.5
Name of the project	7	8.1
Contractor's Name	7	8.1
Location of the project	7	8.1
Level/status	15	17.2
Workers on site	8	9.2
Amount	4	4.6
Material on site	5	5.6
Equipment on site	7	8.1
Challenges	15	17.2
Impact, outcome to the community	2	2.3
Total	87	100.00

Further, the results show that 51.8% of the respondents indicated that they have face to face response with the project implementation team (Table 4.5). It was also found that 21.4, 10.7, 8.9 and 7.1% of the respondents use mobile phones, letters, reports and emails for interaction, respectively. Construction projects are geared towards improving or providing facilities to the citizens. In most cases for the projects to be successful the acceptance of the projects by the citizens and project implementation teams is critical.

Table 4. 5: Mode of response from the citizens.

Mode of response	No. of respondents	% response rate (no. of response/56*100)
Face to face	29	51.8
Letters	6	10.7
Reports	5	8.9
Mobile Phone	12	21.4
Email	4	7.1
Total	56	100.00

4.3 To design and develop a crowdsourcing platform that can enable citizens and the government to interact for effective project monitoring.

4.3.1 Mobile Application Development

Introduction

This chapter outlines the method used for the development of a mobile application. It adopts the agile methodology for software application development. It has explained the various phases involved in the development which includes needs analysis, conceptual design, development, testing, and usability evaluation.

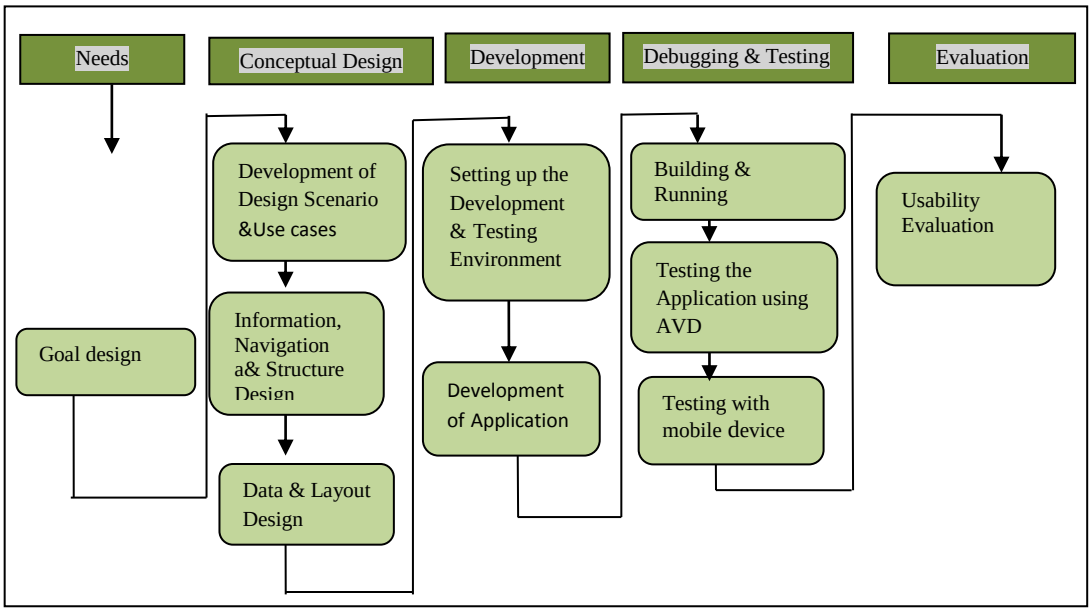

Figure 4. 20: Agile development methodology

Source: (Larman, 2004)

This was a detailed design phase which involved building of models on what is a mobile application, clarifying exactly what the application would do, who would use it, how it would perform and what devices it would work on. It transforms the user requirements into a conceptual user interface and information dissemination system. It involves:

Agile Methodology

The mobile software application has user interface modules which react immediately to user interactions, and since this is an environment with rapidly changing user demands, the development of such applications requires an agile approach. Among the available software development methods, agile methods are the most appropriate and potential solution for mobile applications, (Rahimian & Ramsin, 2008). This methodology was adapted in the application development, which had the following phases:

Needs Analysis

During this phase the scenarios about how the application was to be used in real life were designed. This phase had three processes which include Requirements, features and components specifications. It also involved goal design that determines the principles and goals to guide in the other steps involved in the application development.

Requirements Specifications

Requirements specification involved designing of activities that would give the overall goals and more specific requirements for design of the mobile application. The main goal of the application was to collect information about government projects through the use of an android supported mobile phone.

Features Specification

Use of images and maps to give an overview of the progress and location of the project was incorporated. This made locating of the project it easier.

Specification Evaluation

This was conducted during requirements specifications so as to shape the design (redesign) in order to meet the user's needs.

Goal design

This determined the principles and goals to guide in the other steps involved in the mobile application development. The design goals for the user interface were identified and how the user can capture data using the application.

Development of design scenarios and use cases

This guided on how the user interacts with the system, the functions to be performed with the application. This involved identifying main task of the application which

was to capture information. Features for the designing user interface were identified like tabs, buttons, layout, imageview etc.

