INFORMATION SHARING AMONG WATER AND SANITATION PROVIDERS: A STUDY OF WATSAN PORTAL: KIBERA

BY

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Declaration

This project paper is my original work and has not been submitted for a degree or any other academic qualifications to any other University or institution.

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This project paper has been submitted for examination with our supervision and approval as University supervisors.

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Dedication

This study is dedicated to my mother who dared me to pursue and attain my higher education independently and to my disciplined father who ever dreams for more; to the history of African-American struggle from which I was birthed; and to the Institute for Development Studies, its professors, lecturers and students by which I was challenged.

Collectively, I dedicate this work to the aforementioned because they taught me the life-long lesson that I shall rejoice in striving towards "progress, not perfection."

"The gods condemned Sisyphus to ceaselessly rolling an immense boulder up a steep hill, only to watch it roll back down, and to repeat this action forever." – Greek myth

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Abstract

As informal water and sanitation services grow, understanding how informal water and sanitation providers share and seek information throughout informal settlements becomes of increasing importance in understanding how to support these actors in helping the Government of Kenya to meet their Constitutional mandate of adequate water and sanitation for all. This study investigates the ways in which the emerging information communication technology of WATSAN Portal: Kibera assists water and sanitation providers in planning and implementing improved Projects.

This research applies qualitative methodological approaches to understand the advantages and barriers to the use of WATSAN Portal. Qualitative desktop review identified and analysed information shared through the Portal. In identifying the information provided by the Portal, this study reviewed the content within this website in a first phase of research. The study applies desktop review to determine what information is shared through the Portal and how it enhances information sharing among water and sanitation providers. In the second phase of this research, four key Users of the Portal and nine other water and sanitation Providers in Kibera were selected to participate in-depth interviews to uncover characteristics of Portal Users, the types of water and sanitation information shared and sought, and the advantages and challenges to information sharing through the Portal. Combined, the study of the Portal, the Users, and other select Providers provides an understanding how new information communication technology supports water and sanitation development in Kibera.

The study found that the information aids Users of the Portal in rapid information-gathering, information-sharing, and preliminary planning of water and sanitation projects. However, the technical and infrastructural challenges of NCWSC sometimes limits the presence of practical, functional information in the Portal. This barrier in information-sharing hinders outcomes, including: the ability of this Portal to alter relationships between water and sanitation providers and municipal authorities, and the improvement of how Providers and residents make decisions about project implementation. To this end, the study recommends municipal and County government include, engage, and support water and sanitation providers as essential to meeting water and sanitation demand. Additionally, this study recommends that the developers of the WATSAN Portal should explore alternative information communication technology that increases the accessibility of the information contained within the Portal to water and sanitation providers who have limited computer and Internet access.

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List of Acronyms and Abbreviations

AWSB	Athi Water Service Board
CBO	Community Based Organization
ESRI	Environmental Systems Research Institute
GPS	Global Positioning System
ICT	Information and Communication Technology
KDI	Kounkuey Design Initiative
NCWSC	Nairobi Water and Sewerage Company
NGO	Non-Governmental Organizations
UN	United Nations
UN-HABITAT	UN Human Settlements Programme
WASREB	Water and Sanitation Regulation Board
WATSAN	Water and Sanitation
WSUP	Water and Sanitation for the Urban Poor
WSTF	Water Services Trust Fund

Definitions

Information Need	The data or knowledge sought or required by Providers
Project	The water or sanitation project of the Provider
Providers	The provider of water and/or sanitation services
User	The person using of WATSAN Portal: Kibera
User's Organization	The organization of the person using WATSAN Portal

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Implementing water and sanitation projects is not only resource-driven, but requires extensive planning. Planning for these projects involves understanding water and sanitation options, knowing about existing infrastructure and its geographic location, and having a grasp of the implementation processes. Providers of water and sanitation operating in Nairobi informal settlements and in Kibera Informal Settlement plan and implement water and sanitation projects without clear, relevant information about options, infrastructure, or well-defined processes for improved, formal facilities. Out of this concern, the network of water and sanitation providers in Kibera along with Nairobi Water and Sanitation Company have organized information about water and sanitation provision, infrastructure, and processes in Kibera. This network has initiated Water and Sanitation (WATSAN) Portal: Kibera, which focuses on digital mapping and information-sharing related to developing water and sanitation in Kibera (Appendix I, Figure 7). In other words, this network merges municipal data and local information about Kibera to provide water and sanitation providers access to relevant information for planning and implementing improved, formalized water and sanitation projects. This digital space links water and sanitation service providers, also referred to as Providers, to information – from processes to create formal Projects to evaluations of viability at specific new or existing Project locations.

As the number of Kenyan residents who depend on water and service provision via informal Providers has doubled from 3.0 to 7.7 million between 1989 and 2009. The aforementioned information is vital to Providers, or community based organizations (CBOs), nongovernmental organizations (NGOs), and entrepreneurs, who are instrumental to planning and providing services. Nairobi City Water and Sewerage Company (NCWSC) in 2002 and throughout the first decade of the new millennium prioritized policies that favored the poor, which notably included: network intensification of formal networks, upgrading pipes, facilitation of improved water kiosks, promotion of community managed pay sanitation blocks, including bio-latrines, and facilitation of social and physical connections in underserviced communities (NCWSC, AWSB, 2009). Even prior to these pro-poor strategies, a surge of informal Providers provided market-based and social solutions to

inadequate water and sanitation services as a response to the state's centralised water and sewerage system that neglected to plan for settlements like Kibera. WATSAN Portal: Kibera, also referenced as 'the Portal,' utilizes the support of new information and communication technology (ICT), to share information that supports planning and implementing projects by informal Providers.

This study examines WATSAN Portal: Kibera, investigates information-sharing among Portal Users, or Users, and assesses how this technology assists Providers in Kibera to improve Projects.

1.2 Information and Communication for Development (ICT4D): Kenya's Experience

Information and Communication Technology merges digital technology and programming to communicate information. In recent years, ICT like crowd sourcing have supported the 'outsourced' populations of citizens, experts, or the 'crowd' in organizing and sharing collected data or information" (van Etten, 2011, p. 103). Some conceptualize crowd sourcing as enabling the 'wisdom of the crowds,' invoking the collective knowledge and opinion of groups, rather than of a particular expert or authority. Scholars and technologists perceive a myriad of benefits in this growing pool of grassroots knowledge, recognizing it as having potential to be revolutionary (van Etten 2011, p. 2).

The Kenyan case substantiates the potential for ICT's to engage the 'wisdom of the crowds.' As a model of the enactment of ICTs for development purposes, Kenyan lawyer Ory Okolloh's creation and operation of Mzalendo in the years leading up to Kenya's 2007 national elections is paramount. Mzalendo is an online watchdog forum that aggregated information and opinions on Kenyan Members of Parliament. In the eruption of the 2007/2008 post-election violence, Okolloh formed another platform through modifying Mzalendo. The new platform, Ushahidi, aggregated written content (information and stories) and visual content (photos and video) to document outbreaks of violence. Once verified, each instance of content was digitally mapped using Global Positioning System (GPS) in its respective geographic position, and published online to a digital map (Appendix I). In other words, Okolloh integrated citizens' stories and pictures, submitted through SMS, email,

Twitter and Internet website submissions with its GPS location via Google Mapping of Kenya (Goldstein 2008, p. 6). This tool helped bystanders to document current events during post-election Kenya because anyone with access to Internet (via mobile phone or computer) could share and access information via Ushahidi. Platform users were able to post and to access up-to-date information on the progression of the crisis and conflict. Most noted, in an environment of poor information provision during a crisis situation, the ICT tool of Ushahidi provides a space for people in Kenya to collect and share local information via the Internet.

In the half of a decade since the post-election period of 2007/2008, the Ushahidi platform has been adapted to support information-sharing for collective action during Arab Springs and crisis management in post-earthquake Haiti. This same platform invited the creation of other tools which supports a community for transparent information sharing. In similar fashion, WATSAN Portal: Kibera allows for continuous sharing among Providers planning and implementing water and sanitation projects in an environment where transparent and accurate information is not readily available.

1.2.1 Population Challenge in Meeting Water and Sanitation Needs

This study focuses on improved water and sanitation provision. This type of water and sanitation provision refers to the infrastructure of the facility, the source of the water, or the method for the discharge of the sewerage. Table 1 lists the improved and unimproved water and sanitation categories.

Table 1: Definitions of "Improved" and "Unimproved" Drinking Water and Sanitation Categories

DRINKING-WATER CATEGORIES	
"Improved" sources of drinking-water:	• Piped water into dwelling • Piped water to yard/plot • Public tap or standpipe • Tubewell or borehole • Protected dug well • Protected spring • Rainwater
"Unimproved" sources of drinking-water:	• Unprotected spring • Unprotected dug well • Cart with small tank/drum • Tanker-truck • Surface water • Bottled water
SANITATION CATEGORIES	
"Improved" sanitation:	• Flush toilet • Piped sewer system • Septic tank • Flush/pour flush to pit latrine • Ventilated improved pit latrine (VIP) • Pit latrine with slab • Composting toilet • Special case
"Unimproved" sanitation:	• Flush/pour flush to elsewhere • Pit latrine without slab • Bucket • Hanging toilet or hanging latrine • No facilities or bush or field

Another key terminology used in this study is formal water and sanitation. Formal and informal water/sanitation refers to the public management in water/sanitation provision and regulation. In this research, formal refers to management and regulation by a municipal agency, like NCWSC; while informal refers to management and regulation by informal Providers, governed by compound or by community management and regulation.

In the decade leading up to the Millennium Declaration in September 2000, two billion additional people worldwide experienced improved access to water sources. This declaration resolved to half the proportion of people without access to safe drinking water (UNICEF and

Organization 2012; Article III. 19.). While Kenya is regarded as the economic and business hub of East and Central Africa, the country struggles to provide basic water and sanitation to over 40 million residents (Water Services Trust Fund [WSTF], 2010). In absolute total number of Kenya residents with increased access to formal water services, Kenya has realized steady growth. From 1989 to 2009, Kenya doubled its population accessing formal water services. According to WSTF estimates, 13.4 million people accessed formal water services in 1989. By 2009, the number of people accessing formal water services reached 27.04 million (WSTF, 2010). While the Ministry for Water claimed steady growth between 1989 and 2009, the percentage of the population with formal water and sanitation steadily declined one percentage point (1%) every decade. However, informal Providers reached millions of additional people which formal services were unable to reach.

Table 2: Population with formal water services[1]

	Formal Water Services	**Absolute Population with Formal Water Services, in millions**	**Absolute Population with Informal Water Services, in millions**
1989	32%	13.4	3.0
1999	31%	20.0	6.9
2009	30%	27.04	7.7

1.2.2 Water and Sanitation Reforms

Knowing these achievements and challenges, water and sanitation reform in Kenya and in Nairobi promoted a shift in water governance and overall operations. This shift included a transformation of national structures and institutions, the development of new policies and strategies, and a renewed emphasis on improved customer service, participation, and pro-poor strategies (AWSB, 2011; Moraa *et al*., 2012; WSTF, 2010). The policies recognize the effort and capabilities of the network of pre-existing water and sanitation providers, who operate more informally than a centralised system. The previous, centralised system ignored the urban poor, and produced a pathetic situation for the urban poor, coping in an informal 'parallel state' (WSTF, 2010). This parallel state of water and sanitation provision minimally meets needs while producing high cost inefficiencies of increased leakages, low pressure, and unprofessional practices and procedures.

[1] Water Services Trust Fund (2010).

Understanding these circumstances help to explain the enactment of Government of Kenya Act Number 8 of 2002, also referred to as the Water Act of 2002. This act aimed to decentralise the system from the national level. Additionally, this policy allowed for provision of services to be separated from policy-making and regulatory mechanisms, while emphasizing service standardization and formalisation. Most relevant to this study, the Water Act of 2002 introduced a pro-poor focus for a first time. Funding mechanisms of WSTF backed this shift in policy direction, and faced the challenge of increasing by 500,000 new connections each year and increasing infrastructure by 38.2 billion Kenya shillings (2010).

These reform motivations were institutionalized and re-emphasized via external agents such as the 2010 UN Assembly on Water as a Basic Right, in which Kenya institutionalized the Water for All partnerships (UNICEF and World Health Organization, 2012). The Water and Sanitation Regulation Board (WASREB) of Kenya set the ratio of population with access to improved water and sanitation to the entire population as a key performance indicator, meaning measured success of water and sanitation development was not in growth of connections and infrastructure alone. Rather, measured success is in the percentage of the population reached by the interventions. Out of the increasing population growth, the Government of Kenya launched a Water Master Plan for Nairobi and the 13 satellite towns of Nairobi in 2011 (AWSB, 2011). This plan determined that Nairobi's infrastructure development failed to match population growth and housing density.

Simultaneously, the Master Plan seeks to alleviate infrastructural and technical challenges, including low pressure, leakage, corrosion, illegal connections, and vandalism (NCWSC and AWSB, 2009; AWSB, 2011). While the Water Master Plan for Nairobi launched in 2011, Nairobi's Master Plan for Sewer and Sanitation dates to a Nairobi City Council document from 1998. This plan focused on needs of increasing the sewerage network, but also noted social and institutional challenges including absent landlords, ever-increasing service demand, procedures to overcome physically built structures in the path of proposed sewerage lines, and in increasing the number of sewer lines (AWSB, 2011).

This changing political environment regarding water and sanitation demonstrates the shifting focus towards the challenges of the informal settlements. Despite this improved framework,

overwhelming challenges persist in water and sanitation provision. The World Health Organization and UNICEF Joint Monitoring Programme identified 10 countries which constitute two-thirds of the global population without improved drinking water. Six out of the 10 countries are in sub-Saharan Africa (UNICEF/WHO Joint Monitoring Program, 2012). Kenya is one of the top 10 countries with 17 million residents without access to improved water (UNICEF/WHO Joint Monitoring Program, 2012). Furthermore, 3 million of these 17 million without access are Nairobians. As for sanitation, Kenya again is among the top-ranking ten countries which depend on shared/public sanitation facilities. The devolved political governance framework in Kenya strengthens, regulates, and monitors the implementation of rights-based access to quality water and sanitation services (WSTF, 2010; Republic of Kenya Constitution, 2010), but records little measured success.

Despite the responsive policies and municipal plans to increase improved, formal water and sanitation in Nairobi, informal Providers remain the champions of water and sanitation provision in informal settlements. These Providers remain the primary suppliers in the informal settlements as formal, centralised Providers also struggle to reach this growing demographic. In acknowledgement of their own limitation in reaching those living in Nairobi's informal settlements, NCWSC's network intensification strategy burdens these same providers with the planning, implementation and provision of water and sanitation services. This network intensification strategy recognized and further reinforces the central role of informal Providers in supplying residents with their basic need of water and sanitation.

1.3 Problem Statement

WATSAN Portal: Kibera is a platform which assists local water and sanitation service Providers in information-sharing. In this study, CBOs and NGOs serve as the primary unit of analysis to assess how the Portal supports information-sharing among Providers. A common assumption about communication and information-sharing is that increasing communication leads to increased opportunities to share information with others. Furthermore, Batty's 1992 study generalizes that increased communication and increased sharing impacts decision-making in development policy-making, planning and implementation. In the case of WATSAN Portal: Kibera, it is assumed that the introduction of the Portal would increase opportunities for County government interaction with Providers, enhance Provider decision-

making, and has the potential to transform relationships between Providers and County government.

Emerging research, like that of Lindroos (2011) and Meier (2011), seek to measure the direct impact or reception of the increasing ICTs in Africa, supporting the notion that ICT introduction alters outcomes and relationships. However, additional research suggests that the developing country setting and urban informal settlement setting increases the prospective of institutional, technical, political, and infrastructural challenges (Batty, 1992; Hassanin, 2012; Heacock, 2009). This research traces how Users participate in sharing and seeking information, while equally recognizing benefits of and challenges to information-sharing among them. At its core, this research investigates how the information supplied via the Portal supports, or does not support User needs; explores how the Portal enhances User's patterns of information-seeking and information-sharing; and assesses the benefits and challenges to information provision.

