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Master's Thesis of Dae Sung Eom

Underlying Factors Conducive to  
ICT-based Water Projects  
Comparing the Case Studies of Kenya and  
Tanzania

ICT 기반 물 프로젝트에 이로운 근원적 요인:  
케냐와 탄자니아의 사례연구 비교

February 2021

Graduate School of International Studies  
Seoul National University  
International Cooperation Major

Dae Sung Eom

# Underlying Factors Conducive to ICT-based Water Projects

## Comparing the Case Studies of Kenya and Tanzania

지도교수 김태균

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International Studies  
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February 2021

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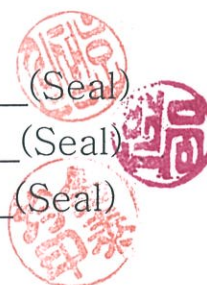
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# **ABSTRACT**

## **Underlying Factors Conducive to ICT-based Water Projects**

### **Comparing the Case Studies of Kenya and Tanzania**

*Dae Sung Eom*

*International Cooperation*

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*Seoul National University*

Despite increasing global efforts to eradicate common problems of humanity, such as securing clean water, progress for some regions has been mediocre, at best. Though initiatives, such as the SDG-6, emphasize universal access to clean water, regions, such as Sub-Saharan Africa, are still suffering from pervasive water crises. Burdened with continuing conflict, corruption, poverty, and inadequate infrastructures, the said region's traditional method of water management is not sufficient.

Recently, an innovative alternative of ICT utilization in the water sector was proposed. At a glance, ICT-based water projects seemed infallible, as they provided a cost-efficient way of managing water, with the added benefits of increased accountability through public participation. As the results of the two case studies in the research,

Kenya and Tanzania's Maji Voice and Human Sensor Web projects, respectively, show, not all ICT-based water projects succeed.

A qualitative case study analysis, consisting of the two above case studies, was conducted to comprehend the conducive factors to the success of ICT-based water projects in Africa. Moreover, the question of whether the superficial, such as economic, social, and political, factors or the more underlying factors were determining variables was sought to be answered. Results showed that though there lacked any significant differences among the superficial factors, meaningful disparities of underlying factors, such as number of stakeholders and quantity and quality of accountability mechanisms, were found.

Mainly utilizing the principal-agent theory, rational choice institutionalism, and the concept of responsibility buck-passing, the research sought to prove that the two disparities were contributing factors to the overall success of ICT-based water projects in Africa. With such findings, policy implications to future implementers of such projects are also given, which strengthens the emphasis on limiting the number of stakeholders to decrease buck-passing, as well as increasing accountability input for greater accountability output.

**Key Words:** SDG-6, Sub-Saharan Africa, ICT, water, stakeholders, accountability

**Student Number:** 2019-25724

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## **List of Abbreviations and Acronyms**

<b>AfDB</b>	African Development Bank
<b>GDP</b>	Gross Domestic Product
<b>GNI</b>	Gross National Income
<b>ICT</b>	Information and Communications Technology
<b>IWRM</b>	Integrated Water Resource Management
<b>MWI</b>	Ministry of Water and Irrigation
<b>NGO</b>	Non-Governmental Organization
<b>NICT</b>	National Information and Communications Technology
<b>SDG</b>	Sustainable Development Goals
<b>SMS</b>	Short Message Service
<b>UN</b>	United Nations
<b>USSD</b>	Unstructured Supplementary Service Data
<b>WASREB</b>	Water Services Regulatory Board
<b>WB</b>	World Bank
<b>WSP</b>	Water Service Provider

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# **I. Introduction**

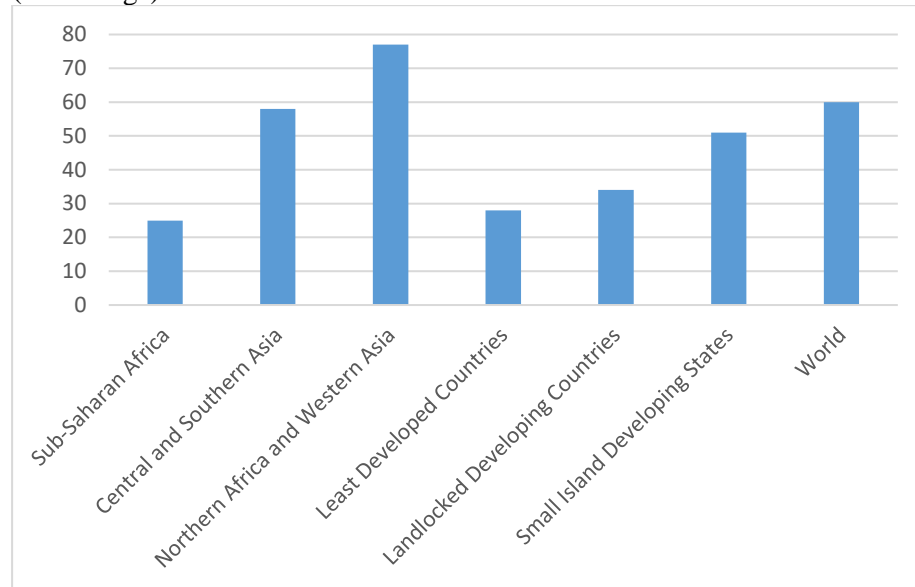
## **1. Background**

In the midst of the COVID-19 pandemic, the everyday task of washing hands has received renewed importance, due to its effectiveness in preventing the spread of the virus. Though for some, washing hands might come off as a trivial, and maybe even a tedious activity, for others, it is an unaffordable luxury. For instance, in Sub-Saharan Africa, only a quarter of all households had access to a handwashing facility at home.<sup>1</sup> Figure 1 below shows the percentage of the global individuals with adequate household handwashing facilities equipped with soap and water, as of 2017, and when compared with the world average of 60%, the 25% rate in Sub-Saharan Africa is far below the norm.

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<sup>1</sup> “The Sustainable Development Goals Report 2020”. (2020). New York, USA.  
United Nations

**[Figure 1.]** Availability of adequate household handwashing, 2017 (Percentage)



Source: Author's work based on UN's "The Sustainable Development Goals Report 2020". (2020)

The hazards of water scarcity were finally able to receive mass global attention with the introduction of the Sustainable Development Goals. The successor to the Millennium Development Goals outsized its predecessor by having 17 goals instead of eight. The spot of goal number six was allotted to the vital task of providing universal access to clean water and sanitation by the year 2030.

Despite its bold mission statement of procuring universal access to water and sanitation, the SDG-6 still has a long way to go for its desired target. Especially in the region of Sub-Saharan Africa, the statistics are far from completion. The WHO-UNICEF Joint Monitoring

Program report shows that 42% of the region's population lacks basic water supplies, and an even greater 72% cannot access basic sanitation.<sup>2</sup> These alarming conditions are exacerbated with the current viral pandemic, where water is in greater demand for basic defense against the virus.

Water is more vital of a resource than most people realize. On the surface, water we know is essential for basic human survival. As we take a closer look, we can see that water serves as a cross-cutting issue for not only health, as abovementioned, but also many other SDG-related topics, such as education, gender inequality, and economic growth, since more women and children could spend their time and energy more productively, had they been more accessible to water.

Then, despite international efforts for universal access to water, why do problems of water scarcity persist for certain regions, especially Sub-Saharan Africa? The answer lies in what Pradeep Naik calls "Physical" and "Economic" Scarcities.<sup>3</sup> The former refers to the factors influenced by nature, such as global climate change, changes in precipitation patterns, and etc. The latter consists of factors contributed

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<sup>2</sup> "Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines" (2017). Geneva, Switzerland. World Health Organization and UNICEF

<sup>3</sup> Naik, P. (2016). "Water Crisis in Africa: Myth or Reality?". Chandigarh, India. International Journal of Water Resources Development

by human beings, such as poverty, rapid population increase, poor government policies, and etc.<sup>4</sup>

With the persistence of water scarcity issues in Sub-Saharan Africa, regional leaders and politicians did not simply stand by. In the year 2000, the continent's leaders agreed upon the AfDB's "The Africa Water Vision for 2025", which emphasized the need for the following: 1) Better management and governance of water resources, 2) Expand knowledge regarding water, 3) Fight urgent water scarcities, and 4) designate a more future-oriented budget for the improvement of water resources.<sup>5</sup>

## 2. Status Quo

The African context of today, riddled with conflicts, due to artificially drawn borders of the post-colonial era; rampant corruption in the government; and general lack of financial resources and infrastructures have made previous attempts at water reforms futile.