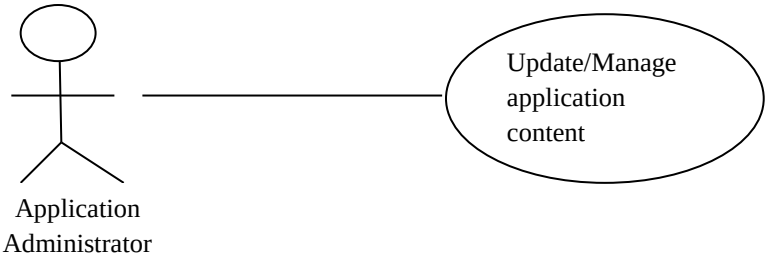

Figure 4. 21: Scenario of the application administrator updating the content

The user who needs who needs to send project information downloads the application from apps store/play store of his android mobile phone and deploys the application in his mobile phone. The application icon is displayed in the main menu of the phone after installation where the user can easily access it.

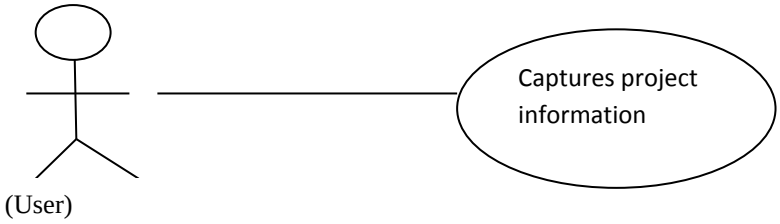

Figure 4. 22: Scenario of a user capturing information

Application Development

This phase involved development of the mobile application. It included the following sub phases

i) Development of low-fidelity prototype

It involved making sketches on paper to see how the application would look like. This assisted in getting the ideas in mind when coding. The paper work was translated into a software prototype.

ii) Development tools

Android application development fundamentals were taken into consideration during the development of the platform that was used in data transmission. This included setting up Android development environment on the machine, AndroidManifest.xml file, Activities, Intents, and XML layouts. In addition, MySQL was employed in the development of the database while PHP and JavaScript were used in the development of pages that were for the reporting end. Finally, Google map API was also utilized to provide the map overlay for the system.

iii) Testing

The application was then tested within the development environment using Android Emulator which is inexpensive way before subjecting it to the field testing. This was done so as to ensure there were no errors in the application like coding errors, navigational errors.

4.3.2 Quality of Use Evaluation

Usability evaluation was conducted to evaluate the implementation of the application and for user acceptance. This was a user based evaluation that measured perceived usability by users. This was guided by Software Usability Measurement Inventory (SUMI) questionnaire which is an internationally-standardized questionnaire for

quantitative measurement of how usable a product is, in the view of the user. It also gives a global measure of usability, together with measure of five orthogonal factors which includes Efficiency, Affect, Helpfulness, Control and Learn ability, which have been empirically identified as dimensions of perceived usability. This may complement objective measures of performance of the application.

The SUMI subscales are referenced in ISO standards on usability (ISO 9241-10, 1996) and software product quality (ISO/IEC 9126-2, 2003). Efficiency refers to the degree to which the user can achieve the goals of his interaction with the application in a direct and timely manner. Affect refers to how much the application captures the user's emotional responses. Helpfulness is the extent to which the application seems to assist the user. Control is the degree to which the user feels them and not the software, is setting the pace. Learnability is the ease with which a user can get started and learn new features of the product.

SUMI requires at least ten users who have experience of the software to evaluate effectively. A working version of the software must be existing. This is according to (Kirakowski & Corbett, 2006)

The application was demonstrated to ten (10) users who are involved with project monitoring on how to use the application. They were then allowed to practically use the application themselves to transmit the information that was required by the application. The users were given a questionnaire to evaluate the application. This phase answered the following question:

Does the application meet the certain criteria such as functionality, visuality and usability?

4.3.3 Instrument Development and Pre-testing

Interview guide questions were developed to guide the interview when collecting data for the application. The data was collected using interview guided by questions and

also observation. The questions were adopted from SUMI questionnaires. The questions were to evaluate usability based on five subscales which included:

A) Functionality/efficiency

1. The organization of the menus or information lists seems quite logical.
2. The way that system information is presented is clear and understandable.
3. If this application stops, it is easy to restart it.
4. The system does what is intended / needed.
5. The application will change the organizations culture if implemented.

B) Usability/affect

1. The system easy to use for its intended user population.
2. I would recommend this application to my colleagues**.**
3. I have to look for assistance most times when I use this application.
4. There is never enough information on the screen when it's needed.
5. The application has a very attractive presentation.

C) **Learnability**

1. Learning to operate this application initially hard.
2. I enjoy my sessions with this application.
3. It takes too long to learn the application commands.
4. I can understand and act on the information provided by this application.
5. It is easy to see at a glance what the options are at each stage.

D) Reliability/Control

1. The application has at some time stopped unexpectedly.
2. The application has always done what I was expecting.
3. The application is accessible whenever needed.

4.3.4 Features of the System

The crowdsourcing platform developed in this study has three main features namely data transmission, reporting end and self-login. The android application once installed on the phone has three instances that the user interacts with to provide information on projects (Figures 4.23 – 4.26). The application has a functionality that allows the user to take a photo of the site that is being inspected and also to pick the coordinates (viz., longitudes and latitudes) of the location. The reporting end is a web based application that helps in displaying the data that was transmitted from the mobile application. The reporting end has various features. The developed web application allows the users to log into the system after inserting appropriate username and password (Figure 4.23).