1.4 Research Objectives

The objectives were as follows:

1. To assess how WATSAN Portal: Kibera supports information sharing among providers of water and sanitation in Kibera.
2. To determine information disseminated via the Portal.
3. To identify the characteristics of Users of the Portal.
4. To trace how Users of the Portal seek and share information.
5. To define the advantages and challenges to information-sharing via the Portal.

1.5 Research Questions

In exploring the WATSAN Portal: Kibera, this study raised five interrelated questions:

1. In what ways does the Portal assist local information sharing among local providers of water and sanitation services?
2. What information does WATSAN Portal: Kibera provide?
3. What are the characteristics of the Users of the Portal?
4. How do the Users seek and share information?
5. What are the advantages and challenges to information-sharing via the Portal?

1.6 Justification

This research project is relevant to current water and sanitation situation in Kibera and informal settlements across Nairobi. As water and sanitation services from informal Providers expands, understanding how Providers share and seek information throughout informal settlements becomes of increasing importance in supporting Providers who help the Government of Kenya to meet their Constitutional mandate whereby Article 56 states "the state shall put in affirmative action programs designed to ensure that minorities and marginalized groups—(e) have reasonable access to water, health services, and infrastructure." Kenya's goal is to ensure accessibility of water and sanitation to all by ensuring equitable distribution of water, sanitation and sewerage systems by 2030. Furthermore, the 2010 Constitution of Kenya delineates "the functions and the powers of the county" to include water and sanitation services. This framework places responsibility for the provision of water and sanitation into the hands of County government. In the case of Nairobi, Nairobi City Water and Sanitation Company has a limited ability to reach its mandates enacted through *Pro-Poor Policy of 2007* that guides their work in informal settlements. Therefore in the Nairobi's policy framework, informal Providers supports the realization of meeting the water and sanitation needs of communities and settlements.

This research assesses how the implementation of one ICT mechanism, WATSAN Portal: Kibera, supports information share among Providers. This research is critical; as according to NCWSC's policy, local level providers CBOs, NGOs, and entrepreneurs in Nairobi share the responsibility of water and sanitation provision in informal settlements. As such, informal Providers have great information needs which WATSAN Portal: Kibera aims to meet. This study interrogates the advantages and challenges to the Portal and use of information by Kibera residents. Such an assessment avails useful information for enriching the Portal, supporting Providers, and serving the information and communication needs of water and sanitation Providers in Kibera and in Nairobi informal settlements.

CHAPTER TWO

LITERATURE REVIEW

Information and communication technology (ICT) is dynamic, and constantly renewing itself to respond to the world in which it operates. Generally, it is difficult to pinpoint the future of use of and outcomes from ICTs from its original objective. For example, the introduction of social media was to enable people to connect via one-to-one communication online. However, 2011 Arab Springs demonstrated that new mediums for ICTs could be used for many-to-many information sharing that facilitated better planned and organized demonstrations. Such historical accounts compelled researchers like Lindroos (2011) and Meier (2011) to examine the real-world impact of citizen interaction with ICTs in Africa. Meier notes that many assume ICTs to be beneficial when in reality little research-based evidence exists to support this claim. At the same time, relevant studies of scholars like Hellström (2013) and Talja (2002) categorize and enumerate the types of ICTs and information sharing. Talja's study in 2002 of the nature of information-sharing communities and Hellström's study in 2013 of the East African ICT environment exemplify overly simplistic studies of ICT use. While the studies of Lindroos, Meier, Hellström and Talja make valuable contributions towards research in regard to defining the current ICT landscape, such previous research fails to take stock of information availability and how ICT interventions support or engage the community involved. Assessing how ICTs support communities is vital to understanding gaps between community information needs and the information available. In other words, looking at the objectives of ICTs against the information provided is a starting point to understanding in what ways such tools support or do not support communities and groups.

1.1. Theoretical Literature

This research hinges on two theories. The first theory is the emerging theory of Wampler and Avritzer (2004) on digital technology and good governance, which broadly reflects the association between digital technologies, deepened democracy, and improved governance. The second theory which informed this research, critical urban theory from the perspective of Marcuse (2009), focuses on how groups foster change through various forms of resistance, which includes cooperation, progressive resistance, and protest.

1.1.1. Participatory Governance

Since the 'third wave' of democracy that reflected a period of a peak in democratic transitions and deepened democracies in newly democratized states like those in Africa (Huntington, 1991), decentralization provided government reformers, civil society, and citizens with the ability to establish new institutional arrangements that incorporate citizens and civil society organizations in enhanced service delivery and political engagement. This redesign is known as participatory governance (Wampler and Avritzer, 2004). By UN Office of the High Commissioner for Human definition, governance refers to the manner in which "public institutions manage resources with due regard for the rule of law." Such actions include the general processes of decision-making and implementation of decisions and plans. More specifically, participatory governance examines the emerging interaction between public institutions and society in local decision-making and service implementation. In the case of WATSAN Portal: Kibera, the County government of Nairobi, civil society and the market are altering the ways in which they relate to one another via ICT intervention. At the center of this relationship is the provision and management of information as a resource to aid in planning and implementation. Furthermore, NCWSC's network intensification strategy serves as the foundation of this new arrangement as it emphasizes the participation of informal water and sanitation Providers – including entrepreneurs, CBOs, and NGOs – as central to pushing the state's agenda of basic water and sanitation for all. As such, this scenario follows Wampler and Avritzer's (2004) characterization of these new institutional arrangements as "accompanied by development of new political values and strategies that foster institutional renewal at the municipal level."

In the Kenyan case, during the period from the 1980s into the 1990s an unsteady history of over-dominating NGOs with limited effectiveness arose before the growth of a supportive NGO and voluntary community. According to Campbell (2008), "donor funding generally, and especially with regard to the NGO sector, sought to achieve a degree of leverage over the Kenyan state, but such an objective was undermined by limited cooperation until the late 1990s." This relationship more reflected a battle of agendas, power, and resources than government or NGO intention to complement the other in improving state-civil society capability, accountability, and responsiveness to citizen needs. Characteristic of the adverse relationship between civil society and government, current theories reflect this same segregation between the civil society and the state (Wampler and Avritzer, 2004). Most

discussions center on the state or civil society unsettling the other; as in the state's "demobilization of civil society in post-transition settings" or the "emergence of counter-institutional civil society organizations of a social movement type" (Wampler and Avritzer, 2004). In other words, history and traditional theories identify government and civil society organizations, like water and sanitation Providers, as opposing actors. Moreover, these theories define civil society by the degree to which the government demobilizes their efforts or the degree to which civil society demobilizes the government.

In contrast to the aforementioned theoretical and historical approaches, WATSAN Portal: Kibera exemplifies the negotiated space between these two actors. Unlike traditional theories, participatory governance "bridges unnecessary divide in debates between institutional and civil society theories" (Wampler, 2004). Participatory publics are responsible for engaging in participatory governance. This theory looks more at coordination and the supportive mechanisms enacted between the two actors, which recent history reflects. As The Paris Declaration on Aid Effectiveness in 2005 altered the adverse relationship between nongovernmental organization and developing countries governments (OECD, 2006), emerging development strategies are based upon coordinating government-driven, NGO-supported efforts. This international policy document placed developing countries like Kenya as the drivers of national development while NGOs align with national priorities and strengthen state capacity (OECD, 2006). Similarly, Nairobi's municipal-level policy via the network intensification strategy looks to increase and improve water and sanitation services through the support of small-scale Providers, or civil society actors, in informal settlements.

Main principles include how publics like civil society (1) act as generators, linking citizens to each other through bridging and bonding social capital, (2) include citizens into policy networks, and (3) expand contacts available to poor citizens (Wampler, 2004). While a number of researchers like Bang and Sørensen (1999) illustrate that the focus for participatory publics remains on democratic governance, or the political coordination and interaction of various stakeholders (Bang and Sørensen, 1999). This study focused on civil society actors as the main actors in linking citizens because through the actors a new arrangement for information provision emerged. For these reasons, this research utilized theory of participatory governance to assess how such new arrangements support information

sharing among Providers from civil society, to characterize the actors from civil society, and to determine advantages and challenges to this new arrangement.

1.1.2. Critical Urban Theory

This theory draws from Lefebvre's interrogation of who owns the city, and advances the argument through identifying how citizens negotiate this process. Marcuse (2009) notes that there must be those that 'demand' rights and those that 'cry' for rights. Those that 'demand' are among the most deprived - with the most unmet needs and in the most want. In the case of water rights in Kenya, the 2002 Water Act introduces devolved water management institutions to govern improved water and sanitation provision. However, water as a right was not introduced as policy until the enactment of the Kenya Constitution 2010. While the right for water was enacts in a top-down approach, cases of citizens demanding their rights emerges one year later. In 2011 the High Court of Embu, Kenya upheld water rights judicially. In Ibrahim Sangor Osman v Minster of State for Provincial Administration & Internal Security (2011), 1,123 citizens petitioned the provincial administration, and the judge reasoned that citizens were entitled to reasonable standards of sanitation and to clean and to safe drinking water in adequate quantities. This case was a milestone in ensuring water and sanitation for ordinary citizens, who were among the most deprived.

Those that cry are superficially integrated into society - beneficiaries of the system, but are also alienated from opportunity. Currently, this could be illustrated via modern social revolutions; whereas the deprived force (or *demand*) the fall of regimes, yet the alienated shape (or *cry*) future politics or regimes. Work in critical urban theory illustrates how citizens and social organizations move from daily protest or social movement protest to practical program in order to stabilize one's alternative practice. In the Kenyan example, the civil society and citizens demanded water and sanitation as essential human rights in the period leading up to its Constitutional recognition in 2010. However, Marcuse (2009) believes that this daily resistance is counterproductive to progressive resistance as it maintains the overarching system that excludes many and benefits few. A group can only engage in such a process if they expose the issue and its roots, propose targeted alternatives (projects or programs), and then politicize support or action for implementation. WATSAN Portal: Kibera is such a mechanism, exposing information regarding water and sanitation in Kibera, proposing collaborative alternatives and relationships. In this study, the patterns and

nature of information-sharing demonstrates the development of practical program and mutually beneficial relationships within the realm of progressive resistance.

2.2 Empirical Literature

2.2.1 Increasing Information, Communication and Technology

Much ICT research captures a snapshot of a specific area ICT research in a specific geographic location. Hellström's research enumerates ICTs for development in East Africa – inclusive of law enforcement and safety to agricultural services. After identifying over 30 projects or applications, he raises a conclusion which questions whether the existence of modern ICTs warrants their integration (2012). Generally, it is understood that ICT has the potential to enhance communication and increase information availability. Yet historical accounts do not reflect the same notion. For example, the invention of the printing press technology centuries ago is associated with advancing democratization as information and literature was able to spread more quickly. Conversely, Sharky (2008) describes the invention as "breaking more things than it fixed." This innovation is known for having placed Europe into an extended period of "intellectual and political chaos," not culminating until one century later. Similarly, the time leading up to the Ugandan and Kenyan elections of 2006 and 2007, respectively, mobile phones were used as a device for communicating political messages to mass audiences (Hellström, 2012). While Hellström's study categorizes and describes several dozen projects which are specific to ICT-supportive structures in East Africa, it also highlights post-election Kenya of 2008 in which continuous dissemination of falsified and exaggerated information via common forms of ICT technology heightened social and political instability (Goldstein and Rotich, 2008; Morozov, 2011). This situation exemplifies advantages and challenges presented by emerging ICTs. In the example of Kenya, ICT had destabilized the country yet the simultaneous development of new mediums, like Ushahidi, provides improved channels for information-sharing during an evolving crisis situation.

In a development planning context, Environmental Systems Research Institute (ESRI) and UN Human Settlements Programme's (UN-HABITAT) 1000 Cities Geographic Information System Program uses the studies of Jan Turkstra and Martin Raithelhuber's study (2004) on urban slum monitoring as the foundation for slum upgrading work. Their work closely observes GIS use in growing cities in of developing and transition countries. Turkstra and

Raithelhuber (2004) argue that "aggregation of data at the city level hides the stark contrast of income and living conditions between better-off urban citizens and the urban poor by providing a single figure." Furthermore, their study of full data coverage and sample household surveys of key indicators (access to improved water, access to improved sanitation, security of tenure, durability of housing, and sufficient living area without overcrowding) in Nairobi, Kenya and Addis Ababa, Ethiopia indicate disparities not only within cities but within slums. As a result, Turkstra and Raithelhuber's study shows that detailed area-specific information aids in visualizing socio-economic and physical characteristics of a population and as an indicator of their quality of life. Similar to the intervention observed in this study, WATSAN Portal: Kibera disaggregates city-level data regarding water and sanitation in order to provide highly localized information for Project planning and implementation in Kibera. Moreover, this intervention brings this information to citizens and civil society and facilitates interaction which further enables use of the information in Kibera.

2.2.2 Nature and Environment of Information Sharing

Increasing the availability of and access to information does not necessarily lead to improved support of communities and groups which could use this information. However, the movement of information, or how information is spread and shared, reflects the helpfulness of particular types of information aids a group or community of people, the norms of information share and seeking, and the advantages and the challenges to information-sharing.

In a 2002 study, Talja's research seeks to understand the nature of information-sharing in academic communities. Rather than studying the impact, Talja (2002) looks at the culture, norms, and behavior that academics and academic departments invoked towards the share and non-share of information. Talja collects data through ten informal, semi-structured interviews of researchers (leaders, researchers, and doctoral students) from each academic departments participating in the study. As the study surveys cultures, norms, and behaviors, group information-seeking activities were identified and thematically coded into five levels of information sharing: strategic sharing, paradigmatic sharing, directive sharing, and social sharing. Also, information sharers were typed into five characterizations of the extent in which they engaged in collective sharing or seeking of information, including: super-sharers, sharers, occasional sharers, or non-sharers. While Talja's 2002 study compartmentalizes

sharing and sharers, this study of WATSAN Portal: Kibera seeks to demonstrate the value, advantages or challenges in various actors in water and sanitation information sharing in Kibera. Nevertheless, this study utilizes a key perspective of Talja's study, which illustrates that information share cannot be studied independent of the community which shares the information. Talja shows that studies on information share should rather be studied in some context – a shared culture, a domain, discipline, research topic – as it is created, defined, and transformed via a group. Therefore, as reflected in this study of WATSAN Portal, the researcher focuses on the context of water and sanitation provision by Providers in Kibera.

While Talja's contextualization of community- and group-share of information provides valuable insight, more commonly studies, similar to studies by Lindroos (2011) and Meier (2011), seek to measure the impact of the act of information sharing by way of new ICT mediums. Lindroos (2011) study details the audience reception and use of information via online communications during post-election Kenya in 2008. Meanwhile, Meier (2011) focuses on the transformation of power relationships between citizens and the state in his case study of Egypt and Sudan.

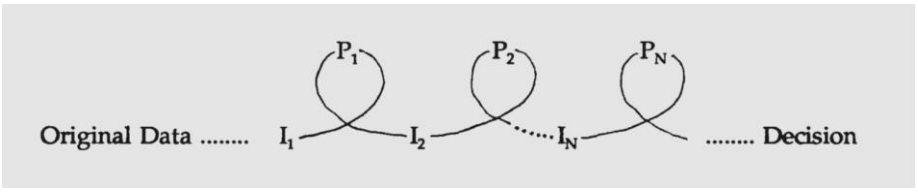
In 2011, Lindroos of University of Amsterdam conducted a reception study inquiring how uncontrolled communication impacts peace in Kenya. Primarily, the study utilizes a reception study method to collect data from audiences affected in order to understand how media and communication impact the political and social environment in context. Specifically, the research wishes to give way to understanding the meaning of social media. Respondents note that such space for dialogue helps them to "know what happened and the effects" (Lindroos, 2011) as it allows citizens to highlight salient issues in a more transparent, efficient manner than traditional media. At the same time, many respondents note the danger in being too transparent or confrontational opposition to the government. The study highlights the influence of peer groups, or similar individuals or organizations, communicating in similar channels. As a result, the study illuminates a sense of apprehension from the Government of Kenya through its attempts to control the free flow of information.