Hence, leaders and politicians of Africa and international aid donors, alike, have started looking for innovative alternatives to the traditional method of reform. Recent World Bank and AfDB statistics

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<sup>4</sup> Ibid

<sup>5</sup> "The Africa Water Vision for 2025: Equitable and Sustainable Use of Water for Socioeconomic Development". (2004). Addis Ababa, Ethiopia. Economic Commission for Africa

showed that the number of mobile subscribers in Africa is to be around 650 million, exceeding those of the US or Europe. Moreover, some African states claimed that the number of mobile users outnumbered that of clean water and electricity users.<sup>6</sup> Taking this into consideration, coupled with the fourth industrial revolution's growing emphasis on ICT, engineers, policymakers, and donors have decided to implement ICT in not only the developed nations' water sectors, but also in those of countries that truly need it, such as those of Sub-Saharan Africa.

Although in theory, unlocking the potentials of ICT to increase water provision in Sub-Saharan Africa looks to be an infallible solution, empirical case studies, such as those later discussed in the research show that in practice, certain underlying factors, such as the buck-passing possibilities, associated with the number of stakeholders, and the quantity and quality of existing accountability mechanisms, play a decisive factor in the performance of ICT-based water projects. Moreover, since one of the major benefits accrued from successful ICT-based water projects is spurring greater accountability through increased public participation, and due to the fact that one signaling factor of a successful ICT-based water projects is increased accountability to ensure successful performance, it can be said that accountability input positively correlates to accountability output.

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<sup>6</sup> Sambira, J. (2013). "Africa's Mobile Youth Drive Change". African Renewal. United Nations

### 3. Scope

This thesis will mainly be divided into seven chapters, which all work in tandem to better explain why some ICT-based water projects are not performing on par with one another, despite similar social, economic, and political backgrounds, and then, what underlying factors make up these different performances. The thesis will not cover the technical aspects of ICT-based water projects in their creation and operation phases but only attempt to explain the policy-oriented mechanisms in the implementation phase.

The first chapter will be the introduction of the research, where background information about the topic and its context are given. Then, the status quo of the topic and thesis statement will be given. Lastly, the chapter will conclude with the general scope, explaining what the thesis does and does not cover, as well as the outline of the thesis.

The second chapter will provide the existing literature review on the said topic, showing the general patterns, trends, and themes of the works by the academic community surrounding the topic. Also, this section attempts to uncover any gaps there might exist regarding the topic, which the current research tries to fill.



Chapter three will go in depth regarding the purpose of the research, where the research puzzle that the thesis aims to unlock is given. Then the chapter will conclude with the research methodology, explaining which measures were taken to reach the conclusion.

Chapter four provides the theoretical framework, which would aid in the reader's interpretation of the findings and analysis.

Chapter five will introduce the two case studies that were chosen and their respective background details. After, a brief explanation of why the cases were chosen will be presented in the justification section in the same chapter.

The sixth chapter will focus on compiling all of the research findings and data on the said case studies that would be useful for analysis in the following sections. Then, the chapter will conclude by analyzing the given findings by looking at the similarities and differences of the two case studies.

The concluding chapters will give the final verdict of the research. Policy implications for future ICT-based water project implementers will be provided, followed by the research's limitations, as well as a brief summary of the thesis.

## II. Literature Review

Due to the concept of ICT-based water projects being a relatively new phenomenon in the academic community, only a limited amount of existing literatures was found to be analyzed. The thesis, nonetheless, will go through a number of noteworthy works by scholars, regarding the implementation of ICT in the water sectors. As mentioned prior, the literature review aims to achieve two following goals: 1) providing the general patterns, trends, and themes of the current academic community regarding the topic of ICT in water sectors, and 2) attempting to uncover and fill any research gaps that might exist in the current literature. In outlining the literature review, the works have been arranged in a chronological order to show the research progress on the topic of ICT in the water sector.

One of the earliest instances of research being done on the impact of ICT in water sectors can be found in the work of Pereira et al., which was published in 2003. In their work, *ICT Tools to Support Public Participation in Water Resources Governance and Planning*, the authors provide an insightful account portraying the inclusive potentials of ICT, which was uncommon at the time. The commonly believed notion at the time, when ICT was at its start-off phase, was that it was inherently exclusive, due to the limited access only provided to the technologically savvy. Pereira et al. argued that ICT had, in fact, an

inclusive nature, since various languages, media tools, visual formats could be expressed. To them, ICT provided alternative means to bring together people of different backgrounds and relations. The authors asserted their points by providing a case study of the Hérault river basin region in Southern France, where ICT was implemented to spur greater participation from non-scientific stakeholders, regarding water resource governance and planning.

Philippe Gourbesville, in his work, *ICT for Water Efficiency (2011)*, explores the uncharted potentials of the fast growing ICT improving the water sector. The sector faces a grave threat, stemming from global climate change and rapid population growth. He argues that ICT provides the impetus to enjoy the fruits of data abundance, rather than suffer from data scarcity. A crucial point to keep in mind from his work is that in order to effectively take advantage of the power of ICT in the water sectors, two conditions must be met. First, policies, guidelines, and initiatives must be coordinated and defined by all major actors of the water sectors. He adds that active dialogue is crucial for making this a reality. Secondly, he points to the need for his approach to be conducted in all levels of the water sectors, not just the upper tier. With the two conditions being met, Gourbesville argues that ICT can serve as a silver bullet to the dire water crises.

The initial conceptualizations of utilizing “human sensors” can be found in Fraternali et al.’s article, *Putting Humans in the Loop: Social*

*Computing for Water Resources Management (2012)*. The authors argue that the advancements in ICT has allowed the innovative integration of humans and computers where potentials of both parties can be maximized. The idea is that local communities and individuals, who have gained more practical knowledge about their surroundings, coupled with the real-time nature of ICT, could bring about countless potentials for efficient water management.

With the growth of ICT and more utilization of it in the water sectors, a global platform has been created, named the Integrated Water Resources Management (IWRM). Sempere-Payá et al., in their work, *ICT as an Enabler to Smart Water Management (2013)*, introduces the IWRM system and its motive for creation. The system was born out of necessity, in order to better manage the urban waters “in a context of efficient and sustainable urban development”.<sup>7</sup> Real-time data was crucial in determining the actual demand and supply of water, which the service providers could base their prices on. The fusion of ICT and the water sector has led to the creation of the IWRM system, which can handle large sums of information real-time, under the categories of generation, transport, and consumption.

Similar to Fraternali et al.’s idea of utilizing human sensors, C.S. Laspidou offers an innovative role that ICT could have in shaping not

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<sup>7</sup> Sempere-Payá, V. et al. (2013). “ICT As an Enabler to Smart Water Management”. Heidelberg, Germany. Springer-Verlag Berlin Heidelberg

only the producers, but also the consumers' behavior toward ICT in the water sector. In her work, *ICT and Stakeholder Participation for Improved Urban Water Management in the Cities of the Future (2014)*, Laspidou offers the impacts that ICT could have on both the water producers and consumers. For the former, ICT would engender full automation of water operations, which would cut energy costs, lower leakages, and cut down water which are non-revenue. For the latter, ICT may alter the general usage patterns and perception of water uses of the consumers via various methods, such as SNS and gaming. Thus, it can be said that her work emphasizes sustainability in novel methods for greater water management efficiency.