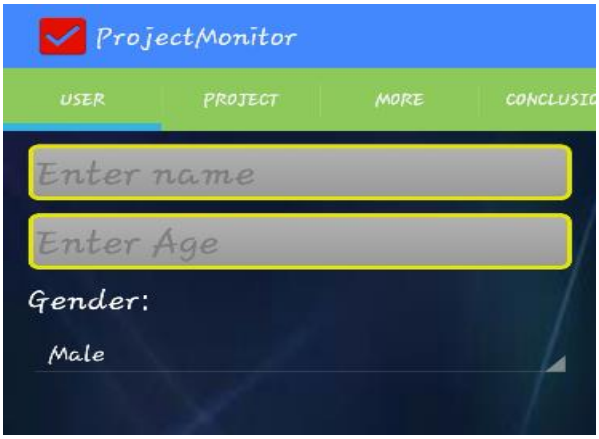

Figure 4. 23: Mobile application interface

Figure 4. 24: Mobile application interface for project details

Figure 4. 25: Mobile application functionality for collecting data

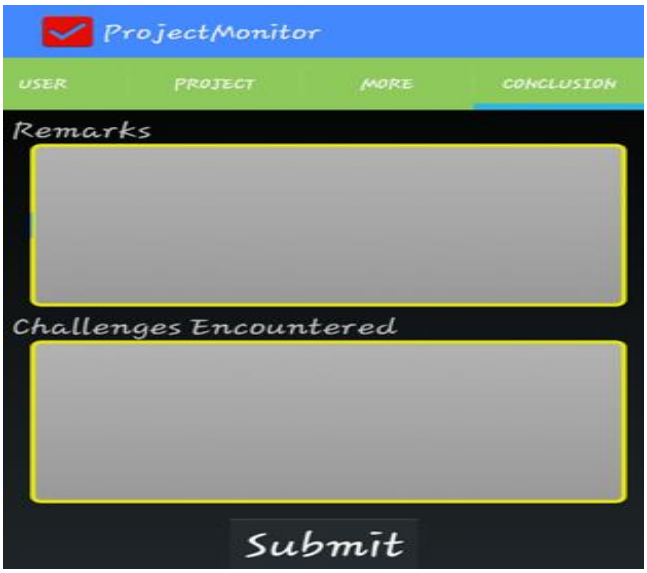

Figure 4. 26: Interface for submitting data

The platform developed had a web interface that picked information that was posted onto the database and displayed it on a browser. Figure 4.27 illustrate the user interface after successful login. Figures 4.27 – 4.29 illustrates the data that has been pulled from database for display and the location of the project.