States and civil service have introduced information and communication technology (ICT) to support improved government-citizen communication. In turn, Meier acknowledges that

innovators and implementers of emerging ICTs assume that their adoption will enhance state capability, accountability, and/or responsiveness. Meier's 2011 study on whether 'liberation technologies' change power relationships between state and society questions whether the addition of such technology has been overly "romanticized." Meier further argues that this romantisation of ICT technology comes with little empirical support for such claims. His research characterizes digital information technology itself as a determinant to outcomes as it provides new forums for discussion and has the ability to support political and non-political decision-making. In other words, Meier specially notes that a country with a strong civil society, but with limited or no digital society would probably have different outcomes from a digital or 'wired' society. A previous study by Howard (2010) concludes that "this infrastructure [digital information technology] has an impact on the opportunity structures for political change and the range of possible outcomes" (Meier, 2011). While ICTs appear as a mere technology to some, its rapid maturation around the continent of Africa is cause for deference. Social media, with the original intent to connect people, has realized rapid maturation through its use to share alternative forms of media and information and its ability to spark political action across the developing world. This study surveys if and how the introduction of new a new ICT, WATSAN Portal, advantageously improves civil society-institutional relationships.

At the same time, Batty (1992) explores how information systems impact society. The research looks at how information systems are evolving through technological change and at the hands of society. One of the primary assumptions which Batty shares is that past studies of information sharing are not relevant to current concerns of the topic. The study utilizes comparative studies and case histories to understand how information systems impact society. Specifically, these concepts are measured through evaluating the impact of GIS on decision-making. First, Batty's study (1992) identifies a pipeline model, which begins with raw data transformed into information. In turn, this information (I_1, I_2, I_3,…) undergoes a continual process (P_1, P_2, P_3,…) towards decision-making (Figure 1).

Figure 1: Data to Decision-Making Pipeline Model



From this point, the research then turns to understanding the 'sharing paradigm' within this pipeline process. In this regard, the researcher then looks at the role of geographic information systems (GIS) relevance to decision-making and information-sharing. While Batty highlights that in the Third World context poor infrastructure and organizational development might be a barrier to explicit sharing; the research generally notes that as a result of increasing communication between groups with interest in GIS use, sharing opportunities also increase. On the other hand, case studies on the application and use of information systems in Third World Planning agencies are limited, but reveals that the major problems of information systems are mostly organizational and institutional rather than technical. As a result, issues with the power elite, donors and aid, poor bureaucratic control of continual data collection impedes information sharing effectiveness in developing countries.

These studies shed light on how audience interacts with information towards shaping opinion and enhancing decision-making. Overall, context plays a key role in each study. While Hellström's study enumerates ICTs in East Africa and Talja's study specifically compartmentalizes types of information-sharing, these studies bring very little to bear in regards to how different forms of information-sharing operation in terms of use, adoption or impact. Meanwhile, generic large-N studies has a limited ability to address research concern because deduced to a very generic depiction of ICT use as opposed to understanding the mechanisms which support these communities. To an extent, Meier's study does the same, but his research takes an additional step through the use of semi-structured interviews as to really understand how individuals and groups use technology and how the increased use of ICTs impacts groups or countries. Batty's study brings to bear the context and demonstrates that the increase in communication simultaneously increases opportunities for information share. Despite the study's focus on developing countries, Batty's use of comparative analysis and case study towards the topic brings to question its applicability to Nairobi and to informal settlements. This study seeks to build upon this previous research through surveying information shared through WATSAN Portal by looking at the information provided, the share and the advantages and remaining challenges of such information share through its use in the informal settlement, developing country context.

CHAPTER THREE

METHODOLOGY

3.1 Research Design

This research applies qualitative methodological approaches. With the use of cross-sectional design, the study analyzes Users of WATSAN Portal: Kibera in order to understand the how Providers engage in information-sharing. This research design charts how the information supported the network water and sanitation providers from July 2013 through August 2013 in Kibera.

3.2 Study Site

Fieldwork for this study is conducted in Kibera Informal Settlement of Nairobi Area, Kenya, approximately 5 kilometers from Nairobi city center. Nairobi's water and sanitation resources supports three million residents, two million visitors, and a growing industrial sector. Additionally, of the 400,000 new Nairobi residents annually, 250,000 are low-income (WSTF, 2010) and have limited resources and capacity to acquire improved water and sanitation. In Kibera, approximately 500,000 to 700,000 people[2] reside in its 13 villages, a settlement of approximately 2.38 square kilometers. Estimates suggest that densities of Kibera reach 2,300 people per hectare, which leaves very little space planned or developed for water and sanitation services.

This study selects WATSAN Portal: Kibera for study as this platform is the first WATSAN Portal to be implemented for informal Providers, seeking to be scaled up and replicated in other informal settlements in the world. Providers are the main entities in Kibera that shares information the enables the planning for and implementation of water and sanitation for people. In this study, a *Provider* is any person, grouping of people, or organization that provides water or sanitation in Kibera. Of the innumerable Providers in Kibera, approximately six (6) Providers of water or sanitation services serve as key Users. In this study, a *User* is a Provider that interacts with WATSAN Portal: Kibera. The key Users that are identified in this study included: Carolina for Kibera, Haki Water, Kounkuey Design Initiative, Maji na Ufanisi, and Umande Trust.

[2] The population of Kibera is debatable, with estimates ranging from over one million to a few hundred thousand.

With the assistance of Spatial Collective, the technology company that developed the Portal, and the Informal Settlements Department of NCWSC, the researcher purposively selects Providers and Portal Users in this study. Generally, a review of the information shared via the Portal informs the interviewing of Users and Providers.

3.3 Sampling and Unit of Analysis

For the research to appreciate the contributions of WATSAN Portal: Kibera in improving water and sanitation efforts, there are two phases to this research. First, the study identifies information available to Users. Specifically, the researcher analyzes the information which the Portal provides online as a primary source by characterizing the information available and determining whether it meets User needs and the extent to which the Portal supports the network of informal water and sanitation Providers who served as the population of the study.

This population of informal Providers of water and sanitation services includes CBOs and NGOs that operate in Kibera. Since this research focuses on the Users that share information via the Portal, the unit of analysis is Providers of water and sanitation in Kibera. They consist of about six (6) small-scale service providers in Kibera. Portal Users and local Providers whose core activity largely includes providing Kibera with water and sanitation services are purposively selected to be interviewed for the study. These Portal Users and Providers are identified with the help of Spatial Collective, the geo-spatial mapping technology company, and NCWSC. Spatial Collective helped to identify the WATSAN Portal Users, while WATSAN Providers at large were largely identified by NCWSC. For each organization, the person who specifically leads the planning and implementation of a water and/or sanitation project were interviewed as the organization's key informant.

3.4 Data Sources and Collection Methods

The independent variable in this study is the information sharing among Providers. The dependent variable is the ability of the Portal to provide support to Providers. The unit of analysis is the Provider of water and sanitation in Kibera.

Each research question is guided by the following: (a) the data needed (qualitative or quantitative), (b) the data sources required, and (c) the instruments necessary to meet the

research objectives (Table 3). It is therefore imperative to evaluate the bearing of each on the questions for this study, which explores the information share across the WATSAN Portal: Kibera.

Table 3: Data Needs and Analysis

Research Question	(a) Data Needs	(b) Instrument	(c) Analysis
1. What information does WATSAN Portal: Kibera provide?	- Identify existing information/data - Importance of information	Interview Guide of Users (Appendix II)	Thematic Analysis
	- Identify existing information/data - Classify type of information/data and its structure within Portal	Review of Portal Content	Thematic Analysis
2. What are the characteristics of the Users?	- Type of User & Characteristics of User (entrepreneur, CBO, or NGO) - Objective of User - Expectations of User - Needs of User - Use/Interactivity of Information for User - Computer availability/accessibility - Technology availability/accessibility	Interview Guide of Users (Appendix II)	Univariate Analysis
3. How do Users share and seek information?	- Needs of information dissemination - Needs of information seeking - User interaction with information - User methods of information sharing and information seeking	Interview Guide of Users (Appendix II)	Thematic Analysis
4. What are the advantages and challenges to the Portal?	- Tasks achieved by participant via information-sharing. - Manner in which information use supports objectives. - Explicit information and sharing barriers for participants. - Gaps of information needed for objectives and to meet user expectation.	Interview Guide of Users and Providers (Appendix II and Appendix III)	Univariate Analysis, Thematic Analysis

In identifying the information provided by the Portal, this study reviews the content by capturing and cataloguing the content on the website in a first phase of research. The study applies desktop review to determine what information is shared across the Portal and how it enhances Provider information sharing.

To characterize the Users of the Portal and water and sanitation Providers, this study gathers qualitative information by using a semi-structured interview guide (Appendix II – WATSAN Portal User Key Informant Questionnaire). In addition to understanding the background of the User and the Provider, the study also interrogates the needs of and interactivity among Providers. For these interviews, the study identifies key Users and Providers in order to understand general needs and also to understand needs unique to Providers not engaging in

the Portal use. After identifying Users and Providers, four key Users of the Portal and nine Providers who do not use the Portal were identified (Table 4).

Table 4: Users and Providers of WATSAN Portal: Kibera

Users		Providers
Kounkuey Design Initiative (KDI)		AMREF
Maji Na Ufanisi		Empowerment to the Community Foundation
Umande Trust		Mashimoni Youth Group
Water and Sanitation for the Urban Poor (WSUP)		Mbuvi Self Help Group
		New Nairobi Dam Community Group
		PEEPOOLE
		Riverside Usafi Group
		Soweto Usafi Group
		Tosha I

To trace how users share and seek information, interview guides determines any shared norms in regards to how the network of Providers shares or seeks information.

Finally, to evaluate the extent to which WATSAN Portal: Kibera contributes to supporting Providers, the study uses an interview guide to determine how the Portal aids information-sharing, and enhances information-seeking and information-sharing norms that meets the needs of Providers. At the same time, this study seeks to understand the limits and barriers to use of this publicly available information. The main aim is to understand Portal benefits and to identify gaps between content available and Provider needs. Table 3 outlines data sources and collection methods which the study used.

3.5 Data Analysis

For the first phase of desktop review, analysis characterizes information provided to Users and ascertains the collaboration between community-generated knowledge and NCWSC data. This data was studied through content analysis of accessible Portal information. In the second phase, notes from interviews are analysed to understand patterns and variations among Users and Providers in order to characterize the sharing of information. Interviews were analysed through univariate and thematic analysis. Thematic analysis is used to describe and record common patterns of the Users and Providers in regards to the aforementioned research questions.

CHAPTER FOUR

Information Sharing Among Providers through WATSAN Portal

4.1 Introduction

This chapter presents findings about the ways in which WATSAN Portal: Kibera supports local Providers of water and sanitation in information sharing. This chapter has five sections. The first section is a review of the information that WATSAN Portal provides. The second section describes the characteristics of Users of the Portal. The third section outlines the patterns that the organizations of Users and Users' Organizations utilize when seeking and sharing information. The final section identifies the advantages and challenges of the Portal for water and sanitation Providers.

4.2 WATSAN Portal: Kibera Information Provision

WATSAN Portal: Kibera is an interactive information tool for public use. It provides information about (1) locating municipal water and sewerage in Kibera, (2) identifying the process and channels for municipal service linkages, and (3) sharing alternative sewerage options. The general purpose of WATSAN Portal: Kibera is to increase access to information about improving formal water and sanitation facilities in Kibera. The development of this Portal is sponsored by Rockefeller Foundation, whose mission is to expand opportunity and to strengthen resilience to social, economic, health and environmental challenges among communities throughout the world. Portal development began in 2012 with the coordination of NCWSC and two local organizations: Spatial Collective, a geo-mapping and technology company, and Kounkuey Design Initiative (KDI), nongovernmental organization implementing water and sanitation projects in Kibera.

WATSAN Portal: Kibera is a first version information and communication technology portal that brings information to current and future Providers of water and sanitation in Kibera. As an informal settlement, municipal water and sewerage services are highly decentralized, which means that it is through informal service providers that formal water and sanitation services reach the urban poor residents of Kibera. Specifically, Nairobi City Water and Sewerage relies on these informal Providers in informal settlements to ensure water and sanitation provision. This Portal shares public, NCWSC information for informal water and

sanitation Providers to increase ability to provide improved water and sanitation of User-identified locations in Kibera.

The main issue that this website seeks to address is the lack of publicly-accessible, transparent, credible, and specific information about improved[3], formal[4] water and sanitation (Table 1, Section 1.2.1). This Portal is made for informal, small-scale Providers in Kibera, which are civil society organizations and private individuals that plan and implement water and sanitation Projects. Providers that use the Portal are referred to as Users in this study. For this study Spatial Collective, the technology partner that developed the website, identified six key Users: Carolina for Kibera, Haki Water, KDI, Maji na Ufanisi, Umande Trust, and Water and Sanitation for the Urban Poor (Table 4).

When a User of the Portal provides the location of a new or existing Project, the Portal disseminates water and sewerage information that assists in project planning. The Portal sources information from formal, centralised NCWSC data to generate user-specific and location-specific information. The use of this institutional information highlights a key objective of the Portal: to increase formal connections with NCWSC through informal Providers. These informal Providers include NGOs, CBOs, and private individuals. Unlike the historically centralised institution of NCWSC, the Portal's audience has not historically been included in centralised efforts to improve water or sanitation in Kibera. NCWSC's innovative network intensification strategies are poised to extend the reach of formal, centralised efforts throughout Nairobi informal settlements through pervasive informal Providers. These informal Providers provide water and sanitation services in areas of Kibera, which are difficult to access by County government agencies or agents not from Kibera. While Providers can use Portal information to develop formal, municipal water and sanitation for residents of Kibera and support NCWSC Network Intensification Strategy; one of the key challenges to the information's usefulness is the human resources which NCWSC requires to maintain up-to-date information within the Portal. Currently, main communications and updates are routed via KDI and Spatial Collective, the two partners in the tool's development.

[3] Improved water and sanitation: refers to the infrastructure of the facility and the source of the water or the method for the discharge of the sewerage. See Table 1 for a complete list of improved/unimproved water and sanitation categories (WHO/UNICEF, 2012).

[4] Formal water and sanitation: refers to the public management in provision and regulation of water/sanitation. In this research formal refers to management and regulation by a municipal agency (i.e. Nairobi City Water and Sanitation) as formal; while informal refers to management and regulation by informal service providers, governed by compound/community management and regulation.

The technology developer of WATSAN Portal: Kibera is Spatial Collective, a company that uses Geographic Information Systems for community development. More specifically, Spatial Collective provided services in data collection, data visualization and communication, and community engagement. This group engages in locally-led data collection which help communities understand its own challenges and opportunities. The Kibera-based nongovernmental organization was KDI, which works in the area to improve infrastructure and water and sanitation in Kibera. This organization provided on-the-ground knowledge of water and sewerage implementation in Kibera. Finally, the owner of the official municipal records used for the framing of this Portal is NCWSC, the County authority on water and sanitation services and of the information provided. This company released this information for public use through the Portal. The use of NCWSC as a source ensures that the website shares credible and accurate knowledge about developing formal, improved water and sanitation.

With WATSAN Portal: Kibera, NCWSC, Spatial Collective, and KDI engaged in extensive consultation with community groups and nongovernmental organizations working with these issues in Kibera. These community groups have local and relevant experience in the direct planning of and implementation of water and sanitation projects. The following sections discusses the information provided via the Portal.

4.2.1 Locating municipal water and sewerage in Kibera

The focus of the Portal is to provide specific information about improving water or sewerage for User-identified locations in Kibera Informal Settlement. The User can use one of three different channels to identify water and sanitation locations, namely: (1) via searching for popular landmarks within the settlement, (2) via exploring the map of Kibera with the zoom feature, or (3) via keying in Global Positioning System (GPS) Coordinates (Figure 2). The Portal assumes that Users have a basic knowledge of Kibera, either through GPS or general familiarity of landmarks and pathways/roads in Kibera.

Figure 2: Methods for Identifying Water/Sanitation Project Location

4.2.2 Sharing municipal process and alternative options for sewerage

The website shares alternative, decentralised approaches for sanitation. Approximately half of Kibera in square meters is able to connect to municipal sewerage, while the remainder is unable to connect to municipal sewerage (Figure 3). Physically, these areas that are not capable to connect because the municipal sewer infrastructure sit above the elevation of the identified Project location. For the areas where connection to municipal sewerage is feasible (Figure 3, in green), a compound or a sanitation facility are capable of connecting to municipal sewerage infrastructure. After payment for initial connection, this sanitation strategy ensures that solid waste leaves Kibera at no cost thereafter.