With Gabriel Anzaldi's work, *A Holistic ICT Solution to Improve Matching Between Supply and Demand over the Water Supply Distribution Chain (2014)*, the concept of IWRM is revisited. He points out that IWRM cannot be fully optimized if production subsystems cannot effectively communicate and exchange data with the consumption counterparts. As a solution, he proposes a holistic approach where production, consumption, and management should work in tandem. Anzaldi cites the case study of the WatERP project, which embodies this holistic approach. The project is an open platform making use of the real-time information gathered, regarding production, consumption, and management. He argues that the holistic approaches

like WatERP would “ensure interoperability and maximize usability”.<sup>8</sup>

The literature provides the following four main benefits that the open platform project brings: 1) improving cooperation among stakeholders, 2) engender perception change, 3) decrease water and energy usage, 4) spur greater social accountability.<sup>9</sup>

Nel et al., in their work, *ICT-Enabled Solutions for Smart Management of Water Supply in Africa (2014)*, goes in depth, regarding the obstacles that face various water sector stakeholders from providers to consumers, and how ICT could provide the answer. The authors present the case study of the “Proof-of-concept” smartphone application, designed to allow users to visualize the water usage meters, status, and graphs, which were traditionally difficult to access, onto their Android-powered smartphones. The case of the proof-of-concept application set an empirical example of how ICT could “increase consumer awareness, reduce water and electricity demand, and provide WSPs with additional data for management tasks”.<sup>10</sup>

Emily Kumpel and her colleagues, in their article, *When Are Mobile Phones Useful for Water Quality Data Collection? (2015)*,

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<sup>8</sup> Anzaldi, G. (2014). “A Holistic ICT Solution to Improve Matching Between Supply and Demand Over the Water Supply Distributio Chain”. Volume 2, Issue 4. Journal of Sustainable Development of Energy, Water and Environmental Systems

<sup>9</sup> Ibid

<sup>10</sup> Nel, P.J.C. et al. (2014). “ICT-enabled Solutions for Smart Management of Water Supply in Africa”. Stellenbosch, South Africa. 1st International Conference on the Use of Mobile ICT in Africa

presented their findings from their research on public water suppliers and health authorities from six different African nations. A common pattern that they found in their research was that all tests concerning water quality were being done in a designated computer-equipped laboratory. Since much costs and energy were burdened for remote water points, the team equipped one remote setting, the national public health agency of Senegal, with a mobile phone that could conduct water quality tests. The team came to a conclusion that the implementation of the mobile phones for water quality tests were indeed cost-efficient for agencies with multiple remote water points. Hence, the article exemplifies how the implementation of mobile phones creates a strong foundation for understanding the potentials of ICT in water management, especially, in the field of quality.

Ssozi-Mugarura et al., in their work titled, *Designing for Sustainability: Involving Communities in Developing ICT Interventions to Support Water Resource Management (2015)*, has focused on ICT implementations in the water sector from the perspective of the users, especially those residing in rural areas. The authors argue that rural water provision should be distinguished from its urban counterpart, since water provision has been relatively poor for the rural citizens. While the authors agree with the potentials that ICT could bring, in terms of effective water management, they propose a new type of design, where the rural water users could “co-design” the ICT-water projects.

With this approach, sustainability of these projects can be achieved, since more emphasis would be placed on actual users' "needs, wants, and limitations".<sup>11</sup>

One of the latest literatures found, regarding the topic of ICT implementation in the water sector is Hitesh Mohapatra and Amiya Rath's *Detection and Avoidance of Water Loss Through Municipality Taps in India by Using Smart Taps and ICT (2019)*. With the 21<sup>st</sup> century challenges to water provisions, such as climate change, rapid population growth, and urbanization, the WSPs simply cannot manage to supply the correct amounts of water, according to actual consumption. An interesting point by the authors is that power can not only be harnessed with one ICT device, but also by multiple ICT devices with the internet of things technology. Mohapatra and Rath state that in order to preserve water supplies in the long run, simultaneous coordination of multiple ICT devices is key. In order to support their claim, the case study of the Sambalpur District in Odisha, India is given. More efficient water management was possible when the ICT was introduced for enhanced sensing of water, as well as improved communications among the water authorities.

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<sup>11</sup> Ssozi-Mugarura, F. et al. (2015). "Designing for Sustainability: Involving Communities in Developing ICT Interventions to Support Water Resource Management". 2015 IST-Africa Conference. Lilongwe



Despite the limited sample size of the existing literature on ICT implementation in the water sectors, there were several discernable patterns, trends, and themes. The overarching idea is that ICT-based water projects benefit both the WSPs and the consumers in rural and urban water sectors. Moreover, the existing literature agrees that ICT provides a cost-efficient solution that could tackle the obstacles that traditional water management methods could not. ICT, itself, has much potential, since it can be synced with other ICT machines to target multiple areas of the water issue ranging from provision, quality assurance, to prevention of unnecessary water losses, due to leakages and non-revenue water. It can also aid in social mobilization, where ICT has the power to shape citizens' behaviors and indirectly let them participate in the change.

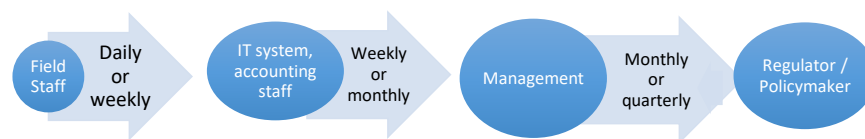
While it is true that the general consensus of the academic community is highly in favor of the adoption of ICT in the water sector, there exists a significant gap in research. The void that has not been yet filled is that most, if not all, of the literatures focus solely on the technicalities or the presumed benefits of the ICT-based water projects. Surely, technical aspects and the benefits that ICT would bring cannot be ignored. The literature, however, is valid only with the assumption that the ICT-based water projects were implemented and maintained with success. In reality, however, not all projects perform on par with one another, and some recipients fail to reap in the promised benefits.

This research attempts to fill in the gap, created by the above assumption, by figuring out which underlying factors are conducive to the overall success and sustainability of ICT-based water projects in developing regions, especially Sub-Saharan Africa, where water crisis is gravest. Since existing literature has mentioned technicalities in plenty, this research will attempt to delve into the implementation policy-oriented aspects surrounding the ICT-based water projects, such as strict evaluation, monitoring, responsibility, and accountability mechanisms, which would ensure the long-run success ICT-based water projects.

### III. Purpose of Research

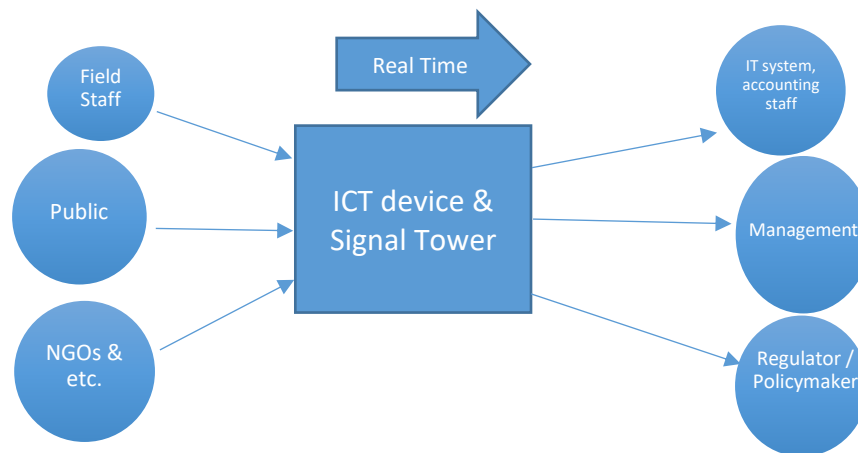
In spite of international efforts, such as the SDG-6, as well as billions of dollars in aid, the water crises in some regions of the world are simply not being eradicated. Currently, the region of Sub-Saharan Africa is receiving the most attention, due to its severity of water stress levels. We have seen that with poor governance, due to high levels of corruption; persisting inter-border conflicts; and lack of adequate financial resources and infrastructures, resulting from poverty, the traditional methods of managing water resources in Sub-Saharan Africa have proven to be unsuccessful. It is time for an innovative alternative. Figures 2-1 and 2-2 below showcase the direction and duration of the flow of information in traditional water management and ICT-utilized water management, respectively.