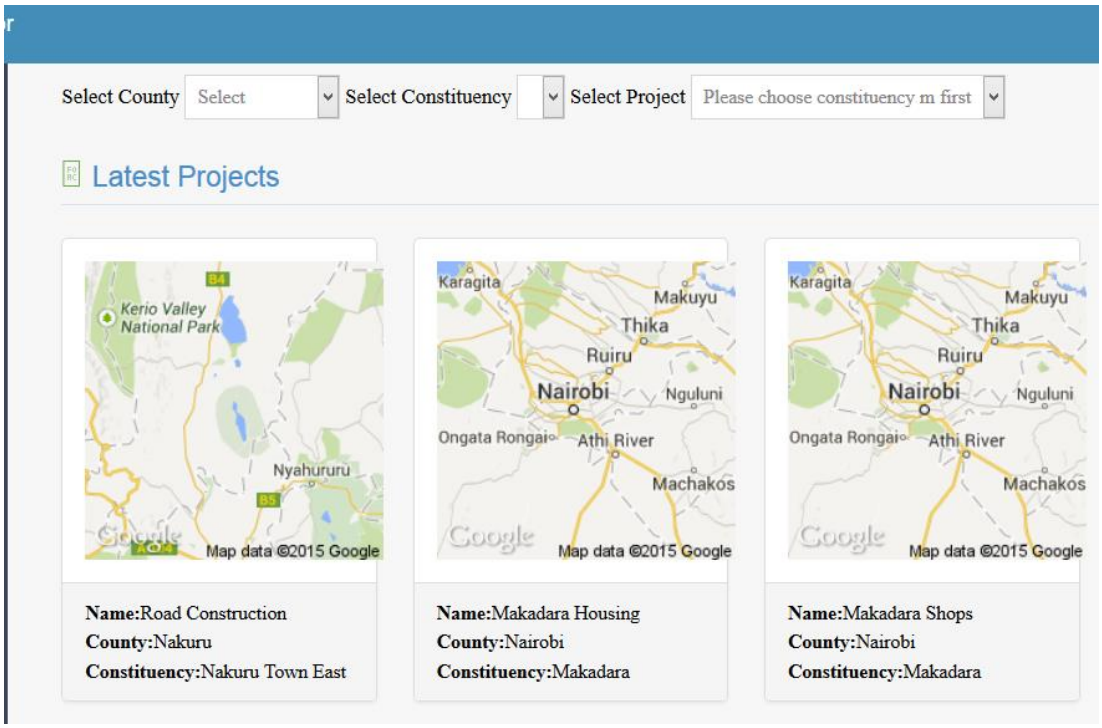

Figure 4. 27: Web interface for displaying project data

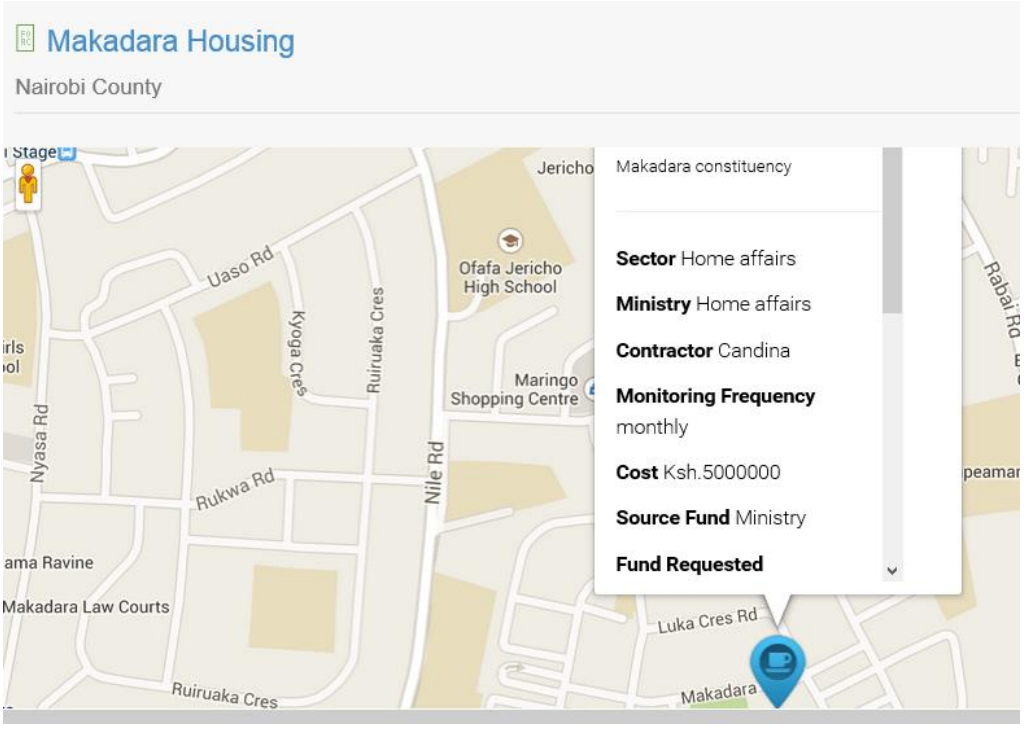

Figure 4. 28: Sample project data that has been transmitted

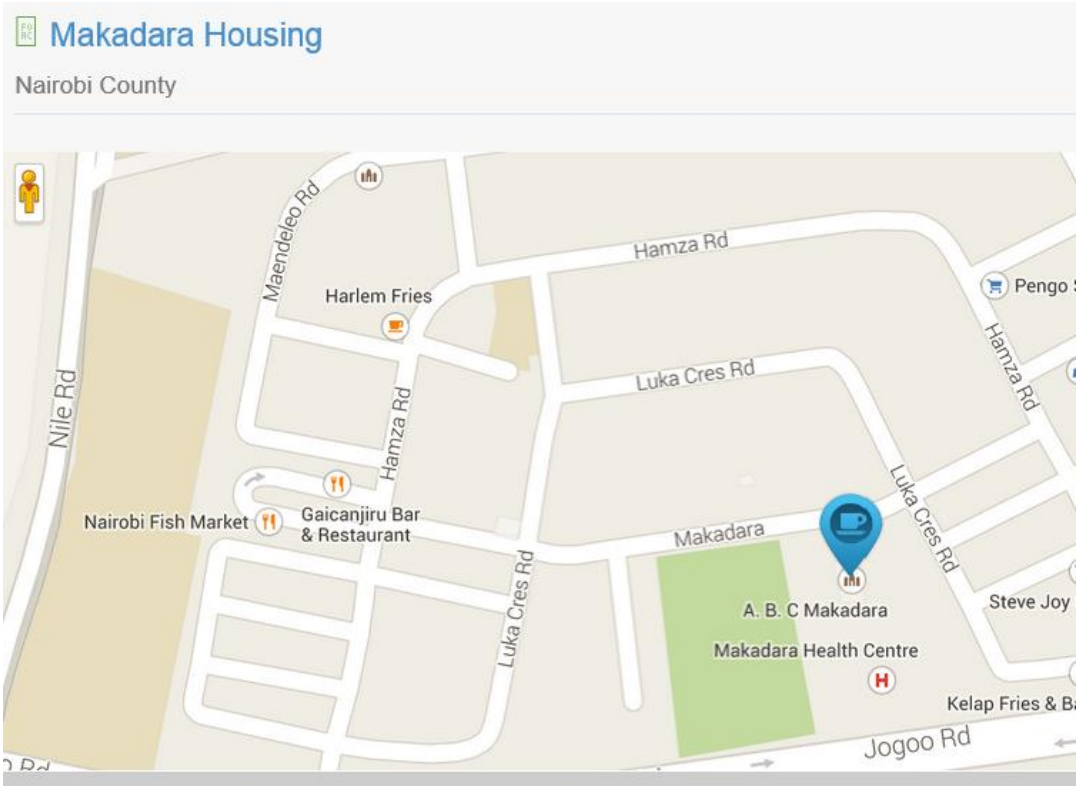

Figure 4. 29: Mapping interface of the application

4.4 To evaluate the quality of the developed crowdsourcing platform.

After developing the application, 10 users were identified to use the application as a way of evaluating the project monitoring application. The users were randomly selected from the various departments in the Ministry. The parameters that guided the evaluation included usability, together with a measure of five orthogonal factors (viz., efficiency, affect, helpfulness, control and learn ability), which have been empirically identified as dimensions of perceived usability.