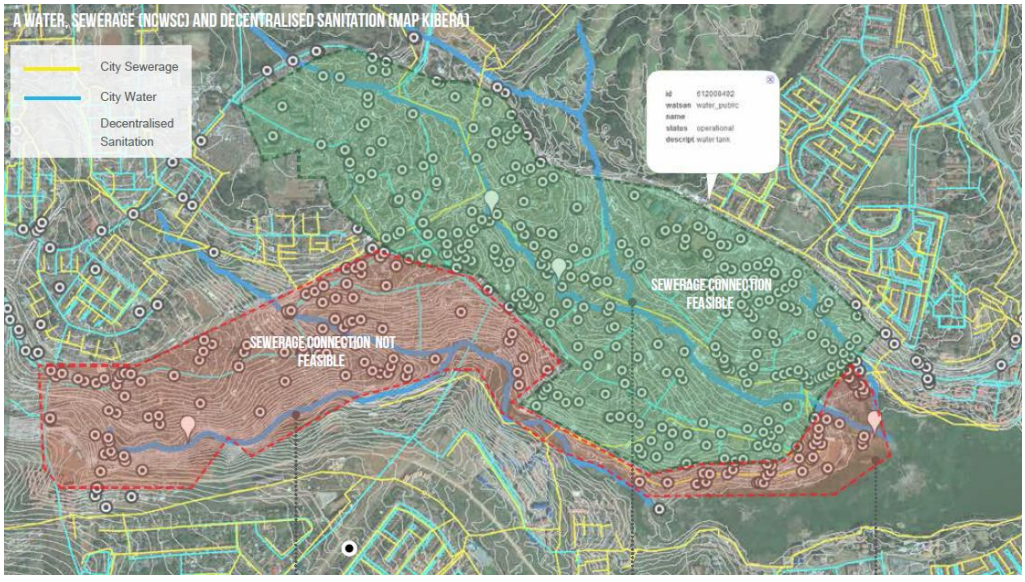
The Portal provides three pieces of information to help informal Providers carry out improved Projects with NCWSC. This information includes: the location of the NCWSC Office for Kibera, the required documents for the Provider's application with NCWSC, and the process to connecting. In addition, the Portal gives a direct link to NCWSC's website. This process of connecting to the municipal infrastructure requires that the Provider files an application with NCWSC and pays a one-time processing fee. The applications requires a copy of identification, a copy of PIN certificate, a passport photo, proof of land ownership, and a map of the location of the Project seeking a connection. Proof of land ownership can

be in the form of title deed, Land Registration Number (LR No.) of plot, or a letter from the Chief. Thereafter, NCWSC sends a team to verify the Project location and confirms a feasible connection, and the Provider implements a project under NCWSC advice.

In these areas where connection to municipal sewerage is not feasible (Figure 3, in red), a Provider must determine an alternative strategy for compound or a sanitation facility. Because a formal option is not achievable via NCWSC's centralised sewerage infrastructure (Table 1, Section 1.2.1), sometimes Providers opt to implement informal, unimproved sanitation options, like unimproved and poorly-ventilated pit latrines or pour flush toilet channeled to open drainage or to the river. Other times, residents employ their own strategies of "flying toilets" or open defecation as sanitation options.

Nevertheless, while it is impossible to provide formal sewerage in these areas, it is possible for these areas to deliver 'improved' sanitation options (i.e. septic tank, bio-gas toilet or composting toilet). A combination of the harsh environmental conditions of Kibera and the limited technical and financial capacity of residents and private Providers causes these 'improved' options to be less feasible than unimproved sanitation options.

Figure 3: NCWSC Water, Sewerage, and Decentralised Sanitation Map



WATSAN Portal: Kibera lists the responsible, decentralised alternatives like septic, bio-gas, and composting toilet options. These options are improved despite operations outside the

formal, County government system. The improved sanitation alternatives are ones which a User could consider. However, the provided alternatives does not directly link Providers or residents to the relevant contacts or technical or financial resources that would them to implement one of these few improved, decentralised alternatives.

4.3 Characteristics of the WATSAN Portal Users and User Organizations

This study is concerned with how this Portal supports information-sharing among Users. To meet this aim, understanding who is involved and who communicates is required to understand in which ways Providers throughout the Kibera relate to one another. This section describes the four Users, who are staff of small and medium non-governmental organizations that provide water and sanitation in Kibera.

4.3.1 Education and Training of Users

Education is usually referred to as formal teaching or training under the guidance of an educator – a teacher, lecturer, or trainer – disseminating knowledge and skills. Previous study (Czaja et al., 2006) indicates that technology use is correlated to one's skills, knowledge, and experience, collectively known as crystallized intelligence. In this study, each of the four Users have a university education at a minimum. Two of the four Users have advanced Master's or postgraduate degrees. Moreover, three out of four Users, have received additional training in water and sanitation. Considering education in this study is important because information and technology can equally be used as an instrument for building democracy or forging domination (Boeder 2012). However, if only those of degree-holding educational achievement are able to make use the Portal and its information, then the instrument could have limited capacity to shape democracy and increased potential to become a tool of domination.

4.3.2 Number of employees in User Organizations

The number of employees illustrates the human capital of the organization and demonstrates an organization's capacity and size. The four Users' Organizations have employees ranging from 11 to 72 employees (Table 5). According to the definition of small and medium enterprises in Kenya, the organizations with 10 to 49 employees qualify as small enterprises, and the organizations with 50 to 100 employees would qualify as medium enterprises. Generally, large organization have significant operating budgets and human resources to

implement improved, formalised water or sanitation facilities in Kibera. This study includes two medium organizations – KDI and WSUP – and two large organizations – Umande Trust and Maji na Ufanisi. This suggests that the medium and large organizations are most ready to use and to absorb Portal information for the purpose of water and sanitation planning and implementation.

Table 5: Number of employees, by User's Organization

User's Organization	Number of Employees
Kounkuey Design Initiative (KDI)	11
Water and Sanitation for the Urban Poor (WSUP)	16
Umande Trust	60
Maji na Ufanisi	72

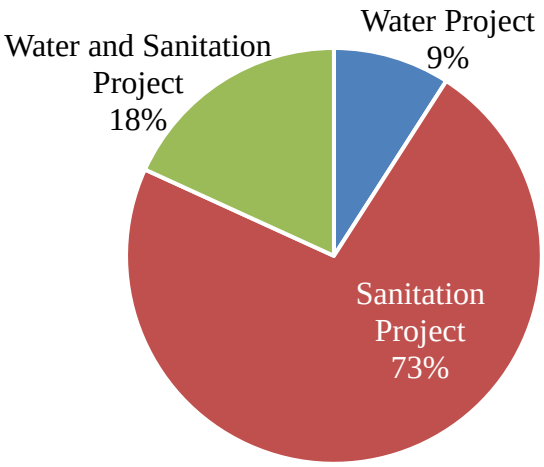
4.3.3 Types of Projects by Users' Organizations

Types of projects refers to the recent water or sanitation projects that Providers implement in Kibera. In this study, the types of projects implemented is as important as the Provider because project types establish the information needs. These Projects have been planned and implemented by Users' Organizations prior to the intervention of the WATSAN Portal. Some of the projects are formal, in partnership with County government agencies; while others are not in partnership with County government agencies but provide improved alternatives. These NGOs support community based organizations or residents in implementing or funding a water or sanitation project.

Three types of projects emerged: sanitation projects, water projects, and water and sanitation projects. Sanitation projects include facilities connected to municipal sewerage infrastructure at the compound-, school-, and community-level; and improved, decentralised alternatives in locations that are unable to connect (Figure 3**Error! Reference source not found.**, in red). econd, a water project is a project established for the sale of water from formal water sources (i.e. NCWSC) to the local community. Lastly, a water and sanitation project provides both of the previously described facilities – an improved, centralised or decentralised sanitation facility and the sale of or use of water. Of the 11 recent projects implemented by the Users' Organizations, eight of these projects are sanitation projects, and one of the projects is a

water project. The final two of the 11 projects are water and sanitation projects. Figure 4 illustrates the dissection of these projects.

Figure 4: Types of Projects

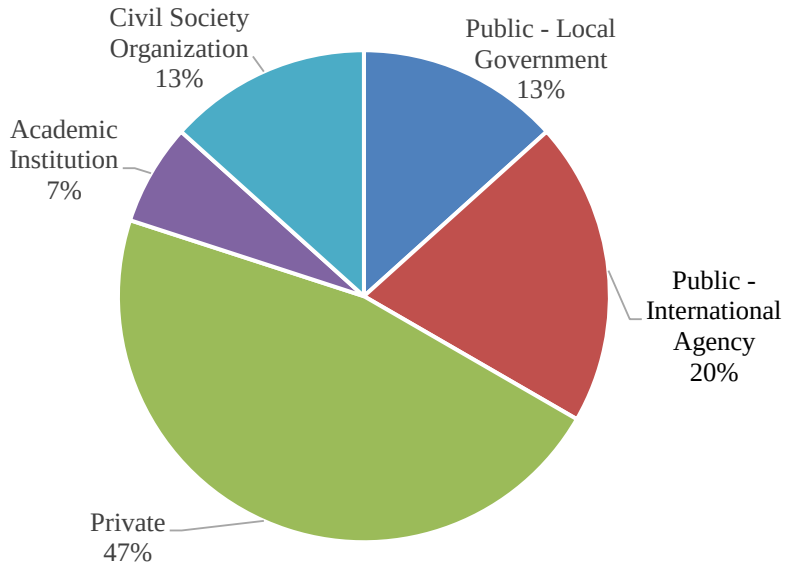


The quality of the projects varies. With 11 out of 13 projects in operation, these projects are functional, currently used facilities. Two of the projects are not operating as they are still in progress and overcoming challenges in becoming improved and/or formalised facilities. One of the non-operating projects is a WSUP sanitation project while the other is a KDI water project. In terms of improved facilities, this study observed the following: all of the operating sanitation projects are improved sanitation facilities, either with infrastructure connection for municipal discharge or an alternative decentralised method; each of the operating water projects are improved water facilities; and each of the two operating water and sanitation projects include improved water and improved sanitation.

Whether improved or unimproved, water is required for most improved sanitation options. Sanitation facilities in this study which require water included: piped, pour flush toilet connection to the municipal sewer system, decentralised connection to a septic tank, or decentralised biogas-toilet system. Three facilities – two facilities of Maji na Ufanisi and one facility of WSUP – had both improved water and improved sanitation. One of Maji na Ufanisi's facilities and one of WSUP's facilities offers public access to water and to sanitation. However, one of MNU's facilities which only offers public sanitation services, yet this facility does not offer public water services even with access its access to formal, improved water for the operations. This Project arose as the only case in the study where an improved sanitation facility also included improved water.

In terms of sponsorship, seven out of fifteen of the Project funding sources included private funds, comprising foundations, private donors, corporate organizations, and household contributions. Of these seven, each funding source was from foundations or private donors, with the exception of one funding source for WSUP, where the community aided in funding the project. Additionally, public entities funded or partially funded five out of fifteen, approximately two-thirds, of the Projects. Public funding sources include county-level government, including Athi Water Service Board (AWSB) and NCWSC, for two of the projects, as well as bilateral and multilateral donor agencies, including UN-Habitat, USAID, and AUSAID for three of the projects. Three projects – one WSUP project, one Umande Trust Project, and one Maji na Ufanisi project – identified support from bilateral/multilateral agencies. Furthermore, one Umande Trust project identified support from local county government. A fourth project identified support from a multilateral agency and from the local Athi Water Service Board. Only in one instance of a project, by MNU, was a project funded by an academic institution, an American university, and by a Civil Society Organization. Figure 5 illustrates the sources of funding for the Projects of the Users' Organizations.

Figure 5: Source of Project Funding



Generally, these findings illustrate that private entities and public international agencies fund the majority of Projects. Private donors, foundations, or agencies like UN-Habitat or bilateral agencies funded two-thirds of Projects. Meanwhile, local government entities that directly

work with water and sanitation like AWSB and NCWSC fund or donate in fewer instances. Again, the limited role of such agencies to support such Projects with resources highlights a key concern in terms of implementation of identified policies and strategies of AWSB and NCWSC in meeting water and sanitation needs in informal settlements. For example network intensification relies on collaboration between informal Providers implementing and increasing improved, formal water and sanitation initiatives as their reach is limited in informal settlements. Despite policy mandates and identified strategies, this study finds that Projects of Users' Organizations have limited resource-backing of local government agencies working with water and sanitation planning and implementation.

The primary beneficiary of these projects is the community. Of the 11 recent projects, Users recognize three beneficiaries: (1) community residents, (2) children, and (3) households. Eight User Projects identifies the community as their primary beneficiaries. Community facilities usually means compound-specific or an income generating toilet for any customer needing services. Two Projects co-identify children and the community as their primary beneficiaries. These facilities are usually within a schools' skills. One Project of WSUP identified beneficiaries as households. This Project specifically refers to WSUP's new program which assists compounds to formally connect to the sewer.

4.3.4 User Organization Access to Technology

This study interrogates access of the Users and of the Users' Organizations to technology. Access to technology included access to computers and other forms of technology, including mobile devices, GPS, Internet and ICTs. The Portal is an ICT; thus this characteristic is important because it measures the access to ICTs in general. Table 6 provides information on the four Users. It demonstrates that each of the four Users' Organizations have access to computers, using computers on a daily basis and owning a minimum of 4 computers. While each User acknowledges the role of the private donors in providing resources for computers, two of the Users' Organizations also noted that public, multinational agencies provided resources for computers in the Users' Organization.

Table 6: Access to Technology/Devices

	Number of computers	Sponsor	Mobile	Internet	GPS	Bluetooth	Camera	Data Management	ICT
KDI	4	Private	**x**	**x**	**x**	**x**	**x**	**x**	**x**
WSUP	5 or more	Private/Public	**x**	**x**	**x**	**x**	**x**	**x**	**x**
Umande	5 or more	Public/Private	**x**	**x**	**x**	**x**	**x**	**x**	**x**
Maji na Ufanisi	5 or more	Private	**x**	**x**	**x**	**x**	**x**	**x**	**x**

Similarly, each of the four Users' Organizations has access to computers and the other technologies, which included mobile devices, Internet, GPS units, Bluetooth devices, cameras, data management tools, and ICTs (Table 6). The frequency of technology use varies. Except for in two instances of the 28 total cases of technology, the Users' Organizations provides resources and access to each technology previously listed. Public and Private funding provided the support for these such devices. Users' Organizations (via Private/Public funding) provided resources for these other technologies for Projects.

Furthermore, the four Users' Organizations justified their use of computers, the Internet, mobile technology and other forms of Information and Communication technologies (ICTs) over other forms of technology because they facilitate communication. Table 7 illustrates the frequency of technology use. Users' Organizations use Computers, mobile devices, internet, and ICTs on a daily basis. Cameras are used on a weekly basis. Data management, Bluetooth and GPS tools are used on a less frequent basis, with its use ranging from weekly to every few months.

Table 7: Frequency of Technology Use, by User

	Computers	Mobile	Internet	ICT	Camera	Data Management	Bluetooth	GPS
KDI	Daily	Daily	Daily	Daily	Weekly	Every few months	Weekly	Every few months
WSUP	Daily	Daily	Daily	Daily	Weekly	Monthly	Every few months	Every few months
Umande	Daily	Daily	Daily	Daily	Weekly	Weekly	Every few months	Monthly
Maji na Ufanisi	Daily	Daily	Daily	Daily	Weekly	Weekly	Weekly	Monthly

One of the Users simply affirms ICTs are "needed in day-to-day communication." In terms of use of Internet and ICTs, another User observes that her organization communicates with three distinct groups: (1) other offices/branches of the User's Organization; (2) donors and other agencies; and (3) internal communication. The Users' Organizations communicate with extensions of their offices in Nairobi, in Kenya, and in other countries. Travel costs and distances between offices increase the need for a reliance of ICT use within Users' Organizations. One User from WSUP describes communication as, "the nature of the work" because WSUP "has offices all over, need to connect and communicate, and cannot necessarily meet physically every time."