**[Figure 2-1.]** Traditional water sector flow of information



Source: Author's work based on Schaub-Jones, D. et al. (2013)

**[Figure 2-2.]** ICT-utilized water sector flow of information



Source: Author's work based on Schaub-Jones, D. et al. (2013)

The mobile penetration rate in Africa reaching 77% of the entire population of the continent, as of 2019, and is expected to increase by another nine percent by the year 2025.<sup>12</sup> As mentioned prior, these absolute figures of mobile subscribers are greater than those of the US or Europe. These optimistic indicators, coupled with the fact that many African countries are incorporating NICT development in their national agendas may provide the alternative cure for the persisting water crisis. In the year 2000, only 13 African states had some sort of NICT in their national agenda; however, that figure has swollen to 42 by the year 2012, and the figure is expected to be much higher in the years following the new decade.

<sup>12</sup> “The Mobile Economy: Sub-Saharan Africa 2020”. (2020). GSMA Intelligence. GSMA

Though utilization of ICT in water management does present an optimistic outlook, the practical aspects of implementation and maintenance does present a challenge, due to the sheer novelty of the concept. The puzzling issue for donor organizations and recipient governments, alike, is that some ICT solutions are not performing on par with others, while others are thriving to help millions in their new environment, hence meaning that simply implementing ICT-based water projects for its sake is not a panacea. For instance, ICT-based water projects in Kenya, which is one of the countries that holds the most of said types of projects, seem to working well, whereas in Kenya's neighboring countries, the same thing cannot be said.

## 1. Research Question and Significance

The research is useful, in the sense that it attempts to answer the puzzling question, what is the underlying factor that causes some ICT-based water projects to succeed and others not? In more detail, the research aims to focus on the narrower question of considering the similar superficial conditions (gender inequality, water scarcity, geographic location, low government perception index, and etc.), why has the Maji Voice initiative (Kenyan case) succeeded, while the Human Sensor Web project (Tanzanian case) failed to deliver on its promises?

Another useful aspect of the research is that it shies away from the mainstream research about the topic of ICT-based water projects, in the sense that it focuses on the implementation and maintenance stages, rather than the technical aspects, of the projects. Simply having superb technicalities is not enough to guarantee success for these projects. Case studies have shown that very few ICT-based tools can blame technical flaws for the reason of failure. The more decisive factors are how the stakeholders implemented and maintained the projects, or lack thereof, after the projects' inception.

Therefore, in order to ensure the proper implementation and maintenance of these ICT-based water projects, stringent mechanisms by the donor organizations and/or recipient governments should be observed. According to the UK Commission on Public Private Partnership, in the absence of accountability mechanisms, the demands and rights of consumers cannot be made certain, therefore,

The currently existing research, regarding ICT-based water projects, tend to solely focus on the projects being the end results of spurring greater accountability, while failing to capture how accountability via stringent mechanisms can also be used as a means to increase the likelihood of these end results.

Since the research builds upon the hypothesis that accountability is not only the desired outcome for ICT-based water projects, but also a vital factor which contributes to its success, the research will be useful

in the process of proving whether accountability input, or the quantity and quality of accountability mechanisms applied, has a positive correlation with the accountability output, or the amounts of accountability generated by the projects to the WSPs and consumers. With the results, the research will aim to guide donor organizations and recipient stakeholders in the right directions with the lessons learned.

## 2. Methodology

The research will be conducted via a comparative case study methodology to prove the previously mentioned hypothesis. The paper will focus in on two case studies of the Republic of Kenya and more specifically, its Maji Voice initiative, and also the United Republic of Tanzania, and its Human Sensor Web project. The supporting evidence for the research will come from a variety of primary and secondary sources consisting, but not limited to, national and public documents, existing research and literature on ICT-based water projects, and the databases of multilateral organizations, such as the World Bank and the OECD.

First, the research will go in depth to uncover any factors that might have existed in the superficial conditions, such as economic, social, and political, of the two case study countries to find any determining factors to success. Then, the same process would be applied

to the projects, themselves, to see if any striking differences existed between the two initiatives.

Then, the research set out to search for any underlying factors, both from the hosting countries and case study projects, which might influence success or failure of the ICT-based water projects. The speculative underlying factors were project locations (urban or rural), status of project ownership, number of stakeholders, method of functionality (fully automatic, partially automatic, or manual), and etc. With these findings, the paper, aided by existing theories and concepts, will compare with other successful and failed cases of ICT-based water projects to see if similar patterns can be observed, which would confirm the hypothesis.

Despite numerous ICT-based water projects springing up in needed regions, especially those of Sub-Saharan Africa, not enough research has been done to evaluate their success or failure. ICT-based water projects, though an optimistic concept, has not been around for long, since the ICT, itself, is a relatively new concept in the developing regions. The few existing reports done on the projects focused primarily on the superficial factors (economic, social, political) to justify their success or failure, but these approaches could not be applied to other cases with similar superficial conditions. Hence, an underlying factor, which could better explain the reasons for success or failure, were to be found by looking at not just the projects, themselves, but also the



surrounding policies, binding mechanisms, and accountability, as well, which presented many challenges to the research, since a number of them (project contracts, MoU) were not disclosed to the public.

#### **IV. Theoretical Framework**

In order to foster a more efficient discussion and a better understanding of the case studies, several theories and concepts must be reviewed beforehand. The major theories/concepts that will be mentioned in this section are the following: 1) Principal-Agent Theory, 2) the concept of accountability, 3) Rational Choice Institutionalism, and 4) the concept of responsibility “buck-passing”.

First, regarding the Principal-Agent Theory, often used in business economics, has its origins in 1974 with Barry Mitnick’s doctoral dissertation, *The Theory of Agency*, from the University of Pennsylvania. According to the author, the definition of the principal-agent relationships is as follows: Power is delegated to the so-called ‘agent’, which acts on behalf of the ‘principal’ for the principal’s benefits. Though the principal-agent relationship takes advantage of David Ricardo’s theory of comparative advantage and specialization of labor, there may exist certain barriers to prevent maximum utility in the said relationship, such as moral hazards. According to Sean Gailmard’s

*Accountability and Principal-Agent Models* (2012), the agent may not always maximize the principal's gains or benefits, since the actions of the agent may not align with the imagined direction of the principal, due to the fact that "the principal and agents have different preferences over the possible actions the agent can take".<sup>13</sup> This situation is especially exacerbated when the principal does not have a direct say in the choices of the agent's actions.

As there can arise problems of moral hazards in the principal-agent relationships, the concept of accountability may provide the cure. Though the dictionary definitions of accountability have existed for centuries, the term that the research wishes to expound upon, focusing on accountability used in its political nature, is best summarized by Andreas Schedler's *Conceptualizing Accountability* (1999). In his work, Schedler proscribes the three pillars of "enforcement, monitoring, and justification", when conceptualizing the term accountability.<sup>14</sup> Enforcement refers to "subjecting power to the threat of sanctions", monitoring deals with guaranteeing transparency from the agents, and lastly, justification is simply demanding the agent that it "justify its acts".<sup>15</sup>

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<sup>13</sup> Gailmard, S. (2012). "Accountability and Principal-Agent Models". Oxford Handbook of Public Accountability. Oxford University Press

<sup>14</sup> Schedler, A. et al. (1999). "The Self-Restraining State: Power and Accountability in New Democracies". Lynne Rienner Publishers

<sup>15</sup> Schedler, A. et al. (1999). "The Self-Restraining State: Power and Accountability in New Democracies". Lynne Rienner Publishers

Regarding the concept of accountability, when it comes to multilateral organizations, they can have the same spirit but utilize differing mechanisms to achieve the said spirit. As for the OECD, the organization provides three main types of accountability mechanisms when it comes to international development cooperation. Firstly, “goals” are agreed upon “targets, commitments, and benchmarks”,<sup>16</sup> such as the MDG’s, SDG’s, and the aid effectiveness forums. Secondly, there are “measurements”, which are “monitoring and evaluation providing evidence of result”.<sup>17</sup> Measurements can come in various forms, such as the Commitment to Development Index and the joint OECD-UNDP assessments. Lastly, there are “actions” that provide “incentives for changing strategy, due to poor performance”.<sup>18</sup> Examples include dialogues, learning from experience, peer pressure, sanctions, and arbitration.<sup>19</sup>

Another prominent multilateral organization is the United Nations. Here, accountability mechanisms are defined by responsibility, answerability, and enforceability. First, responsibility refers to requiring the stakeholders to have unambiguously set powers and standards. Responsibility can come as MoU, Safeguards, and policy dialogues.