On functionality and efficiency of the system developed, majority (75.0%) of the respondents indicated that the developed system functioned satisfactorily and they felt the platform would change culture if implemented (Figure 5.8).Another 58.3% indicated that the system did what it was intended to do. In addition, 58.3% of the respondents noted that the system information had clearly been presented and understandable this could be attributed to the fact that the users were new to the system whereas 50.0% were of the opinion that the menu or information list was logical.

On usability, majority (83.3%) of the respondents indicated that the system was easy to use and noted that they could recommend the application to their colleagues (Figure 5.9). Another 66.7% observed that the application had an attractive presentation while 75.0% felt that the application was easy to use for its intended target population. However, 16.7% of the respondents felt that the application did not present them with enough information on the screen whenever they needed the information.

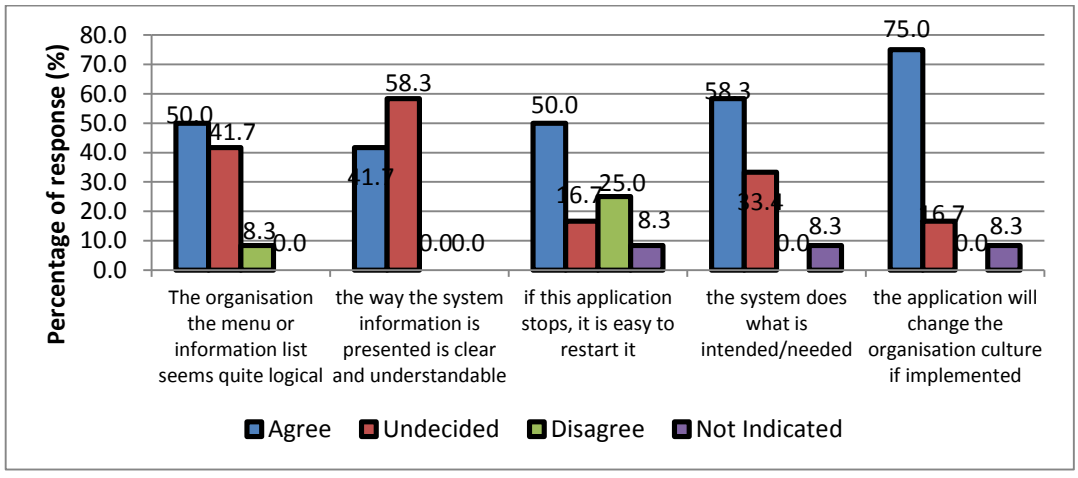

Figure 4. 30: Response on evaluation of the system functionality and efficiency

The system was also evaluated on the ease with which a user can get started and learn new features of the application. Majority (91.7%) of the respondents indicated that the system was easy to use. Another 91.7% indicated that enjoyed their session while interacting with the application. However, 66.7% of the respondents felt that it took them long to learn the application commands and 16.7% felt that it was hard to use the application the first time.