ICT also allows the Users' Organizations to link with donor agencies. Many times, donor agencies need to understand the progress of funded projects. One User from WSUP highlights this notion, stating, "We also communicate and report back to our donors and other agencies on a frequent basis through the Internet." Yet another User Organization notes that the role of ICTs is for supporting internal communication. ICTs sometimes aid in standardizing and documenting project communication and implementation. Maji na Ufanisi User describes ICTs as helping their organization to "organize, communicate and standardize our projects."

While the four User groups state that they have access to all technologies presented in the survey, over half of the technologies are not used on a daily basis. Technologies that each of the four Users' Organizations do not use on a daily basis include: computers GPS, Bluetooth, and Data Management (Table 7). Two of the Users' Organizations justify their 'occasional,' or monthly, use of these technologies because they are used for the planning or implementation of Projects. For some Users' Organizations, only trained staff use some tools like GPS devices and data management tools. KDI stated that they are "used on occasion with the survey and implementation process" of water and sanitation projects. Two of the Users' Organizations focused on the low use of GPS technology in their work. Noting that these Users use GPS, WSUP uses this technology to pinpoint or "to drop and locate the location of a project without landmarks." By doing this, an organization can quickly map and document the exact location of a project. Moreover, Maji na Ufanisi uses GPS only in "mapping our [new] projects which happens occasionally." Within the Portal, Users have the option of locating a new/existing project via GPS coordinates. Knowing the relevance and frequency of use helps to indicate the relevance of the website, as the Portal gathers and shares information via ICTs.

4.4 Patterns of User Organizations in Seeking and Sharing Information

After reviewing WATSAN Portal and the Users who engage with the Portal, this study also traces how Users seek and share information by assessing information need, and the patterns of Users' Organizations to seek and share information.

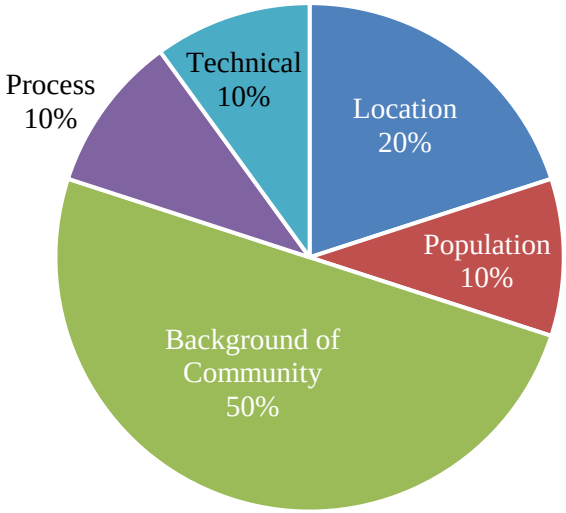
4.4.1 Information Needs

"Information need" refers to information that water and sanitation Providers seeks or requires prior to the initiation of the Project. This information is important as the Provider involves this information in planning and in implementing a project. Often times, if the Project lacks required information, then the Provider cannot move forward with the Project or must source additional human resources or effort to close information gaps.

When evaluating the specific information needs which organizations require for project planning, most Users' Organizations identify similar information needs. The desired information can be classified into five areas of need, namely: (1) the background of the community that lives or works near to the Project (50%), (2) the process for making implementing the Project (10%), (3) the technical information required to implement the

Project (10%), (4) the location of the Project (20%), and (5) the population of the community that lives and works near to the Project (10%). As displayed in Figure 6, the breakdown of the various Information Needs of Users is shown.

Figure 6: Users' Information Needs



Information relating to the background of the community is Users' most cited information need. 'Community background' generally means information or knowledge about community or village in which the project is planned or will be implemented. This information includes but is not limited to: community need for water and sanitation, history of the community, and measures of the community's quality of life. This information about the community is applied in project implementation, and used as a general baseline for knowledge and understanding. The Users enumerated various information needs that is categorized into "community background." For example, understanding current water or sanitation options and community challenges and need were classified as community background. As one User noted the objective of Community Background is to "understand what has been documented about the project area," which builds a general understanding of the Project area. Since this information and knowledge is not always 'documented' in writing; it cannot be assumed this information can be gathered through "researching previous baselines," as noted by Maji Na Ufanisi.

Users' Organizations gathering such information requires extensive interviewing of the community at large and key informants. The Portal does not provide background on the communities or villages of Kibera. Through Users engaging in verbal interviews, this information tends to be most informed by the community which does not tend to document

their current environment or context continuously. Moreover, comparable to other communities, Kibera is subject to change with demographic and cultural shifts. When from credible sources, this information can highlight the community's needs, historical experience, or offer precedent in terms of local water and sanitation provision, or lack thereof. For example, the User from WSUP noted that her organization finds this information important because the community is the end user of the sanitation strategy. This User further notes that the implemented strategy should encourage the population to be "comfortable, happy, and meet community needs." Similarly, Maji na Ufanisi uses this information to understand project feasibility because community background or "community experience informs us of project success and challenges in the area." Information about the community's background "remedies the challenges" that is presented through implementing a Project. Timelines for such gathering such information from the community ranged from two days to two months (Table 8).

Table 8: User Organization timeline for gathering Community Background information

Confirm research findings with the community	2 days
Gather documented, secondary information from government entities or NGOs	7 days
Understand similar projects in the community and their success/challenges	7 days
Understand current community sanitation methods	42 days
Survey households in the community	56 days

Two organizations, KDI and Umande Trust, identify the Project Location as a significant Information Need in planning or implementing a water/sanitation project. Location refers to knowing an exact site of the Project or for the 'Owners[5]' adjacent to or within the area of the Project. KDI mentioned that the Location as important information because "there is very little space for [water and sanitation] projects in Kibera." Kibera is very dense and most space is designated for either informal housing or business. Very little infrastructure is present for its demanding and rising population. Furthermore, the current situation confirms the absence of the informal settlement in the centralised system over the years. KDI and Umande Trust said that information about space and project location is found via community organizations and meetings with community members, and assistant and area chiefs. While Umande Trust said their organization could determine the location for the Project in one day,

[5] All land in Kibera, like most informal settlements, is owned by the Government; however, individuals illegally buy, sell, and control this land without security of title deeds or land tenure.

KDI, the smallest of the organizations that use the Portal, said determining the location of the Project could take two months.

KDI also identified Process Information as an important Information Need. This User regarded this information as important because it guides how to implement a formal, improved water and/or sanitation project with local county agencies. KDI meets this Information Need through discussions with NCWSC and with other nongovernmental organizations experienced that are implementing projects within Kibera. On average, finding this information takes one month.

In contrast, the User from WSUP organization listed technical information as one of its information needs. Specifically, WSUP classified "water availability, sludge management, physical access to the site, location of mains, and location security" as technical information needed for project planning and required before implementing any project. While this information is only found directly in the field, this User's Organization uses its own internal procedures and processes that it uses to locate this information in the field. This information is particularly helpful in knowing the technical feasibility of the water or sanitation project. Typically, finding this technical information for a location takes 1.5 week.

Lastly, Maji na Ufanisi noted the need to know and understand the 'Population.' This information is important in understanding the number of 'potential users' or customers of the Project. Maji na Ufanisi finds this information through Kenya Bureau of Statistics estimates from government documents. For Maji na Ufanisi, this information is found in one day because this User's Organization uses government documents for secondary data. These estimated numbers require significantly less time because they are obtained via public and accessible government documents, not time-consuming local baseline surveys or censuses.

Table 9 demonstrates that meeting these information needs is "easy" for two of the four Users' Organizations. One out of Users, meeting information needs is difficult. The final User's Organization did not have strong opinion of whether it is easy or difficult to obtain information.

Table 9: Degree of ease/difficulty in finding information on water/sanitation in Kibera, by Users' Organization

User's Organization	Degree of Ease	Information Needs
Maji na Ufanisi	Easy	- Challenges to water/sanitation in area - Similar local projects in the community - Population of the community
Umande Trust	Easy	- Background of the community - Survey feedback from the community - Land Ownership of the space
WSUP	Neutral	- Population of the community - Methods/Strategies in water/sanitation provision in community - Technical understanding of the area to support a water/sanitation project
KDI	Difficult	- Location available for a water/sanitation project - Process or right contact with NCWSC

While each User's Organization owned or had access to computers, mobile devices, Internet, GPS, Bluetooth, cameras, data management tools, and ICTs, the degree of ease in finding information was higher for Maji na Ufanisi and Umande Trust. These two Users' Organizations have increased human resources, and data management and GPS use. Of the Portal Users, Maji na Ufanisi and Umande Trust have human resources of a medium enterprise to implement water and sanitation projects. Furthermore, these organizations use two technologies at a higher frequency than the other Users' Organizations in the study. While the other Users' Organizations used data management and GPS once a month or every few months, Maji na Ufanisi and Umande used these technologies on a weekly basis. These two variables appear to be correlated; however, direct causation could not be determined through this study. Maji na Ufanisi notes that these technologies help their medium-sized organization to "organize, communicate, and standardize projects." The high technology use of these two Users' Organizations suggests either of the following: (1) medium Users' Organizations find related project information easier or (2) Users' Organizations with increased use of technology find information easier.

4.4.2 Patterns in Seeking Information

In this study, information seeking refers to the process of water and sanitation Providers to obtain information that is referenced in Table 9. Each of the four Users' Organizations seek information; however, seeking occurs at varying frequencies. While two organizations, MNU and Umande Trust, seeks information on a daily or weekly basis, the two other organizations, KDI and WSUP seek information occasionally, or on a monthly basis (Table 10).

Table 10: Users' Organizations frequency in information-seeking

User's Organization	Frequency
Umande Trust	Daily
Maji na Ufanisi	Weekly
KDI	Monthly
WSUP	Monthly

Frequency of information-seeking practices only hints at the nature of how the Users' Organizations interact with information about water and sanitation in Kibera. While on average Users' Organizations self-identified as seeking information on a weekly to monthly basis, further interrogation reveals that information-seeking occurs more often. In this study, information seeking for the planning or implementation of a Project is measured through the frequency in which a Provider seeks information from a specified location. According to this study, 6 out of 24 Information Needs are sought "often," which is defined as daily information-seeking. 11 out of 24 of this information-seeking occurs "sometimes," or on a weekly basis (Table 11). Therefore, this data supports the notion that information-seeking of Users occurs largely on a daily to weekly basis.

Table 11: Frequency of Users in Seeking Information from Locations

	Own Information	Residents/ Businesses	Local Administration	Organization Research	Expert	Municipality / NCWSC	Other
KDI	Often	Often	Rarely	Sometimes	Never	Sometimes	Never
WSUP	Sometimes	Often	Rarely	Rarely	Rarely	Sometimes	Never
Maji Na Ufanisi	Sometimes	Sometimes	Sometimes	Often	Occasionally	Often	Never
Umande Trust	Occasionally	Often	Sometimes	Sometimes	Sometimes	Sometimes	Sometimes*

** Seeks 'Other' information through (1) Athi Water Service Board.

Each Users' Organization owned information and reference this information for Projects. Most frequently, the Users' Organizations seek information from local residents and businesses on a daily basis. Three out of the four Users' Organizations – KDI, WSUP, and Umande Trust – seek information daily from local residents/businesses. Half of Users seek information from local administration on a weekly basis, an equal number of Users seek information from local administration every few months. Only two information locations, the local administration and hired experts, are used on a daily basis by at least half of the Users' Organizations. Each of the four Users' Organizations seek information from hired experts at different frequencies – from a weekly or monthly basis to never. Moreover, no two of the Users' Organizations share responses in regards to the use of hired experts. The majority of Users – three out of four conduct their own research or surveys on a fairly frequent basis. Only one User, KDI, rarely engages in research, conducting its own studies only once every few months. In addition, Users that use the Portal also seek information less frequently from municipal agencies, like NCWSC. Three of four Users' Organizations seek information from municipal agencies weekly.

Generally, information-seeking occurs at a weekly basis. Information-seeking that occurs on a weekly basis arises largely from the following four sources: organizational information and notes, local administration, organizational research, and NCWSC. Daily information-seeking arises as salient also. The source of this Information Need tends to be sourced from local residents or businesses.

4.4.3 Patterns in Sharing Information

Information sharing refers to the dissemination of information by Water and Sanitation Providers. Each organization engages in information-sharing about different issues relating to water and sanitation. Table 12 details the kinds of information each User's Organization shares and the frequency in which the User shares that information.

For Maji na Ufanisi, most of the information that they share is related to building sustainable, community-driven and community-run projects. Therefore, partnerships with municipal agencies like NCWSC and AWSB are vital partners and information sources for associated Providers and Projects. Most of information sharing from Umande Trust relates to community information, including changes in the Project, especially related to day-to-day

operations or organizational updates about Umande. KDI's mainly focuses on sharing information regarding areas of water shortages, advocating to local administration and other relevant parties about rectifying such situations. At the same time, this User shares information with other Providers about how to create formal, improved connections with NCWSC. If such options are not available, KDI also advocates improved decentralised options (compost, septic sanitation options). Lastly, WSUP has the most diverse array of information shared. In the community realm, WSUP focuses on communicating information which enables community-based organizations to implement their own water or sanitation project. Such information includes: accessing water and sanitation, funding for water and sanitation projects, and how to operate and maintain water and sanitation projects. On the other hand, WSUP also advocates level of knowledge-sharing and policy advocacy with NGOs and public entities. WSUP acknowledged that most of this information-share occurs through program-specific and sector-based workshops and technical working groups. At the same time, WSUP shares information about their experience in program implementation and issues within the Kibera community public, local government entities so that they can advocate for more effective and scalable solutions. For the most part, Users' Organizations generally share information on a weekly or monthly basis (Table 12).

Table 12: The frequency in information-sharing of the Users' Organizations

User's Organization	Frequency	Information Shared
Maji na Ufanisi	Weekly	1. Sustainability 2. Capability
Umande Trust	Weekly	1. Changes in project 2. Updates on Umande Trust and community updates
KDI	Monthly	1. Water shortages 2. How to connect to water/sanitation
WSUP	Monthly	1. To community: accessing water/sanitation, funding, operations/maintenance. 2. To organizations: program implementation, resolving issues, knowledge-share in workshops and in technical working groups that are program-specific or sector-based

In consistency with the method used in the previous section (Section 4.4.2), this study analysed frequency of information sharing against locations in which the User's Organisation shares information about Projects. Information sharing in regards to the planning or implementation of a Project is measured through the frequency in which a Provider shares information with an indicated location. When aggregated, information sharing is totaled as a count of the frequency in which each Provider shares information in a particular location (Table 13).

Moreover, this study reveals that most of information-share occurs weekly and monthly (Table 13). Therefore, information-sharing occurs "sometimes" to "occasionally." For the most part, these Users most frequently share information on a daily to weekly basis with the local administration, research and learning institutions, and municipal agencies like NCWSC.

Table 13: Frequency of Users in Sharing Information in Locations

	Own Info	**Residents/ Businesses**	**Local Administration**	**Research**	**Expert**	**Municipality**	**Other**
KDI	Sometimes	Occasional	Rarely	Sometimes	Rarely	Sometimes	Never
WSUP	Occasional	Occasional	Sometimes	Rarely	Sometimes	Occasional	Never
Maji Na Ufanisi	Rarely	Often	Often	Often	Occasional	Sometimes	Sometimes**
Umande Trust	Sometimes	Often	Sometimes	Sometimes	Occasional	Sometimes	Never
** Shares information through (1) NGOs and (2) Organizational Website.							

The channels of communication are also important, as literature suggests communication affects the frequency of interactions with other organizations, alters outcomes and relationships, and influences decision-making (Batty, 1992; Hassanin, 2012; Heacock, 2009). Each of the four Users confirms that their organization makes use of email and organizational notes to share information at-large (**Error! Reference source not found.**). Such communication s more frequently referenced as the method of sharing information than word-of-mouth and formal meetings. Only half of Users' Organizations use word-of-mouth or meetings to communicate information about water and sanitation Projects in Kibera.

4.5 WATSAN Portal Expectations and Information Use

The following section outlines the expectations which Users had for the Portal. The following section has four subsections. The first section describes the expectations of Users;

and the subsequent sections highlight the usefulness of Portal-provided information. The final three sections discusses the extent to which infrastructure location information, municipal process information, and cost estimation information adds value to Projects.