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<sup>16</sup> “Development Co-operation Report 2015: Making Partnerships Effective Coalitions for Action”. (2015). Paris, France. OECD Publishing

<sup>17</sup> Ibid

<sup>18</sup> “Development Co-operation Report 2015: Making Partnerships Effective Coalitions for Action”. (2015). Paris, France. OECD Publishing

<sup>19</sup> Ibid

Second, the concept of answerability demands agents that they justify their acts to their principals<sup>20</sup>, and can come in the forms of peer review, monitoring, and evaluation. Lastly, enforceability demands agents to be effectively evaluated and assessed, and also be subject to arbitration, in case of poor performance.<sup>21</sup>

The next theory/idea that must be reviewed is Rational Choice Institutionalism, but before doing so, the closely related theory of rational choice must be discussed. This economic theory stems from the basic ideas of economics, which states that all individuals are ‘rational’ in the sense that they measure their acts according to the total benefits and losses of each actions. Hence, rational choice institutionalism can be summarized as incorporating institutions to ensure the “rationality” of maximizing benefits and minimizing costs of its actors. Rational choice institutionalism is especially vital when dealing with dilemmas associating from governing common goods. Naturally, as “rational” actors, individuals tend to prioritize personal interests over communal interests. This is clearly illustrated in Ellinor Ostrom’s *Governing the Commons* (1990), where she champions institutional change for combatting collective action dilemmas, such as Garret Hardin’s tragedy of the commons and Mancur Olson’s collective action and free-riding

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<sup>20</sup> Ibid

<sup>21</sup> “Who Will Be Accountable? Human Rights and the Post-2015 Development Agenda”. (2013). New York and Geneva. UN Human Rights Office of the High Commissioner

issues. Kenneth A. Shepsle, in his work, *Rational Choice Institutionalism* (2008), contributed to rational choice institutionalism by providing the means to deal with collective action dilemmas in “unstructured institutions”. Shepsle states that on top of the selective benefits proposed by Olson, there exist the roles of leadership, whom provides “unusually large contributions” not based on passion or devotion, but for benefiting their self-realization,<sup>22</sup> and repeated prisoner’s dilemma games, which would force them to abandon their short-term strategies in the one-time prisoner’s dilemma scenario and opt for cooperation.<sup>23</sup>, in dealing with the problems of collective action. This is of value to the research, since the context of international development cooperation currently does not have an overarching governance structure.

The last theory/idea that will be covered in the theoretical framework is the concept of “buck-passing”, which by definition, means to pass the responsibility to someone else. Different forms of buck-passing are also present in the field of international development cooperation, especially where collective action takes place. Taekyoon Kim and Sojin Lim, in their article, *Forging ‘Soft’ Accountability in Unlikely Settings* (2017), provide a 2x2 matrix of what could occur in the absence of accountability mechanisms for development cooperation.

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<sup>22</sup> Shepsle, K. (2008). “Rational Choice Institutionalism”. Oxford, England. Oxford University Press

<sup>23</sup> Shepsle, K. (2008). “Rational Choice Institutionalism”. Oxford, England. Oxford University Press

The authors present four scenarios that could occur when factoring in the 1) intensity of partnership (low cost technical cooperation vs. high cost infrastructure projects) and 2) number of partners (two vs. many). Their research proposes that as there are only two stakeholders in a given project, whether it be high or low cost, there would be a lower likelihood of each stakeholder passing the responsibility ‘buck’ to one another.<sup>24</sup> The authors attribute this phenomenon to the rational choice institutionalism’s views of the absence of institution (in this case, accountability mechanisms), not being able to prevent the dilemmas of collective action. Figure 3 below showcases the 2x2 matrix of actor(s) behavior with the absence of accountability mechanisms classified by the number of actors (bilateral or multilateral) and intensity of the cooperation (low cost or high cost).

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<sup>24</sup> Kim, T. and Lim, S. (2017). “Forging ‘Soft’ Accountability in Unlikely Settings: A Contextual Analysis of Mutual Accountability in the Context of South-South Cooperation”. *Global Governance*, 23 (2)

**[Figure 3.]** 2x2 matrix of development cooperation actor behavior in the absence of accountability mechanisms

	Bilateral Cooperation	Multilateral Cooperation
Technical Cooperation (Relatively <u>low</u> cost)	Trust Building	Ad hoc Buck-Passing
Infrastructure Turnkey Projects (Relatively <u>high</u> cost)	Strategic Alliance	Organized Buck-Passing

Source: Author's work based on Kim, T. and Lim, S. (2017)

## V. Case Study of ICT-based Water Projects

In this chapter of the research, the introduction of the two case studies, Maji Voice and Human Sensor Web, will be given, as well as their hosting nations of Kenya and Tanzania, respectively. First and foremost, general background information will be given, regarding the hosting nations, followed by an institutional framework of each country's water sectors, and then a more detailed description each respected ICT-based water projects will be provided. Then, the chapter will conclude with the justification of the reasons for choosing the said countries and their associated projects.

## 1. Case Study 1: Kenya and Maji Voice

### 1-1. Background: Kenya

The Republic of Kenya is a fairly large sized country located in the eastern parts of Sub-Saharan Africa. According to the World Bank database, Kenya was home to approximately 52.6 million people as of the year 2019, with the national official languages being English and Swahili. The nation's capital is named Nairobi, which is situated in the southern parts of Kenya, and the capital inhabits 4.4 million people, as of 2019.<sup>25</sup>

The economy of Kenya was classified as lower-middle income country, which has a total GDP of 95.5 billion USD<sup>26</sup> and a GNI per capita of 1134.4 USD as of 2017.<sup>27</sup> According to the OEC country profile report, Kenya's main exports are centered around primary commodities, such as tea, flowers, and coffee.<sup>28</sup>

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<sup>25</sup> "2019 Kenya Population and Housing Census Volume 1: Population by County and Sub-County". (2019). Nairobi, Kenya. Kenya National Bureau of Statistics

<sup>26</sup> World Bank. (2020). "GDP (Current US\$) – Kenya". World Development Indicators. Retrieved from <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=KE>

<sup>27</sup> World Bank. (2020). "GNI per capita (Constant 2010 US\$) – Kenya". World Development Indicators. Retrieved from <https://data.worldbank.org/indicator/NY.GNP.PCAP.KD?locations=KE>

<sup>28</sup> Observatory of Economic Complexity. (2020). "Kenya". Retrieved from <https://oec.world/en/profile/country/ken>



In terms of the country's freshwater resource availability, all of the country's water are stored in each of the following five drainage basins, consisting of lakes, rivers, and valleys, with Lake Victoria serving as the largest of the five.<sup>29</sup>

The climate of Kenya is known to have wide variations, consisting of two rainy periods. The rainy season from March to May yields slightly more precipitation, when compared to the rainy months from October to November. Due to these fluctuating rainfalls throughout the year, the country experiences, on average, droughts and floods every three years.<sup>30</sup>

Lastly, when it comes to ICT, the Sector Statistics Report (July-September 2019), published by the Communications Authority of Kenya, showed that the mobile penetration figures stood at 53.2 million subscribers, which is more than the entire population of the country. The mobile penetration rate of 112% were able to be achieved via the telecom service providers' strategies to allow users more than one SIM ownership.<sup>31</sup> Regarding the percentage of the population with access to mobile networks, the figures were 96% for 2G services and 93% for 3G networks. Another interesting aspect about the Kenyan mobile market

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<sup>29</sup> "Kenya National Water Development Report". (2006). World Water Assessment Programme. UNESCO

<sup>30</sup> Ibid

<sup>31</sup> Xia, H. (2019). "Kenya's Mobile Penetration Rises in Q3: Report". XinhuaNet. Retrieved from [http://www.xinhuanet.com/english/2019-12/24/c\\_138653071.htm](http://www.xinhuanet.com/english/2019-12/24/c_138653071.htm)

is that currently it has a higher penetration rate for mobile money than any other country in the world, standing at 58% of the population.<sup>32</sup> This monumental feat has been reached shortly after a decade of the country's initial launch of mobile money services in 2007.