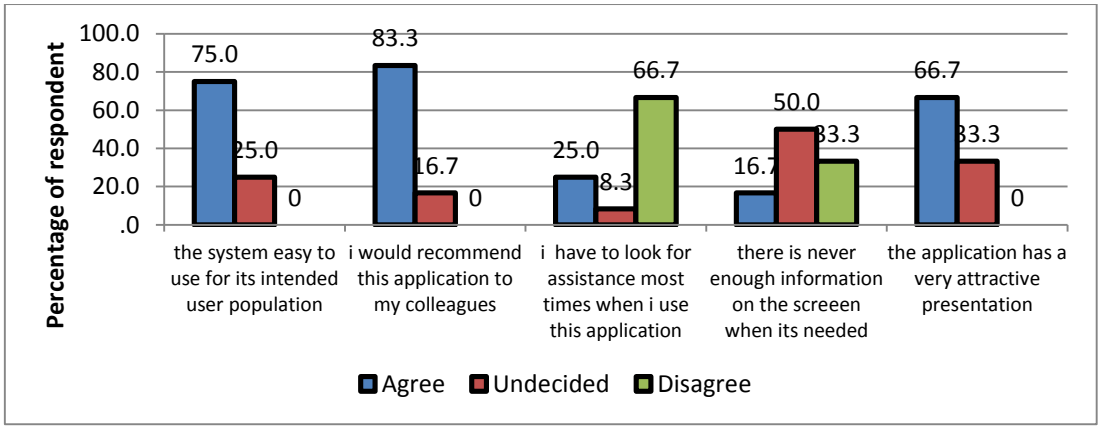

Figure 4. 31: Response rate based on system usability

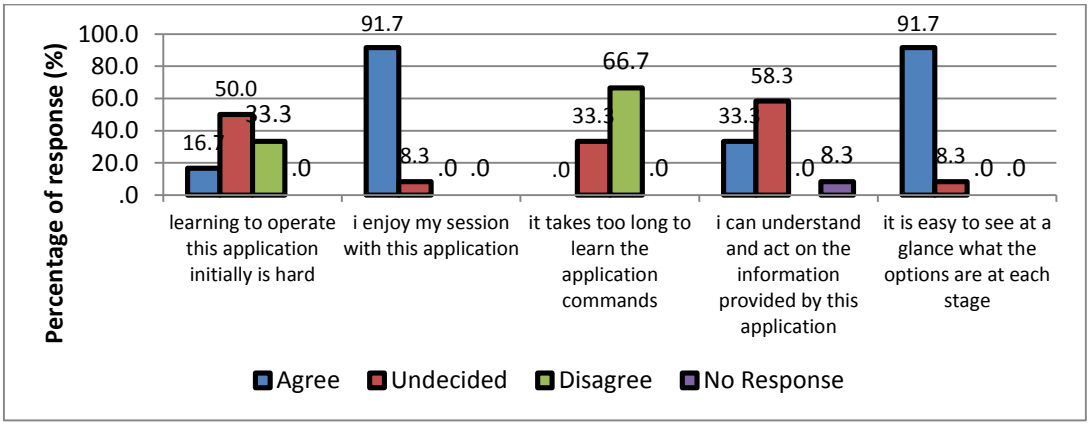

Figure 4. 32: Response rates based on system learnability

4.5 Summary

The factors that were identified in the literature review were further broken down into subsectors to give a clear understanding on how the respondents felt. The results revealed that project monitoring was part of the Ministry's mandate, the technical stuff in the Ministry were the ones tasked with the responsibility of project monitoring, citizen involvement in project monitoring was also critical. This chapter also revealed that the changes in specifications and standards with the current market rate was the major challenge

CHAPTER FIVE

5.0 SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

Factors to be considered when developing the crowdsourcing platform

The study revealed the various factors to be considered when developing a crowdsourcing platform. These factors were:

a) Vision and Strategy

The study found out that project monitoring was part of the Ministry's mandate and that 81.7% of the respondents indicated that project monitoring was part of their duties and responsibilities whereas 18.3% indicated that they do not perform project monitoring. It was prudent to note the reasons for monitoring projects. The study however revealed that 33.3% of the respondents indicated projects were monitored to check if they met the specification and quality checks as designed by the various professional, whereas 20% noted that it was to ascertain progress of the project on site, both the issue of monitoring cost and project supervision had 11.7 and 8.3% respectively. It was also noted that 26.7% of the respondents did not respond of the question and this can be attributed to the fact that some of the respondent did not perform the task of project monitoring.

b) Human Capital

There were various aspects that were looked into this factor. Some of these include:-

The study revelaed that that 31.7% of the respondents were architects and this was the majority. This could be attributed to the fact that they had the required skills to to carry out monitoring electrical engineers and civil engineer constituted 13.3 and 10.0%, respectively, while the quantity surveyors, structural engineers and mechanical engineers with 8.3% each. The other departments the Economist and accountants had a response rate of 5%, while the finance, information technology and building services had a percentage of 3.3 %. This trend was also exhibited in the departmental response where findings revealed that the Architectural department accounted for the majority of the response with 30%, Electrical and Mechanical department had 25% while, Structural Department had 18.3%. The Administration, Quantity and contracts and central planning departments had 11.6%, 8.3% and 5.3%, respectively.

The study also revealed that the correspondents were equipped with the right skills as 68.3% of the respondents were graduates with and they have bachelors' degree as the highest level of education. Those with Masters constituted 13.3% whereas Diploma, Technical course and higher diploma had 11.7%, 5.0% and 1.7% .This indicates that the staffs at the Ministry of Public Works were qualified in their respective areas of specialization.

c) Infrastructure

Construction projects are geared towards improving or providing facilities to the citizens. In most cases for the projects to be successful the acceptance of the projects by the citizens and project implementation teams is critical.

The results of the study indicated that 48.3% of the respondents indicated that they have face to face response with the project implementation team and 20% use mobile phones for the interaction. 10% use letters and 8.3% and 6.7% use reports and emails

respectively to get response from citizens. While it was noted that the use of mobile phones was critical in monitoring projects, the study revealed that 81% of the respondents indicated that it improved project monitoring and timely delivery of information while 13% felt it was not important.