4.5.1 Expectations of WATSAN Portal: Kibera

WATSAN Portal: Kibera provides information to support the planning and implementation of water and sanitation projects. Each of the Users' Organizations had different expectations in terms of what WATSAN Portal: Kibera could provide them as User and their affiliated organizations. These expectations for the Portal included: locating connections, increasing transparency of the municipal process and information, predicting costs, easing workload, and increasing community access (Table 14). Of the various expectations listed, most Users expect the online tool to aid in locating connections. Furthermore, one of Users envisages the Portal would bring transparency to the process of and information about building formal, improved water and sanitation facilities in Kibera. Cost prediction, easing workload, and increasing community information access are each mentioned once as an expectation for the Portal.

Table 14: User Expectations for WATSAN Portal: Kibera

Expectation	User	Justification by User
To locate water and/or sewerage connections	KDI	*That it would make it easier to locate connections for projects.*
	Umande Trust	*To identify the main water pipes and sewerage streams in Kibera.*
	WSUP	*It is easier for location usefulness for early decision-making.*
To make information about the process of formalisation transparent	KDI	*That it would make the process to connect clear and transparent.*
	Umande Trust	*With verified data and all the water points and manholes shown.*
	WSUP	*It can be used for personal and community reference to verify information not previously verifiable.*
To estimate costs for connection	WSUP	*That it is easier for cost prediction for early decision-making and it can be used for personal and community reference to budget.*
To make work easier	Umande Trust	*To make work easy for partners to implement projects.*
To increase community access	WSUP	*That it is accessible to more than technical people.*

Comparatively, Users believe that this Portal meets the aforementioned expectations moderately to occasionally. While those implementing water and sanitation projects have been involved with the Portal from its inception; key justifications for the Portal only meeting expectations from moderately to occasionally highlighted that the Portal still has its own set of challenges, which are institutional and technical.

A primary institutional challenge takes account of municipal involvement. Specifically, Users expressed a lag in NCWSC response time and processing. Secondly, technical challenges arise in terms of the Providers' awareness of, access to, and capability of using the Portal. The final findings section discusses some of the highlighted advantages of and challenges to WATSAN Portal: Kibera, not just to Users, but to all Providers which were included in the study.

4.5.2 Provision of Location Information

Location information refers to the NCWSC data set illustrating the geographic distance to NCWSC infrastructure. Whether acquired formally through NCWSC or informally via community-mechanisms, this information assists in building a formal and informal connections to NCWSC and also increasing sources of drinking water and sanitation. In this study, 12 out of all 13 Providers in this study find information about location of infrastructure to be useful (Table 15). Of the 12 Providers, six Providers perceive this data to be "very useful." Another six Providers find this data to be "somewhat useful." Only one Provider from Mbuvi Self-Help Group thought the information is neutral, stating that even with the information, it is still "difficult to connect in our Kibera."

Table 15: Degree of Usefulness of Infrastructure Location Information

Degree of Usefulness	Name of Provider
Very useful	Empowerment to the Community Foundation Soweto Usafi Riverside Usafi Group PEEPOOLE Mashimoni Youth Group KDI*
Somewhat useful	AMREF New Nairobi Dam Community Group

	Tosha I WSUP* Maji na Ufanisi* Umande Trust*
Neutral	Mbuvi Self-Help Group
Asterisk (*) denotes Provider that is also a User of WATSAN Portal: Kibera.	

Regardless of the difficulty that the project implementation presents, Providers largely felt locational information to be vital to water and sanitation projects to some degree. Maji na Ufanisi in particular enumerated multiple reasons that location proved useful. Information about location helps Providers in the following ways:

> *One, to be able to calculate budget for the facility and piping; two, to ensure that a project does not happen over existing infrastructure; three, to understand accessibility and costs and to apply for authority municipal government to move or connect; and four, to know the existing infrastructure as to do or not and to avoid duplication of resources.*

This account highlights that the use of location information is contextual, or not taken at face value, but applied in order to understand the costs and complexities in implementing a project in Kibera. Another Provider, Riverside Usafi Group, noted that for water and sanitation projects in Kibera, location information is "the main thing that triggers projects and groups to think strategically."

Moreover, the congestion of Kibera structures also makes location information important because it is not easy to erect a safe, secure and viable connection without causing displacement or destruction, be it temporary or permanent. For Providers, knowing the "location and direction from the line is important because you do not want to demolish or move many households." Furthermore, knowledge of the operational quality of the municipal infrastructure is equally important to Providers. Knowing this information supports the development of technically sound projects. For example, a water project must be connected to functioning water infrastructure, and usually a sanitation project must be aware of both water and sanitation infrastructure. That is to say, improved sanitation methods not only includes connection to sewerage but also requires water to support sanitation facilities. Therefore, sanitation projects also access to water. Umande Trust

observed that a Provider "cannot construct without being close to operational water pipes. Also, we must know the distance to the sewer because Providers cannot construct over a sewer line."

In particular, this study revealed that technical and institutional challenges diminish the usefulness of location information. As aforementioned, inactive or poor infrastructure impedes the ability of Providers to build and maintain Projects. This lack of quality, universal infrastructure throughout Kibera is a technical challenge in terms of the adoption of infrastructural standards, protocols, design, and set-up. At the same time, Providers mentioned "gaining permission" from informal groups that are not affiliated with NCWSC or other formal agencies who authorize 'permission from strong groups' to connect to municipal water infrastructure. This situation creates an institutional challenge because it weakens the formal structure in which infrastructural implementation, provision, and operation is supposed to occur. This finding supports theories which suggests that in the context of developing countries and in the context of informal settlements, institutional and technical challenges are more frequent (Batty, 1992; Hassanin, 2012; Heacock, 2009).

4.5.3 Provision of Municipal Process Information

"Municipal process information" refers to that which informs Providers about the formal systems, structures, and/or processes which enables the provision of formal water and sanitation. This information can be gathered formally or informally through NCWSC or through the community. This information directly supports increasing formal connections to NCWSC, and improving drinking water sources and sanitation. Like location information, the information about municipal processes is "useful" to some degree; as six Providers perceived the information to be "very useful" and six Providers perceived the information to be "somewhat useful" (Table 16). In total, 12 out of 13 Providers find this information useful to some degree. One Provider saw the information as neutral because even though an organization can go through a formal processes with NCWSC, water vendors break and damage these formal connections to maintain a monopoly on water-selling.

Table 16: Degree of Usefulness of Municipal Process Information

Degree of Usefulness	Name of Provider
Very useful	Empowerment to the Community Foundation Soweto Usafi Riverside Usafi Group New Nairobi Dam Community Group Mashimoni Youth Group Maji na Ufanisi*
Somewhat useful	AMREF PEEPOOLE Mbuvi Self-Help Group KDI* WSUP* Umande Trust*
Neutral	Tosha I
Asterisk (*) denotes Provider that is also a User of WATSAN Portal: Kibera.	

There were several, varied reasons why this information would be helpful to water and sanitation providers in Kibera. Generally, Providers found this information to be helpful to "make work easier." More than providing information about formalising water and sanitation in Kibera, this information would help Providers improve the reliability of water and sanitation. Reliability refers to the consistency in the provision of water and sanitation. One Provider from New Nairobi Dam Community Group narrated the following:

> *The first time we tried to put a water project, we were cheated. The second time we initiated a formal water project has been good because we are not dealing with the middlemen. We have a meter reading; but with our first project, we were overcharged. Middlemen would cut our line and we would pay more to get the water turned on again.*

These "middlemen" mentioned in narration references strong cohort(s), consisting of informal, water vendor operator(s) controlling water in Kibera. These groups and individuals provide water for Kibera residents, but oftentimes fail to provide "a legal, reliable, clean water."

This study suggests that Providers in Kibera think that information from municipal entities regarding formal systems and structures are important. However, NCWSC encounters

significant difficulties trying to curb the proliferation of this informal structure that generally threatens the market for water. One Provider acknowledges "the [NCWSC] fine is high" for illegal, informal water connections, "yet NCWSC is reluctant to enforce" these fines. Several other Providers admitted to their reliance on water vendors because of (1) the poor provision of water in certain areas by NCWSC or (2) NCWSC inability to follow-through on its promises to support formalising Projects in Kibera. This dynamic highlights some technical and infrastructural challenges, and severe institutional challenges. These challenges exemplify the notion that increased information provision via the WATSAN Portal does not overcome the difficult social, political, and economic environment of informal settlements. Even the Users of the Portal confirm the challenges of this environment, stating that the information provided via WATSAN Portal: Kibera regarding the process is only moderately helpful (Table 16). Users acknowledge "there are still barriers remaining with processing and response time" of NCWSC within the Portal.

4.5.4 Provision of Cost Estimate Information

"Cost estimate" information refers to a rough calculation of the average cost of materials and labour per meter for the installation of a water or sewerage connection. For the Portal, this number is developed from surveying several built water/sanitation projects in Kibera. However, in reality many of these costs are location-specific. Thus, the Portal states, "actual costs should be verified on-site by an engineering professional or a member of the NCWSC." Again, this information was fairly useful to most organizations. 11 out of 13 of Providers find this information as very useful or somewhat useful; meanwhile, one organization finds the information neutral and another finds it almost never useful (Table 17).

Table 17: Degree of Usefulness of Cost Estimate Information for Providers

Degree of Usefulness	Name of Provider
Very useful	Soweto Usafi Mashimoni Youth Group Umande Trust*
Somewhat useful	Empowerment to the Community Foundation AMREF Riverside Usafi Group New Nairobi Dam Community Group Mbuvi Self-Help Group PEEPOOLE KDI* Maji Na Ufanisi*
Neutral	WSUP*
Almost never useful	Tosha I
Asterisk (*) denotes Provider that is also a User of WATSAN Portal: Kibera.	

For the most part, this information for Providers would support budgeting and planning of water and sanitation projects in Kibera. Three Providers find cost estimation as "very helpful" because this information primarily aids in "budgeting and planning." Maji na Ufanisi understood cost information is "somewhat useful." For a Provider, this information helps with implementation by supporting Providers in technical assessment of what Maji na Ufanisi calls "the where, when and how" of a Project. Furthermore, WSUP, a multinational NGO suggested that the benefit of cost estimation is that this information assists in "quickly understanding the cost implications" for potential water and sanitation projects.

These responses suggest that this information encourages project planning. Nevertheless, Tosha I identified that this information is not useful because "even if the Provider can afford it, the community of water vendors do not let the connection happen." This response yet again points to the notion that institutional challenges hinder the use of information and the process to implement a formal, improved Project in Kibera.

CHAPTER FIVE

Advantages and Challenges to Information Sharing via WATSAN Portal

5.1 Introduction

A key aim of this research was to describe advantages and challenges of information-sharing through the Portal. This section describes how the Portal supports information sharing and barriers to the use of this information in two parts. The first section discusses advantages of the Portal and the second section discusses remaining challenges which impede the effectiveness of the Portal as a tool.

5.1 Advantages to WATSAN Portal: Kibera

WATSAN Portal Users said this tool would ease the work load for water and sanitation Providers. Among all Providers in this study, this opinion highlights one of the greatest benefits of the Portal because 4 out of 13 Providers considers finding information on water and sanitation in Kibera to be difficult, while 1 out of 13 finds this information to be very difficult (Table 18). Combined 5 out of 13 Providers in this study reported that finding information on water/sanitation in Kibera is difficult or very difficult. Generally, this Portal seeks to assist any Provider, planning or implementing a Project in Kibera. For the five Providers that considers finding information difficult or very difficult, each Provider had two information needs in common. These Providers listed the technical knowledge of the existing infrastructure location or the process of formally connecting to this municipal infrastructure. The Portal is advantageous to this cohort which finds it difficult to meet their information needs because it provides information about distances to municipal infrastructure and the NCWSC-confirmed procedures which should be followed for a formal, improved facility.

Table 18: Degree of Difficulty Finding Water and Sanitation Information

Degree of Difficulty	Name of Provider
Very easy	
Easy	New Nairobi Dam Community Group PEEPOOLE Mashimoni Youth Group Maji na Ufanisi*
Neutral	Tosha I Mbuvi Self-Help Group WSUP* Umande Trust*
Difficult	Empowerment to the Community Foundation AMREF Riverside Usafi Group Kounkuey Design Initiative*
Very difficult	Soweto Usafi
Asterisk (*) denotes Provider that is also a User of WATSAN Portal: Kibera.	

Meanwhile, 4 out of 13 Providers reported impartiality in the ease/difficulty in finding this information, while another 4 out of 13 Providers reported ease in finding this information for planning and implementing water and sanitation projects in Kibera (Table 18).

Largely, Providers mentioned that determining areas spacious enough for the development of a water or sanitation project occurred through meetings with residents, the local community and chiefs (assistant and/or area chief(s)) to seek and find the owner of the space. Usually, it takes a Provider one day to two months to determine this ownership. The Portal does not identify structure or land 'ownership' in Kibera. However, one of WATSAN Portal's features includes an aerial map (GoogleMap) which may support Providers in visually detecting undeveloped and undeveloped space.

Technical information is also important information for Providers. Specific technical needs varies from Provider to Provider. For some Providers, technical information needs includes understanding the availability and connectivity to water because water is required for most sanitation technologies. For others, technical information included knowing the possibility of and distance to a water or sewerage connection. For Providers that are not User of the Portal, they usually determine this information through meetings with NCWSC, surveys, or hiring a specialist. Gathering this information takes anywhere from less than one day to two weeks.

Besides sharing the availability of water, WATSAN Portal: Kibera addresses the majority of these mentioned technical information needs.

Lastly, about five Providers similarly express an Information Needs in terms of understanding how to make formal water and/or sewerage connections. This information is required for implementing projects which officially link to municipal agencies and their infrastructure. Knowing this process would support Providers going through clear channels which would ensure a formal Project, connected to the central institution of NCWSC. Riverside Usafi Group notes that "brokers on-ground" helped their Project to connect to NCWSC; while other Providers like AMREF and New Nairobi Dam Group note the challenges in finding brokers and working with these brokers. At the same time, Providers express difficulty in reaching the NCWSC to setup a formal connection. The estimated time required to engage in the process with municipal institutions also illustrates the challenge; as Providers calculate that this process would take from one week to one month to complete. One Provider stated that the process is "sometimes never completed." While it is not given that Portal Users avoid these community and institutional issues; WATSAN Portal: Kibera provides transparent information about institutional process and procedure to Users, which may aid in reducing time wasted in uncovering the institutional process for partnering with NCWSC. Therefore, Providers would still need to determine and challenge dominating community issues, i.e. brokers, and institutional concerns, i.e. lagging response time, poorly functioning infrastructure.

5.2 Challenges for WATSAN Portal: Kibera

A User-identified information gaps and organizational information needs helps illustrate remaining challenges to the Portal. One User from WSUP expresses that the Portal helps her personally and her organization, and "more community need to know about it." Essentially, WATSAN Portal: Kibera needs to reach a wider community of those who provide water and sanitation across the settlement.

Nevertheless, this study showed that Users have greater access to and use of computers technology related to the Portal and to the implementation of water and sanitation Projects. For example, all Users' Organizations own at least 4 computers. For Providers, only 2 of the 9 Providers owned computers; and these two computer-owning Providers own less than three

computers. Moreover, only three Providers have computer access, and two Providers have access to additional forms of technology, like Bluetooth, cameras, or data management tools; and none have access to GPS devices. Only Users have access to GPS devices. To obtain the most accurate information from the Portal regarding distance to and cost of water and sanitation infrastructure, access to GPS data for User-selected locations is required. Beyond access to these technologies, each of the Users had a minimum of a university education; while the other 9 Providers not using the Portal had either completed primary or secondary education. Knowing this information, the education levels of Providers and their non-use of the Portal suggests that their computer and technology literacy, or ability to use computers and technology effectively; and their information literacy, or ability to identify, locate, and use information. Knowing these disparities between Portal Users and other Providers in Kibera, it is noticed that a number of all Providers might not be able to easily access and use the information which the Portal provides.