## 1-2. Institutional Framework: Kenyan Water Sector

Prior to going in depth about the current Kenyan water sector, the Kenyan National Water Act of 2002 (No. 8) must be considered, for it serves as the cornerstone for the current water sector's institutional framework today. The 2002 Water Act, effective as of March, 2003, had three distinguishable motives, which are the following: 1) separation of policy-making from regulation and service provision, 2) decentralization policies, and 3) Public Private Partnership.<sup>33</sup>

The latest legislation involving water management in Kenya was the bill passed in 2015, named the Water Bill No. 7 of 2014, which went into effect of July of 2015. This bill upped the ante on the previous

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<sup>32</sup> "The Telecommunications Industry in Kenya 2019: Growing in the Digital Economy, Mobile Telephony & Internet Penetration". (2020). Retrieved from <https://www.prnewswire.com/news-releases/the-telecommunications-industry-in-kenya-2019-growth-in-the-digital-economy-mobile-telephony--internet-penetration-300990299.html#:~:text=Kenya%20has%20the%20world's%20highest,were%20223%2C084%20mobile%20money%20agents>

<sup>33</sup> "Water Act: Chapter 372". (2002). Kenya National Council for Law Reporting. Retrieved from [https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/Kenya\\_water%20act\\_EN.pdf](https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/Kenya_water%20act_EN.pdf)

Water Act of 2002 by further decentralizing the roles from the eight regional water authorities (WASREBs) to the 47 Water Works Development Boards that exists in each of the 47 Kenyan counties.<sup>34</sup>

As of today, according to the abovementioned Water Bill No. 7 of 2014, the policy-making and coordination aspects of the Kenyan water sector are solely delegated to the Ministry of Water and Irrigation (MWI). Though the ministry cooperates with other essential ministries, such as the Ministries of Health and Public Health and Sanitation, the majority of the task is given to the MWI.<sup>35</sup>

When it comes to regulating the policies formulated by the MWI, as well as managing the assets, the previously mentioned eight regional WASREBs are in charge.<sup>36</sup> Finally, as for the actual provision of water, the responsible parties are the public and private WSPs, whom must be approved by the WASREB in the form of Service Provision Agreements.<sup>37</sup>

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<sup>34</sup> “Kenya Gazette Supplement No. 27: National Assembly Bills No. 7”. (2014). National Council for Law Reporting. Retrieved from <http://kenyalaw.org/kl/fileadmin/pdfdownloads/bills/2014/WaterBill2014.pdf>

<sup>35</sup> Ibid

<sup>36</sup> Ibid

<sup>37</sup> “Kenya Gazette Supplement No. 27: National Assembly Bills No. 7”. (2014). National Council for Law Reporting. Retrieved from <http://kenyalaw.org/kl/fileadmin/pdfdownloads/bills/2014/WaterBill2014.pdf>

### 1-3. Background: Maji Voice

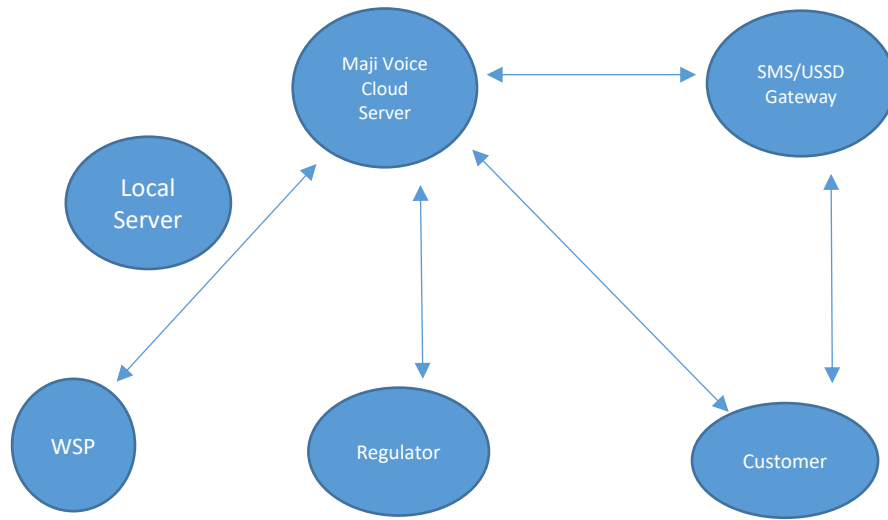
Maji (translated to water in Swahili) Voice, is an ICT-based complaint reception and processing software introduced and funded by the World Bank in late 2013. Currently, the project is being run by the Nairobi Water Company operators with implementation taking place in four Kenyan cities of Nairobi, Nakuru, Mathira, and Thika.<sup>38</sup>

The general goal of Maji Voice is to spur greater social accountability regarding the urban water quality and supply. The project handles all of the consumer complaints, billing enquiries, as well as other questions, and automatically sends updates regarding them to their mobile devices. Users of Maji Voice can voice their inquiries via four following methods: 1) text messages (SMS or USSD), 2) provided hotlines, 3) Homepage visits, and 4) in-person visits. Furthermore, after placing an inquiry, users are then given a reference code to track the process of their inquiries. Figure 4 below shows the overall technical set-up of the Maji Voice project, consisting of all of the major parties involved in operation.

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<sup>38</sup> Hirn, M. (2015). "MajiVoice: A New Accountability Tool to Improve Public Services". Nairobi, Kenya. Water and Sanitation Program. World Bank Group

**[Figure 4.]** Maji Voice technical set-up and major parties



Source: Author's work based on Hirn, M. (2015)

The Maji Voice software also benefits the water authorities, since inquiries can be more efficiently received, processed, and delegated to the appropriate divisions. Furthermore, the tracking mechanisms of Maji Voice also give the water operators a chance to bring the matter to higher levels of management if the inquiry cannot be solved at their respected divisions.

#### 1-4. Justification for Selecting Kenya and Maji Voice

Though there were several countries in Sub-Saharan Africa that were suitable for the research, the Republic of Kenya was chosen as one of the case studies, due to the following three reasons: 1) poor water

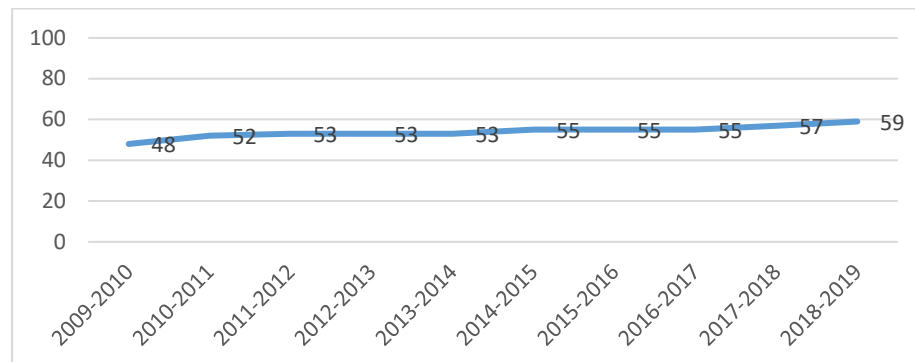
coverage rates, 2) nonetheless, high emphasis on water and ICT, and 3) wealth of ICT-based water projects.

First, in regards to poor water coverage rates, the latest impact report by the Kenyan WASREB in 2019 shows that water coverage rates stand at a mere 59% of the population, meaning that 41% must resort to unchecked water sources. The report, as well as the graph, does show that there is an increase, but the pace is simply not enough. In the last five years, the country has gained a four percent increase in coverage rates. For the goal of universal water availability, stated in the SDG-6, as well as the national target of Kenya, “the required annual growth is at least four percentage points”.<sup>39</sup> Hence, the low rates of coverage and the sluggish increase make Kenya the suitable choice for research on ICT-based water projects to speed up the pace. Figure 5 below shows the decade-long trend of Kenya’s national clean water coverage rates.