The study also revealed that there was little use of web-based / online mode of project monitoring 83.6% did not use online based project monitoring while 16.4% indicated that they use online based project monitoring. The study also revealed that mapping of projects was a challenge as there was no clear way of mapping the projects that were spread across the country. As noted each project was located in a specific location and there was need for probing on the effectiveness of the use of geographical maps to locate / site projects. On the effectiveness of the use of geographical maps in project monitoring 81% of the respondents consider it to be effective while 19% of the respondents disagreed that the use of maps would be effective in project monitoring.

d) Linkages and Trust

The study established that responsibility of project monitoring was vested with the architects this was represented by 75.0 % of the respondents. The Electrical and Mechanical Engineers represented by 53.3% while the Structural engineers and Quantity Surveyors were represented by 51.7 % and 50.0 % respectively. The Central planning and citizen were represented by 40.0 % and 6.7 %. This response could be attributed to the fact that the Ministry's mandate was construction projects. Thus construction designs were needed and expertise on the various aspects of the projects required the involvement of the architects.

e) External Environment

The study revealed that the respondents encountered some challenges in project monitoring. 38% of the respondents indicated that the changes in specifications and

standards with the current market rate was the major challenge. This was closely followed by changes in weather which was at 30%. Approvals from the local authorities which is an external entity in the process and the client / owner of the project and government procurement regulations had 18.3% and 13.3% respectively.

f) Motive Alignment of the Crowd

Study results revealed that best those fitted to give feedback on the project parameters was the project team this was represented by 83.3% , 41.7% of the respondents indicated that workers on the site were the best suited. Also 30.0% of the respondents indicated that the contractors would also provide feedback. In addition the citizens and client had 13.3% and 5% respectively. It was prudent to note that it is important for the citizens to provide project feedback as the information the citizens provide was critical and meaningful to both the project implementation team involved monitoring the project.

The study revealed that the most critical information was the level of completion or status of the project and the challenges experienced in the projects were both at 25%. This was closely followed by the information on the county in which the project is located with 21% whereas information on labor on site the respondents indicated 13.3%. 11.7% was cited on the name of the project, contractors' name, location of the project and equipment on site. However material on site and impact or outcome to the community was cited by 8.3% and 3.3% respectively.

5.2 Conclusion

i) The study established the factors to consider in the development of a crowdsourcing platform. It revealed from the findings that monitoring government projects has been mandated to the technical staff in the ministry. Majority of the staff conduct monitoring on a monthly basis. This would however change to daily if the government would embrace crowdsourcing in

which citizens would be involved in monitoring. The method preferred by most staff is through site visits which translate to extra expense for the government to move the staff from one site to another. Citizen involvement would be a boost to cost reduction since most of this projects are for the community and thus if the community is involved less costs would be incurred by the ministry.

ii) A crowdsourcing platform was developed. The solution developed was an android application that was used to collect project data from the project location. This application was integrated with a web interface that was used to display the data that had been collected using the mobile application.

iii) The platform that was developed was evaluated to test for its quality. The study found out that the mobile application developed can be used effectively for project monitoring. This was evident from the usability evaluation conducted after development of the application. Therefore the researcher recommends piloting of the application by the Government to enhance its service delivery to the public.

5.3 Recommendations for future research

1. The parameters identified for developing the crowdsourcing platform represent the correct position of the project and if the platform developed is adopted it can enable citizens and government interacts for effective project monitoring.
2. Further research could be carried out to determine if the platform developed can be integrated with project budgeting.

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APPENDICES

QUESTIONNAIRES

1. Data collection questionnaire.

I am an MSC student at Jomo Kenyatta University of Agriculture and Technology undertaking a thesis on the topic Crowdsourcing –a platform for monitoring government projects.

Crowdsourcing is a process where an institution takes a task that is undertaken by its employees and outsources it to an undefined large group of people and this is usually done voluntarily.

I therefore request for your input towards this research and all information obtained is confidential and is purely for research purposes.

Please complete the questionnaire by filling all the sections.

PART A

1. Profession ……..

2. Department …….

3. Age [ ] 20 -30 [ ] 31-40 [ ] 41 and above

4. Gender [ ] Male [ ] Female

5. Work experience

[ ] Below 5 years

[ ] 6-10 years

[ ] 11-15 years

[ ] Above 15 years

6. Highest level of Education

[ ] PHD

[ ] Masters Degree

[ ] Bachelor Degree

[ ] Diploma

[ ] Technical or Professional course

[ ] Secondary

[ ] Others (specify) ……

7. Area of specialization in highest level of education, specify (Economics, Engineering, Architect, etc).

……

8. How long have you served in Government (Ministry/ Ministries)

[ ] Below 4 years [ ] 5 -10 years [ ] 11-15 years [ ] above 15 years

PART B

9. Who is responsible for project monitoring in your ministry? (Tick all that apply)

Architects ☐

Quantity surveyors ☐

Structural engineers ☐

Electromechanical engineers ☐

Central planning unit ☐

Citizen (People on the ground) ☐

Others (specify) ……

☐

☐

Do you monitor projects in your ministry?

Yes [ ] No [ ]

If yes how long have you been monitoring projects

[ ] Below 5 years

[ ] 6-10 years

[ ] 11-15 years

[ ] Above 15 years

Why do you monitor the projects?

……

……

……

……

……

……

……

10. How often is project monitoring done in your ministry? (choose one)

Daily ☐

weekely ☐

Monthly ☐

Quarterly ☐

Half Yearly ☐

Once a year ☐

Other specify ……

11. Which of the following method do you use to monitor projects? (Tick where it applies)

Reportsfrom Clerk of work ☐

Site Visit ☐

Reports from project manager ☐

Reports from the contractor ☐

Crowd sourcing ☐

Minutes from meeting ☐

Other (Specify) …….

12. What parameter do you check in monitoring the progress of a project?

County of the project ☐

Name of the project ☐

Name of the contractor ☐

Location of the project ☐

Level / status of Completion ☐

Labour on site ☐

Amount certifed ☐

Materials on site ☐

Equipement on site ☐

Challenges ☐

Other (Specify) …….