Second, WATSAN Portal lacks a direct connection to NCWSC or other helpful government agencies who support the implementation of formal, improved water and sanitation in urban informal settlements, including Nairobi. In other words, NCWSC is not charged with the management of this Portal. Moreover, most discussion topics that all Providers mentioned surround technical and infrastructural challenges that interrupts efficient service delivery. Specifically, Providers mention that NCWSC infrastructure in Kibera sometimes lacks pressure, rations water, and suffers with pipes without water and leaks. At the same time, a User suggests that the procedures for approval should be publically shared. However, WATSAN Portal could not reach the aforementioned Information Need because they are NCWSC address these concerns directly as the authority overseeing water and sanitation provision.

Furthermore, at some point each Provider mentioned some background on the community as necessary for project implementation in Kibera. Technical, infrastructural, and other information provided are helpful in terms of planning, but in order to implement a useable and sustainable community water or sanitation project, the Provider must know about the community itself. The use of WATSAN Portal does not eliminate the need for a baseline survey, meetings with the community or structure owners, or the prerequisite of

understanding the area's population or potential for customers, if operating as a social enterprise.

Lastly, as identified by the Portal User WSUP, the Portal does not provide "sufficient linkages to supporting organizations" in areas of Kibera where sewerage is not feasible. A significant portion of Kibera cannot connect to the central sewerage system unless new infrastructure is built (Figure 3). In these instances, the Portal lists alternative options for sanitation. However, Users generally felt that this area could be developed more so that more options are available and so that groups with the technical know-how are linked to the website.

CHAPTER SIX

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

6.1 Introduction

The main aim of this study was to understand how WATSAN Portal: Kibera strengthens the nature of information sharing among Providers in Kibera. Most research supports the notion that more communication increases opportunities to share information, impacts decision-making, and alters relationships. However, research also suggests that developing countries and informal settlements have their own challenges to information sharing, as some of the main barriers are not the access to information but rather the application of this information, or turning this information into practical knowledge. This study started with first understanding the nature of the information contained within the Portal. This phase of the study helped to guide the research, and informed key informant selection. From this phase, 13 Providers were interviewed, of which four are Users of the Portal. In exploring how the Portal aids Providers of water and sanitation in Kibera, this study also found that barriers still remain in the ability of increased information share to impact opportunities to share, decision-making, and relationships as suggested by Batty (1992), Hassasin (2012), and Heacock (2009).

6.2 Summary of Findings

In the content review of the website, the study identified what information WATSAN Portal provides. Moreover, the researcher was able to understand what and how the Portal shares information, which brought forth two strong notions. First, the information delivered to Providers and NCWSC's involvement promotes the network intensification strategy, which supports improved, formal water and sanitation through informal and decentralised Providers. Secondly, the website does not give information sufficient to start a water or sanitation project autonomously. The website encourages Providers to seek inclusion in the centralised NCWSC structure in order to implement improved, formal Projects. The information helps Providers to make decisions regarding project feasibility, estimated costs, and alternatives.

The limitation of the capacity of Providers that do not use the Portal is also a challenge to the effectiveness of the Portal. While the information is presented in a simple way, this study demonstrated that these groups do not have access to nor do they possess technology which

would help assist them in accessing the Portal or in using information from the Portal. Of the nine Providers not using the Portal, seven Providers do not own other forms of technology besides a mobile device. At the same time, seven out of nine Providers, who do not access the Portal, do not own computers. Conversely, Users have higher capacity to use technology in the implementation of water and sanitation Projects; and, these Users are able to better utilize the information available from the Portal. A correlation between technology use and access to water and sanitation information (via the Portal or otherwise) seems to rise in this study. However, this study did not determine the degree to which one variable causes or influences the chance of the other.

The major value addition of the Portal is that it demystifies the process of formalization and improvement of water and sanitation methods. It shares information with informal Providers, sharing options for improving water and sanitation in a specific locality. Such is particularly useful to Users with geographical understanding of Kibera but limited knowledge on how to formalize and improve water and sanitation.

The major challenges surrounding the practical application and usage of the information. Half of Provider Information Needs concerned the background of the community itself. While WATSAN Portal shares technical and infrastructural water and sewerage information, Providers need to know about the history and challenges of the community distinctly, and there are challenges in utilizing this technical and infrastructural information, and institutional knowledge. Nevertheless, the Portal helps to reduce the time required to determine other information needs, including process, technical, and locational information. Furthermore, patterns of User information-seeking tendencies, the advent of the Portal has not eliminated the need of directly communicating with NCWSC, as all Users in the study communicate with the municipal or with NCWSC on a daily or weekly basis despite the intervention of the Portal.

6.3 Conclusion

Technical and infrastructural information about provision of water and sanitation in Kibera is not static. Rather, this type of information is dynamic, not only changing under centralised planning efforts, but also subject to day-to-day operational impediments, such as leakages, shortages, and broken lines, especially with the population demands on the limited

infrastructure. NCWSC does not engage in direct communication about this information via the Portal. Therefore, at times the website presents structural, and less informing, data (i.e. location of infrastructure and cost to connect to it), in the absence of practical, functional information (i.e. technical or infrastructural functionality of particular infrastructure).

Furthermore, NCWSC lacks the capacity to engage with the Portal to provide up-to-date information regarding water and sanitation provision. So, even though this Portal offers the possibility for a dynamic shift in the relationship between the state and civil society, NCWSC would have to alter how it relates to these organizations as opposed to offering the same slow, inefficient communication channels but via new technology. In other words, a shift in relationships requires more than a shift in communication channels but also requires a shift in how these actors relate to one another. One of the main aims of this Portal is to increase the reach of informal Providers in meeting NCWSC's network intensification policy; whereby informal Providers deepen and extend improved, formal water and sanitation in informal settlements. As much as informal Providers dominate the provision of new water and sanitation Projects in Kibera, and as Users have been able to be linked to more citizens and Providers; the advent of this Portal has not fundamentally changed or challenged how these actors are incorporated into planning or policy networks, as noted in the main principles of participatory governance (Wampler, 2004). Thus, while theoretically, more communication leads to informed decision-making, increased opportunity for sharing information, and has the potential to fundamentally alter relationships, this study suggest that the Portal does aid in information-gathering, information-sharing, and planning but has yet to fully realize its potential to support informed decision-making or shifting relationships between informal Providers and municipal authorities.

6.4 Recommendations

This study's purpose was to understand the potential contribution of ICTs to ever-present development issues in water and sanitation. The policy shift in Nairobi, supporting the incorporation of informal Providers in informal settlements to provide efficient and effective water and sanitation services, and the intervention of WATSAN Portal: Kibera for Providers offered an interesting case for research. Therefore, ensuring informal Providers face few barriers or challenges to implementing improved and formalised water and sanitation in

informal settlements is essential in realizing related development goals in Kenya. The following recommendations are suggested as a result of this study.

6.4.1 Inclusion of informal Providers in the NCWSC intensification network

For the majority of Kenya's history, most of the provision of water and sanitation provision has been at the hands of the central government. However, as the country and urban centers face rapidly growing populations in formal estates and in informal settlements, centralised ministries cannot accommodate the provision of services for this growing population. While recent policies, like NCWSC's network intensification policy, consent to the complementary role of informal Providers in meeting the demands of and the right of residents to water and sanitation in informal settlements; municipal and county governments should develop strategies which actively includes, engages, and support informal Providers. Informal Providers serve as essential players in terms of meeting population-related and strategic demands and furthering municipal and county mandates.

6.4.2 Alternative resources and community mechanisms for planning and implementation

In accordance with the political framework for decentralisation in Kenya, the implementation of rights-based access to quality water and sanitation services is paramount. Therefore, the county governments of Kenya are responsible for the provision of these services. For the state to realize water and sanitation service provision in even the most disadvantaged communities requires appropriate financial subsidy or alternative mechanisms which supports the implementation of these services. At the same time, private corporations and mobile service providers could prove useful in advancing this resources and technologies for non-state actors in this arena.

At the same time, the different characteristics between those that use ICTs for improving service provision (Users) and those that do not illustrates major divides in access to and ownership of computers and technology. This disparity indirectly suggests that interventions based upon new technology could see limited use and adoption in planning and decision-making. However, those who use ICTs usually have many connections to various Providers throughout informal settlements. As such, those who use ICTs could serve as offline 'hubs'

of information; whereby Users serve as offline 'suppliers' of and utilize more traditional means (i.e. meetings, one-on-one meetings, and printed literature) for disseminating information provided through the ICTs.

6.4.2.1 Exploring alternative ICT

While service providers using technology could share the information offline, the developers of the ICT technology could explore alternative ICTs that capitalize on technologies that is most accessed by service providers in informal settlements. Universally, mobile phones have become one of the most highly adopted ICTs in Kenya (Portland Communications, 2012) and in informal settlements. Understanding how and finding ways to present this information through more simplified devices could encourage increased usage and adoption of ICTs by service providers.

6.5 Suggestions for Further Research

While this study contributes to the knowledge base of information and communication technologies for development, many possibilities for future research remains. This research served as a starting point in evaluating the extent to which existing ICTs reach needs of direct service providers. A large-N study would prove as useful in defining and tracing the environment of service providers and their communication. Analysis of this information would help developers of these technologies to understand how to design interventions that build pre-existing communication interactions.

Furthermore, in-depth, qualitative research is still needed in relationship to institutional use of information and communication technology that interacts with other actors, such as civil society actors or market actors. Understanding such would be informative of how increased institutional communication alters its relationship(s) with non-state actors. While this study highlighted the relationship between the provision of data and information to non-state actors, it did not significantly study the barriers and challenges (technical, infrastructural, political, or institutional) of information-sharing within state institution.

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Appendix I: Additional Figures and Tables

Figure 7: Screenshot of WATSAN Portal: Kibera

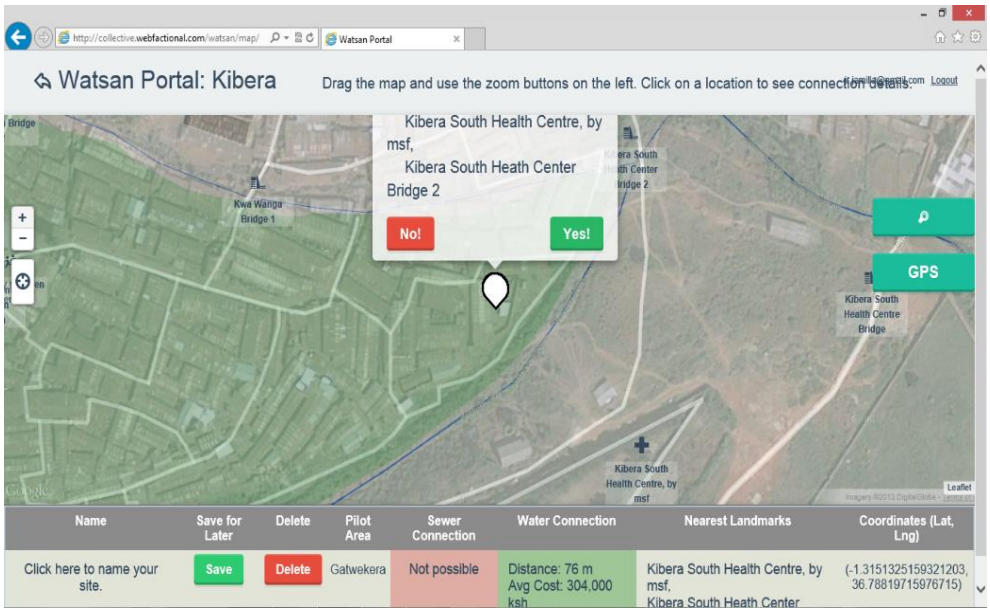
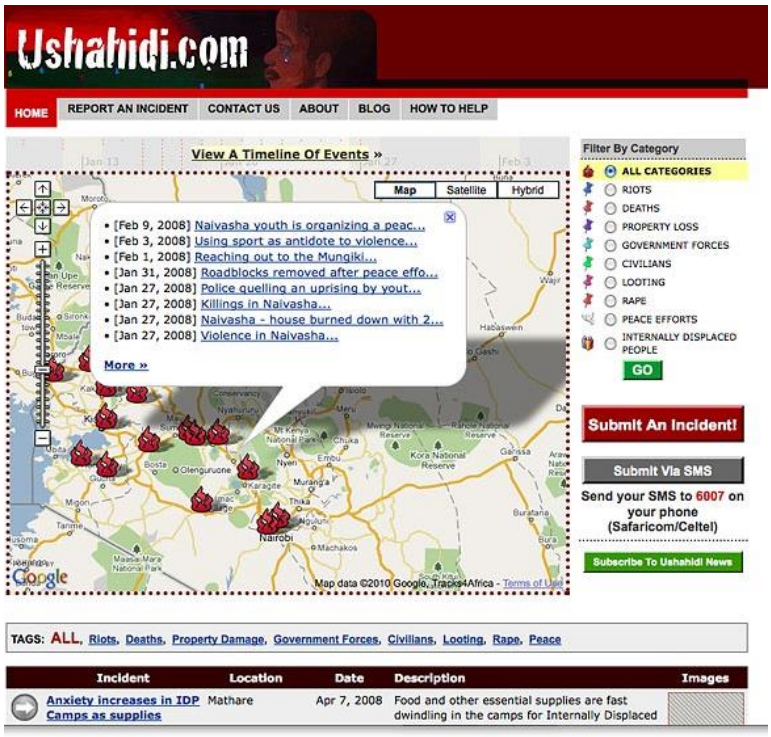


Figure 8: Screenshot of Ushahidi, geospatial mapping for crisis management



Appendix II: WATSAN Portal User Key Informant Questionnaire

KEY INFORMANT QUESTIONNAIRE

Hello. My name is Jamila Harper and I am a M. A. student based at the Institute for Development Studies of the University of Nairobi. I am carrying out a study on information sharing among water and sanitation providers in WATSAN Portal: Kibera. The findings of this study will be used towards fulfillment of the requirements of a Master of Arts project paper in Development Studies. I would highly appreciate if you could give about 30 minutes to answer the following questions.

All information collected will be treated as confidential, and only used for research.

Thank you in advance for your cooperation.

SECTION A: QUESTIONNAIRE LOG BOOK

1. Questionnaire Number _____
2. Date of Interview _____

SECTION B: Organization & User Information

3. Type of User
   - □ 1 Community Based Organization
   - □ 2 Government Organization
   - □ 3 Nongovernmental Organization
4. Number of years working with water and/or sanitation in Kibera _____
5. Position in Organization
   - □ 1 Administration
   - □ 2 Management
   - □ 3 Senior
   - □ 4 Technical
   - □ 5 Other
6. Highest Level of Education
   - □ 1 Primary Incomplete
   - □ 2 Primary Complete
   - □ 3 Secondary Incomplete
   - □ 4 Secondary Complete
   - □ 5 Tertiary
   - □ 6 University
   - □ 7 Masters/Postgraduate
   - □ 8 Doctorate
7. Please give the following details of the organization.