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<sup>39</sup> “IMPACT: A Performance Report of Kenya’s Water Services Sector – 2018/19”. (2020). Nairobi Kenya. WASREB

[Figure 5.] Kenya water coverage rates 2009-2019



Source: Author's work based on "IMPACT: A Performance Report of Kenya's Water Services Sector – 2018/19" (2020)

Secondly, though the above figures were by no means impressive, the country of Kenya does have high national emphasis on both water and ICT development. For instance, the reformed constitution of Kenya, which went into effect as of 2010, states in its article 46 (Economic and Social Rights), section 1.d, "every person has the right to clean and safe water in adequate quantities".<sup>40</sup> Moreover, in terms of ICT, the Kenyan Ministry of ICT, in November 2019, published their National Information, Communications, and Technology Policy, and in it, five following main objectives were stated: 1) create adequate infrastructures for an always-on, high speed, and wireless internet across the country, 2) support growth of data centers, IoT, machine learning, and an innovative ecosystem, 3) growth of ICT to account for 10% of the GDP

<sup>40</sup> "Constitution of Kenya, 2010". (2010). Kenya Law. Retrieved from <http://kenyalaw.org:8181/exist/kenyalex/actview.xql?actid=Const2010>

by 2030, 4) allow Kenya to take advantage of emerging trends, such as shared and gig economy, and 5) attain global recognition as innovative, efficient, and quality rich in public services.<sup>41</sup>

Lastly, Kenya was chosen, due to its wealth of ICT-based water projects in the country. Of the 23 notable ICT-based water projects mentioned in World Bank's Water and Sanitation Program report, 12 were implemented in Kenya.<sup>42</sup> Hence, with numerous projects to analyze, Kenya was a highly apt choice for the case study selection.

Of the 12 ICT-based water projects implemented in Kenya, Maji Voice was specially chosen, due to its exceptional evaluation in WaterAid's report on ICT and sustainability in water service in 2015. The report evaluated various ICT-based water projects on three main criteria: problem reporting, issue processing, and repair services. Maji Voice was one of the rare three projects, which received the maximum scoring on all three sections.<sup>43</sup> Figure 6 below displays all of the eight ICT-based water projects covered in the report and their scores for the three performance criteria of problem reporting, issue processing, and repair service.

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<sup>41</sup> "National Information, Communications and Technology (ICT) Policy". (2019). Kenya. Ministry of ICT

<sup>42</sup> Ndaw, M. (2015). "Unlocking the Potential of Information Communications Technology to Improve Water and Sanitation Services". Water and Sanitation Program. World Bank Group

<sup>43</sup> Welle, K. et al. (2015). "Testing the Waters: A Qualitative Comparative Analysis of the Factors Affecting Success in Rendering Water Services Sustainable Based on ICT Reporting". Making All Voices Count. WaterAid



**[Figure 6.]** Categorical scoring of ICT-based water projects

	Smart Handpumps	M4W	Maji Matone	Maji Voice	SIBS	Re-imagining Reporting	Next Drop	Human Sensor Web
Problem Reporting	1	1	0	1	1	1	1	0
Issue Processing	1	1	0	1	1	0	1	0
Repair Service	1	0	0	1	0	1	1	0

Source: Author's work based on Welle, K. et al. (2015)

## 2. Case Study 2: Tanzania and Human Sensor Web

### 2-1. Background: Tanzania

The country of Tanzania, which has the official title of the United Republic of Tanzania, is a Sub-Saharan African state situated on the eastern part of the continent. The country shares its borders with its northern neighbor, Kenya, as well as countries, such as Malawi, Rwanda, and the Democratic Republic of Congo. According to the World Bank database, Tanzania is home to just over 58 million people, as of 2019. For the most part, the official language of Tanzania is English and Swahili with the exception of Zanzibar. Zanzibar, which also uses Arabic as an official language, is a semi-autonomous island off the eastern coast of the mainland. The nation's capital is the city of Dodoma,

which inhabits approximately 2.1 million individuals, according to the 2012 figures.<sup>44</sup>

Tanzania's economy is deemed as a lower-middle income country, by World Bank standards, and has a GDP of 63.2 billion USD<sup>45</sup> and a GNI per capita of 915.4 USD as of 2017.<sup>46</sup> The OEC country profile indicates that the main exporting commodities of Tanzania are natural resources and primary goods. Gold was the top export at 15.4% followed by raw tobacco at 5.77%.<sup>47</sup>

In regards to the country's freshwater availability, water management is done through the country's nine major drainage basins.<sup>48</sup> The eight external drainage basins, consisting of but not limited to Lake Victoria, Pangani River, Lake Rukwa, and more, lead to either the Atlantic, Indian Ocean, or the Mediterranean Sea. The internal drainage basins in the mainland of the country, including lakes Natron, Eyasi, and Manyara, all drain to the Rift Valley Basin.<sup>49</sup>

As for the general climate of Tanzania, there exists a tropical setting as the coast becomes closer, and a more temperate climate as the

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<sup>44</sup> "Profile". (n.d.). Retrieved from <http://www.dodoma.go.tz/profile>

<sup>45</sup> World Bank. (2020). "GDP (Current US\$) – Tanzania". World Development Indicators. Retrieved from <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=TZ>

<sup>46</sup> World Bank. (2020). "GNI per capita (Constant 2010 US\$) – Tanzania". World Development Indicators. Retrieved from <https://data.worldbank.org/indicator/NY.GNP.PCAP.KD?locations=TZ>

<sup>47</sup> Observatory of Economic Complexity. (2020). "Tanzania". Retrieved from <https://oec.world/en/profile/country/tza>

<sup>48</sup> "FAO AQUASTAT Reports: Country Profile – United Republic of Tanzania". (2016). Rome, Italy. FAO

<sup>49</sup> Ibid

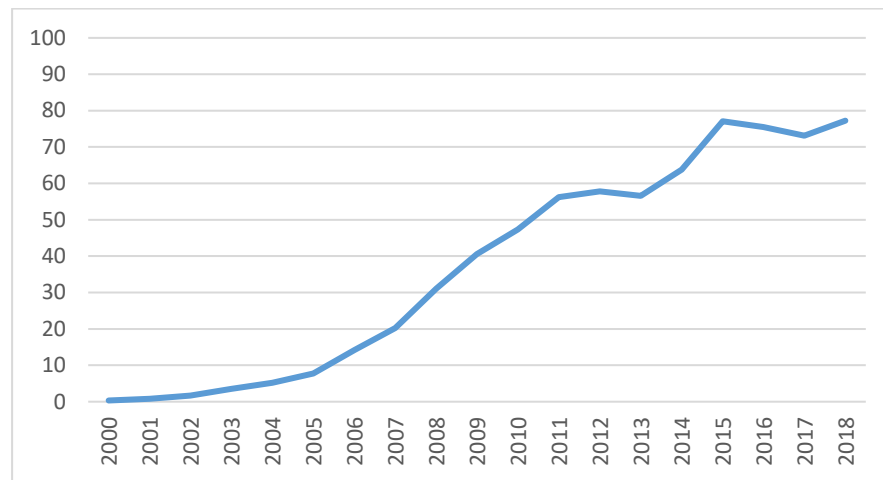
highlands are reached.<sup>50</sup> Uniquely, the country has two seasonal rainfall patterns, which are unimodal and bimodal types. The former refers to the singular period of long rain from the October months to April, which is concentrated in the southern parts of the country. The latter refers to the northern highland regions, where it receives two periods of heavy rainfall, first in the autumn season, and later in the spring season. Though the country experiences periodic droughts, floods are less of a national problem, when compared to the Kenyan climate.

Lastly, when it comes to ICT, according to findings from Statista, 77.24% of the entire population had access to a mobile cellular device, which amounts to approximately 43.5 million individuals. Though the numbers may not compare with some of its neighbors, the sheer pace of the increase in mobile subscribers, as seen in the graph, is noteworthy. In a span of just one decade, there was a growth of about 148.6% increase in the number of mobile subscribers. Figure 7 below shows the growing trend of mobile penetration rates in Tanzania starting from 2000 to 2018, with the latest figures reaching 77.24%.