13. Who do you think are best fitted to Providefeedback on the parameters?

People on the ground ☐

Project team ☐

Contractor ☐

Foreman ☐

Citizens ☐

Other (Specify) …….

14. Do you get feedback on projects from the citizen?

Yes [ ] No [ ]

If yes what kind of projects information? (Tick all that applies)

County of the project ☐

Name of the project ☐

Name of the contractor ☐

Location of the project ☐

Level / status of Completion ☐

Labour on site ☐

Amount certifed ☐

Materials on site ☐

Equipemtns on site ☐

Challenges ☐

Other (Specify) …….

How do you get the feedback from the citizen?

Face to face ☐

Letters

reports

Email ☐

Mobile phone ☐

Others (specify)……

How often to you use your mobile phone to monitor projects in a month?

[ ] Below 5 times

[ ] 6-10 times

[ ] 11-15 times

[ ] Above 15 times

Who do you speak to?

People on the ground ☐

Project team ☐

Contractor ☐

Foreman ☐

Citizens ☐

Cleint

Other (Specify) …….

15. Does the use of mobile phones improve in project monitoring in you ministry?

Yes [ ] No [ ]

If yes, how do mobile improve in project monitoring?

……

……

……

……

16. Do you use online based project monitoring?

Yes [ ] No [ ]

If yes, how is online based project monitoring undertaken?

……

……

……

……

……

17. a) How do you locate the ministry's projects within the country? By

Provinces ☐

Counties ☐

Districts ☐

Division ☐

Ministries ☐

Others (Specify) ……

b) Do you think having maps that shows the location of all project in all the counties would make project monitoring efficient?

Yes [ ] No [ ]

c) Do you know what interactive maps are? Yes [ ] No [ ]

d) If yes, give examples of interactive map

……

……

……

……

e) Do you think interactive maps can be used in locating the projects?

Yes [ ] No [ ]

d) If yes, briefly explain how they can be used.

……

……

……

……

18. a) Do you have a central repository of all the projects being undertaken by your ministry?

Yes [ ] No [ ]

b) What kind of repository do you use in your ministry?

Manual ☐

Electronic ☐

Others (specify) …….

19. What challenges do you face during project monitoring?

Procurement regulations ☐

Approvals from authorities ☐

Changes in specifications ☐

Weather ☐

Others specify .....

20. Any other comment regarding project monitoring?

……

……

……
……
……

2. Systems evaluation criteria questionnaire

Questionnaire (Agree (A) / Undecided (U) / Disagree (D)

Functionality/efficiency

1. The organization of the menus or information lists seems quite logical.
2. The way that system information is presented is clear and understandable.
3. If this application stops, it is easy to restart it.
4. The system does what is intended / needed.
5. The application will change the organisations culture if implemented.

Usability/affect

1. The system easy to use for its intended user population.
2. I would recommend this application to my colleagues**.**
3. I have to look for assistance most times when I use this application.
4. There is never enough information on the screen when it's needed.
5. The application has a very attractive presentation.

Learnability

1. Learning to operate this application initially hard.
2. I enjoy my sessions with this application.
3. It takes too long to learn the application commands.
4. I can understand and act on the information provided by this application.
5. It is easy to see at a glance what the options are at each stage.

Reliability/control

1. The application has at some time stopped unexpectedly.
2. The application has always done what I was expecting.
3. The application is accessible whenever needed.

APPROVALS

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471, 2241349
254-020-310571, 2213123, 2219420
Fax: 254-020-318245, 318249
When replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: **NCST/RCD/14/012/1141**

Date: **9th August 2012**

Phane Kemunto Nyaanga
Jomo Kenyatta University of
Agriculture and Technology
P.O.Box 62000-00200,
Nairobi.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "***Crowdsourcing – a platform for mentoring government projects,***" I am pleased to inform you that you have been authorized to undertake research in **Nairobi Province** for a period ending **31st December,** *2012.*

You are advised to report to **the Permanent Secretary, Ministry of public works, Nairobi** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. M. K. RUGUTT, PhD, HSC.
DEPUTY COUNCIL SECRETARY

Copy to:

The Permanent Secretary
Ministry of Public Works
Nairobi.

"The National Council for Science and Technology is Committed to the Promotion of Science and Technology for National Development."

CONDITIONS

1. **You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit**
2. **Government Officers will not be interviewed with-out prior appointment.**
3. **No questionnaire will be used unless it has been approved.**
4. **Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.**
5. **You are required to submit at least two(2)/four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.**
6. **The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice**

GPK6055t3mt10/2011

REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT

(CONDITIONS–see back page)

PAGE 2

THIS IS TO CERTIFY THAT:
Prof./Dr./Mr./Mrs./Miss/Institution
Phane Kemunto Nyaanga
of (Address) Jomo Kenyatta University of Agriculture and Technology.
P.O.Box 62000-00200, Nairobi.
has been permitted to conduct research in

Location
District
Province
Nairobi

on the topic: Crowdsourcing – a platform for mentoring government projects.

for a period ending: 31st December, 2012.

PAGE 3

Research Permit No. *NCST/RCD/14/01*
Date of issue *9th August, 201*
Fee received *KSH. 1,000*

Applicant's Signature

Secretary
National Counc
Science &Techr