Organization	Date started	Age (in complete years)	Number of employees	Size of capital	Sponsor	Financial Capacity (in monthly average)		
						Budget	Expenditure	Income

8. Please give the following details about your five recent water/sanitation project(s) in Kibera.

Water/ Sanitation Project	Date started	Sponsor(s)	No. of projects	No. projects operating	Improved water facility	Improved sanitation facility
					1 Yes 2 No	1 Yes 2 No
					1 Yes 2 No	1 Yes 2 No
					1 Yes 2 No	1 Yes 2 No
					1 Yes 2 No	1 Yes 2 No
					1 Yes 2 No	1 Yes 2 No

9. What are your information needs when starting a water or sanitation project in Kibera?

   □ 1 **Technical :** lack of knowledge of how to implement a water/sanitation project (i.e. how to survey, how to connect)

   □ 2 **Institutional :** lack of knowledge or practical know-how for productive organizational-institutional interaction with municipal institution (i.e. how to engage with NCWSC)

   □ 3 **Infrastructural :** lack of knowledge of the environment for implementing water/sanitation project (i.e. how to find water/sanitation mains in Kibera)

10. Who introduced you or your organization to WATSAN Portal: Kibera?

    □ 1 Friend □ 2 Colleague □ 3 Direct Email □ 4 Social/Traditional Media

    □ 5 Google (or other internet search engine) □ 6 NCWSC

11. What were your two main expectations for WATSAN Portal: Kibera?

    1- _____

    _____

    2- _____

    _____

12. Does WATSAN Portal: Kibera meet these two expectations?

    □ 1 Yes □ 2 No

13. Please explain how WATSAN Portal: Kibera does or does not meet expectations. _____

_____

_____

_____

14. What is your organization's main objective in using WATSAN Portal: Kibera?
[Check all that apply.]

□ 1 To gather information
□ 2 To share information
□ 3 To plan water projects
□ 4 To plan sanitation projects
□ 5 To understand how to connect to Nairobi City Water and Sanitation
□ 6 To survey potential water and sanitation project locations
□ 7 To collaborate with other organizations in Kibera water and sanitation network
□ 8 To conduct personal/professional research
□ 9 Other (Please specify. _____)

SECTION C: Organization & Use of Technology

15. Does your organization have access to computers? If no, skip to question 20.

□ 1 Yes □ 2 No

16. How many computers/laptops does the organization own?

□ 1 □ 2 □ 3 □ 4 □ 5+

17. Who purchased these computers or laptops which the organization owns? _____

18. How many computers/laptops does the organization have access to?

□ 1 □ 2 □ 3 □ 4 □ 5+

19. How often does your organization use computers?

□ 1 Frequently □ 2 Sometimes □ 3 Occasionally □ 4 Rarely □ 5 Never

Daily *Weekly* *Monthly* *Every few months*

20. Does your organization have access to other forms of technology (Internet, mobile devices, GPS, etc)? If no, skip to question 21.

□ 1 Yes □ 2 No

21. Please answer the following about forms of technology which your organization uses.

Type of	**Who**	**Frequency of use**

Technology	**purchased**	□ 1 Frequently *Daily*	□ 2 Sometimes *Weekly*	□ 3 Occasionally *Monthly*	□ 4 Rarely *Every few months*	□ 5 Never
Mobile device		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Internet		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
GPS		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Bluetooth (transfer of information from one device to another)		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Cameras (digital, video, web cam)		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Data management tools		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Communication technology (email, social networking)		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Other (Please specify)		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Other (Please specify)		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Other (Please specify)		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never

22. What is your level of computer competency?

    □ 1 Excellent □ 2 Very good □ 3 Good □ 4 Fair □ 5 Poor

23. What is your level of competency in regards to other technology?

    □ 1 Excellent □ 2 Very good □ 3 Good □ 4 Fair □ 5 Poor

24. What is the level of computer competency of organization staff (employees and/or volunteers)?

    □ 1 Excellent □ 2 Very good □ 3 Good □ 4 Fair □ 5 Poor □ 6 N/A

25. What is the level of technology competency of organization staff (employees and/or volunteers)?

□ 1 Excellent □ 2 Very good □ 3 Good □ 4 Fair □ 5 Poor □ 6 N/A

SECTION D: Organization and User Information Needs

26. How easy is it to find information about water and sanitation provision in Kibera?

□ 1 Very easy □ 2 Easy □ 3 Neutral □ 4 Difficult □ 5 Very difficult

27. Please provide your top three organizational information needs for ***planning or initiating*** an improved water/sanitation project.

Information Need	Information Importance	Method(s) of finding information	Location Information	Amount of time (in hours) to gather info

28. How often does your organization/business seek information on water and sanitation?

□ 1 Frequently *Daily* □ 2 Sometimes *Weekly* □ 3 Occasionally *Monthly* □ 4 Rarely *Every few months* □ 5 Never

29. How does your organization you seek information?

□ 1 Do not need to seek – we own information □ 2 Ask local residents/businesses

□ 3 Ask local administration □ 4 Conduct research or survey of the area

□ 5 Hire a surveyor/expert □ 6 Contact NCWSC

□ 7 Other_____

30. How often does your organization/business share information on water and sanitation?

□ 1 Frequently *Daily* □ 2 Sometimes *Weekly* □ 3 Occasionally *Monthly* □ 4 Rarely *Every few months* □ 5 Never

31. How does your organization share information on water and sanitation? (Check all that apply)

□ 1 Word of Mouth □ 2 Email or organizational notes

□ 3 Information-sharing Meetings □ 4 Awareness campaigns

□ 5 Publically source (website, brochure, etc) □ 4 Other:

_____

32. How does your group share new information with its members?

□ 1 Word of Mouth □ 2 Email or organizational notes

□ 3 Information-sharing Meetings □ 4 Other:

_____

33. Do you coordinate/collaborate with other projects? If no, skip to next section.

□ 1 Yes □ 2 No

34. How often do you coordinate/collaborate with other WATSAN projects?

□ 1 Frequently *Daily* □ 2 Sometimes *Weekly* □ 3 Occasionally *Monthly* □ 4 Rarely *Every few months* □ 5 Never

35. How often does your organization collaborate to develop water and sanitation projects?

□ 1 Frequently *Daily* □ 2 Sometimes *Weekly* □ 3 Occasionally *Monthly* □ 4 Rarely *Every few months* □ 5 Never

36. How does your group coordinate such activities? _____

_____

_____

_____

SECTION E: Usefulness of Information to Organization/User

37. How useful is information on **<u>location</u> of water and sanitation infrastructure** to your organization's work?

□ 1 Very useful □ 2 Somewhat useful □ 3 Neutral

□ 4 Almost never useful □ 5 Not at all useful

38. Please explain how this information is or is not useful. _____

_____

_____

_____

39. How useful is information about **the <u>process</u> of connecting to water and sanitation** to your organization's work?

□ 1 Very useful □ 2 Somewhat useful □ 3 Neutral

□ 4 Almost never useful □ 5 Not at all useful

40. Please explain how this information is or is not useful. _____

_____

_____

_____

41. How useful is information about **the <u>cost</u> of connecting to water and sanitation** to your organization's work?

□ 1 Very useful □ 2 Somewhat useful □ 3 Neutral

□ 4 Almost never useful □ 5 Not at all useful

42. Please explain how this information is or is not useful. _____

_____

_____

_____

43. Do you communicate with other water and sanitation projects in Kibera or with Nairobi City Water and Sanitation? If no, skip to 47.

□ 1 Yes □ 2 No

44. In what ways do you communicate with other water and sanitation projects in Kibera or with NCWSC?

□ 1 Phone □ 2 Email □ 3 In-person meetings

45. How often do you communicate with other projects or NCWSC?

□ 1 Frequently □ 2 Sometimes □ 3 Occasionally □ 4 Rarely □ 5 Never

Daily *Weekly* *Monthly* *Every few months*

46. What do you communicate about?_____

_____

_____

_____

SECTION F: User Appraisal of WATSAN Portal: Kibera

47. We've reviewed the information available via WATSAN Portal: Kibera. Please assess the following about the portal.

WATSAN Portal: Kibera-provided information about infrastructure location is:

□ 1 Very useful □ 2 Somewhat useful □ 3 Neutral

□ 4 Almost never useful □ 5 Not at all useful

WATSAN Portal: Kibera-provided information about the process of planning and implementing water/ sanitation projects is:

□ 1 Very useful □ 2 Somewhat useful □ 3 Neutral

□ 4 Almost never useful □ 5 Not at all useful

WATSAN Portal: Kibera-provided information about costs to implement water/sanitation projects is:

□ 1 Very useful □ 2 Somewhat useful □ 3 Neutral

□ 4 Almost never useful □ 5 Not at all useful

Does the information provided by WATSAN Portal: Kibera help achieve tasks related to planning and/or

implementing water and/or sanitation projects in Kibera?

□ 1 Yes □ 2 No

Please explain how WATSAN Portal: Kibera does or does not help achieve tasks. _____
_____
_____

Does the information provided by WPK help reduce time or work requires to plan and implement WATSAN projects in Kibera?

□ 1 Yes □ 2 No

Amount of time reduced (in number of working days): _____
Please explain how WATSAN Portal: Kibera does or does not help reduce work. _____
_____
_____
_____
_____

Are there barriers which still remain to information sharing in WATSAN Portal: Kibera?

□ 1 Yes □ 2 No

Please list barriers which still exists. _____
_____
_____
_____
_____

With WATSAN Portal: Kibera, are there still information needs for the planning and implementation water and sanitation projects?

□ 1 Yes □ 2 No

Please specify information still required. _____
_____
_____
_____
_____

Additional comments:

_____
_____

Appendix III: WATSAN Provider Key Informant Questionnaire

KEY INFORMANT QUESTIONNAIRE

Hello. My name is Jamila Harper. I am an M. A. student at the Institute for Development Studies at University of Nairobi. I am carrying out a study on information sharing among water and sanitation providers in WATSAN Portal: Kibera. The findings of this study will be used towards fulfillment of the requirements of a Master of Arts project paper in Development Studies. I would highly appreciate if you could give about 30 minutes to answer the following questions.

All information collected will be treated as confidential, and only used for research.

Thank you in advance for your cooperation.

SECTION A: QUESTIONNAIRE LOG BOOK

1. Questionnaire Number _____

2. Date of Interview _____

SECTION B: Organization & User Information

3. Type of User
   - □ 1 Community Based Organization
   - □ 2 Government Organization
   - □ 3 Nongovernmental Organization

4. Number of years working with water and/or sanitation in Kibera _____
5. Position in Organization
   - □ 1 Administration
   - □ 2 Management
   - □ 3 Senior
   - □ 4 Technical
   - □ 5 Other
6. Highest Level of Education
   - □ 1 Primary Incomplete
   - □ 2 Primary Complete
   - □ 3 Secondary Incomplete
   - □ 4 Secondary Complete
   - □ 5 Tertiary
   - □ 6 University
   - □ 7 Masters/Postgraduate
   - □ 8 Doctorate
7. Please give the following details of the organization.

Organization	Date started	Age (in complete years)	Number of employees/ volunteers	Size of capital	Sponsor	Financial Capacity (in monthly average)		
						Budget	Expenditure	Income

8. Please give the following details about your five recent water/sanitation project(s) in Kibera.

	Water/ Sanitation Project	**Date started**	**Sponsor(s)**	**No. of projects**	**No. projects operating**	**Improved water facility**	**Improved sanitation facility**
1						1 Yes 2 No	1 Yes 2 No
2						1 Yes 2 No	1 Yes 2 No
3						1 Yes 2 No	1 Yes 2 No
4						1 Yes 2 No	1 Yes 2 No
5						1 Yes 2 No	1 Yes 2 No

9. What are your information needs when starting a water or sanitation project in Kibera?

   □ 1 **Technical :** lack of knowledge of how to implement a water/sanitation project (i.e. how to survey, how to connect)

   □ 2 **Institutional :** lack of knowledge or practical know-how for productive organizational-institutional interaction with municipal institution (i.e. how to engage with NCWSC)

   □ 3 **Infrastructural :** lack of knowledge of the environment for implementing water/sanitation project (i.e. how to find water/sanitation mains in Kibera)

SECTION C: Organization & User Use of Technology

10. Does your organization have access to computers? If no, skip to question 15.

    □ 1 Yes □ 2 No

11. How many computers/laptops does the organization own?

    □ 1 □ 2 □ 3 □ 4 □ 5+

12. Who purchased these computers or laptops which the organization owns? _____

13. How many computers/laptops does the organization have access to?

    □ 1 □ 2 □ 3 □ 4 □ 5+

14. How often does your organization use computers?

□ 1 Frequently *Daily* □ 2 Sometimes *Weekly* □ 3 Occasionally *Monthly* □ 4 Rarely *Every few months* □ 5 Never

15. Does your organization have access to other forms of technology (Internet, mobile devices, GPS, etc)? If no, skip to question 17.
    □ 1 Yes □ 2 No

16. Please answer the following about forms of technology which your organization uses.

Type of Technology	**Who purchased**	**Frequency of use** □ 1 Frequently *Daily*	□ 2 Sometimes *Weekly*	□ 3 Occasionally *Monthly*	□ 4 Rarely *Every few months*	□ 5 Never
Mobile device		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Internet		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
GPS		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Bluetooth (transfer of information from one device to another)		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Cameras (digital, video, web cam)		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Data management tools		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Communication technology (email, social networking)		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Other (Please specify)		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
		□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never

17. What is your level of computer competency?

□ 1 Excellent □ 2 Very good □ 3 Good □ 4 Fair □ 5 Poor

18. What is your level of competency in regards to other technology?

□ 1 Excellent □ 2 Very good □ 3 Good □ 4 Fair □ 5 Poor

19. What is the level of computer competency of organization staff (employees and/or volunteers)?

□ 1 Excellent □ 2 Very good □ 3 Good □ 4 Fair □ 5 Poor □ 6 N/A

20. What is the level of technology competency of organization staff (employees and/or volunteers)?

□ 1 Excellent □ 2 Very good □ 3 Good □ 4 Fair □ 5 Poor □ 6 N/A

SECTION D: Organization and User Information Needs

21. How easy is it to find information about water and sanitation provision in Kibera?

□ 1 Very easy □ 2 Easy □ 3 Neutral □ 4 Difficult □ 5 Very difficult

22. Please provide your top three organizational information needs for *planning or initiating* an improved water/sanitation project.

Information Need	Information Importance	Method(s) of finding information	Location Information	Amount of time (in hours) to gather info

23. How often does your organization/business seek information on water and sanitation?

□ 1 Frequently *Daily* □ 2 Sometimes *Weekly* □ 3 Occasionally *Monthly* □ 4 Rarely *Every few months* □ 5 Never

24. How does your organization seek information?

□ 1 Do not need to seek – we own information □ 2 Ask local residents/businesses

□ 3 Ask local administration □ 4 Conduct research or survey of the area

□ 5 Hire a surveyor/expert □ 6 Contact NCWSC

□ 7 Other_____

25. How often does your organization/business share information on water and sanitation?

□ 1 Frequently *Daily* □ 2 Sometimes *Weekly* □ 3 Occasionally *Monthly* □ 4 Rarely *Every few months* □ 5 Never

26. How does your group share information on water and sanitation? (Check all that apply)

□ 1 Word of Mouth □ 2 Email or organizational notes

□ 3 Information-sharing Meetings □ 4 Awareness campaigns

□ 5 Publically source (website, brochure, etc) □ 4 Other: _____

27. How does your group share new information with its members?

□ 1 Word of Mouth □ 2 Email or organizational notes

□ 3 Information-sharing Meetings □ 4 Other: ___

28. Do you coordinate/collaborate with other projects? If no, skip to next section.

□ 1 Yes □ 2 No

29. How often do you coordinate/collaborate with other WATSAN projects?

□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Daily	*Weekly*	*Monthly*	*Every few months*	

30. How often does your organization collaborate to develop water and sanitation projects?

□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Daily	*Weekly*	*Monthly*	*Every few months*	

31. How does your organization coordinate such activities? _____

_____

_____

_____

SECTION E: Usefulness of Information to Organization/User

32. How useful is information on **<u>location</u> of water and sanitation infrastructure** to your organization's work?

□ 1 Very useful □ 2 Somewhat useful □ 3 Neutral

□ 4 Almost never useful □ 5 Not at all useful

33. Please explain how this information is or is not useful. _____

_____

_____

_____

34. How useful is information about **the <u>process</u> of connecting to water and sanitation** to your organization's work?

□ 1 Very useful □ 2 Somewhat useful □ 3 Neutral

□ 4 Almost never useful □ 5 Not at all useful

35. Please explain how this information is or is not useful. _____

_____

_____

_____

36. How useful is information about **the <u>cost</u> of connecting to water and sanitation** to your organization's work?

□ 1 Very useful □ 2 Somewhat useful □ 3 Neutral

□ 4 Almost never useful □ 5 Not at all useful

37. Please explain how this information is or is not useful. _____

_____

_____

_____

38. Do you communicate with other water and sanitation projects in Kibera or with Nairobi City Water and Sanitation? If no, skip to 47.

□ 1 Yes □ 2 No

39. In what ways do you communicate with other water and sanitation projects in Kibera or with NCWSC?

□ 1 Phone □ 2 Email □ 3 In-person meetings

40. How often do you communicate with other projects or NCWSC?

□ 1 Frequently	□ 2 Sometimes	□ 3 Occasionally	□ 4 Rarely	□ 5 Never
Daily	*Weekly*	*Monthly*	*Every few months*	

41. What do you communicate about?_____

_____

_____

_____

Additional comments:

_____

_____