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<sup>50</sup> Ibid

**[Figure 7.]** Tanzania mobile penetration rates 2000-2018 (Percentage)



Source: Author's work based on Statista's "Number of Mobile Cellular Subscriptions Per 100 Inhabitants in Tanzania from 2000 to 2018". (2020)

## 2-2. Institutional Framework: Tanzanian Water Sector

Though currently, the Tanzanian water sector is all public, looking at the past attempts to privatize may prove to be of use in the research. In 2003, the Tanzanian government agreed to the conditionality set forth by the World Bank that the water sector must be privatized, in order to receive aid disbursements. Hence, in August of 2003, City Water Services, a German international water company, received a 10-year lease from the Tanzanian government, which would replace Dar es Salaam (largest city in Tanzania)'s public water authorities. The contract had a worth of 164.4 million USD and was named the Dar es

Salaam Water and Sanitation Services Project.<sup>51</sup> City Water Services, however, quickly met an unfortunately series of events, such as lower than expected income; worsened relations with consumers, laborers, and shareholders; and contract breach.<sup>52</sup> The contract had an early termination after just two years, and water management was given back to the Tanzanian government.

The legal framework for the current water policy regulations and management stems from Water Supply and Sanitation Act 2009, which went into effect as of May 2009. The main role of the act was to decentralize some functions of the water sector to regional and local governments, establish grounds for the creation of Community Owned Water Supply Organizations<sup>53</sup>, which will be further explained later.

As of today, the Tanzanian Ministry of Water and Irrigation is mainly responsible for formulation, guidance, regulation, and evaluation of water supply-related policies. Though the MWI does coordinate with other ministries, such as the ministries of health and social welfare, regarding issues on sanitation and hygiene, water is mainly left to the MWI. One of the subsectors of the MWI is the Energy and Water Utilities Regulatory Authority, which oversees technical and economic

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<sup>51</sup> “Why did City Water Fail? The Rise and Fall of Private Sector Participation in Dar es Salaam’s Water Supply”. (2008). Tanzania. WaterAid

<sup>52</sup> Ibid

<sup>53</sup> “Act Supplement No. 12 to the Gazette of the United Republic of Tanzania Na. 20 Vol. 90”. (2009). Dar es Salaam, Tanzania. United Republic of Tanzania

regulatory functions, such as quality checks, licensing provisions, and tariff reviews.<sup>54</sup>

Lastly, in terms of service provision, Tanzania presents a unique case, since it is differentiated by urban and rural regions. In the former, except in the case of Dar es Salaam, the responsibilities of maintenance and service provisions are held by the Urban Water and Sanitation Authorities. Dar es Salaam is unique in the sense that after its failed attempt at privatization, the Dar es Salaam Water and Sewage Authorities replaced the City Water Services, despite having nearly identical contract conditions.<sup>55</sup> In rural areas, the role of service provision is assigned to the aforementioned Community Owned Water Supply Organizations.<sup>56</sup> Due to the lack of technical training and reluctance to formalities in the rural settings, in practice, water provision and maintenance are done through informal means by the villages.<sup>57</sup>

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<sup>54</sup> “About EWURA”. (n.d.). Energy and Water Utilities Regulatory Authority. Retrieved from <https://www.ewura.go.tz/about-ewura/>

<sup>55</sup> Pigeon, M. (2012). “From Fiasco to DAWASCO: Remunicipalising Water Systems in Dar es Salaam, Tanzania”. Retrieved from

<sup>56</sup> “Act Supplement No. 12 to the Gazette of the United Republic of Tanzania Na. 20 Vol. 90”. (2009). Dar es Salaam, Tanzania. United Republic of Tanzania

<sup>57</sup> Katomero, J. and Georgiadou, Y. (2018). “The Elephant in the Room: Informality in Tanzania’s Rural Waterscape”. International Journal of Geo-Information. MDPI

### 2-3. Background: Human Sensor Web

Human Sensor Web was an open source ICT-based real-time voluntary citizenry update mechanism, ran on the Google Maps platform. The initiative was funded and supported by various stakeholders, such as the University of Twente, Twente Institute for Wireless and Mobile Communications, 52 Degree North, UN Habitat, Google.org, the Zanzibar local government, and two local partners.<sup>58</sup> The initiative was implemented in the island of Zanzibar from 2009 to 2011 and targeted a total of 50 urban water kiosks.<sup>59</sup>

The main goal of the Human Sensor Web was to efficiently obtain information regarding water supply shortages and quality and publicize them in a real-time manner. Users of the Human Sensor Web were encouraged to text water authorities, in case of issues, such as water shortages and/or poor water sanitation, with the short hotline number provided at each water kiosks signs. Once a problem was reported, the Zanzibar Water Authorities would send out a technician, who will then investigate and provide possible solutions. The technician would then send updated status reports to the HSW system, and consumers could

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<sup>58</sup> Verplanke, J. et al. (2010). "HSW Final Report: Empowering Communities in East Africa in Water Service Provision Through Information from Human Sensor Webs". Enschede, Netherlands. UN-Habitat and University of Twente

<sup>59</sup> Welle, K. et al. (2015). "Testing the Waters: A Qualitative Comparative Analysis of the Factors Affecting Success in Rendering Water Services Sustainable Based on ICT Reporting". Making All Voices Count. WaterAid

see the updates real-time. Upon completion of repair, the users would also receive a text message notifying them of the successful update.<sup>60</sup>

The Human Sensor Web would not only have been beneficial to the users but also to the WSPs, since it could spur unintended social accountability, due to the high levels of transparency of repair processes through the open platform, as well as the indirect pressure of punctuality on WSPs. Moreover, not having to allot time and resources to track down broken down or unsanitary water points would have been another perk.

#### 2-4. Justification for Selecting Tanzania and Human Sensor Web

When choosing a case study country to compare with Kenya, there were many valid candidates; however, due to the similarities in the superficial settings (geographic proximity, language, population, economy, and etc.), the United Republic of Tanzania was chosen as the second case study. Like Kenya, Tanzania shared similar characteristics of low water coverage rates, national emphasis on both water and ICT, and respectable number of ICT-based water projects hosted.

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<sup>60</sup> Welle, K. et al. (2015). “Testing the Waters: A Qualitative Comparative Analysis of the Factors Affecting Success in Rendering Water Services Sustainable Based on ICT Reporting”. Making All Voices Count. WaterAid



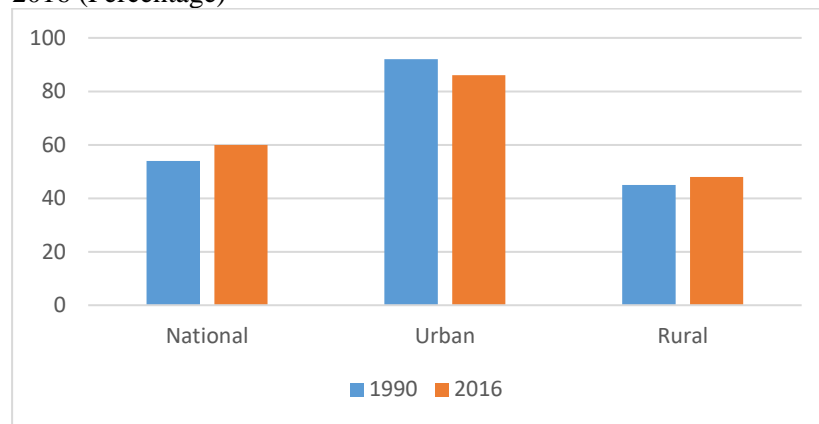
First, in terms of low water coverage rates, the World Bank's *Reaching for the SDGs: The Untapped Potential Water Supply, Sanitation and Hygiene Sector (2018)* report shows that the 2016 figures for Tanzania's national water coverage stood at 60%, meaning that 40% of the 58 million population did not have access to improved water.<sup>61</sup> Though the figures for urban areas did fare relatively better, more work still needs to be done to procure more water access to rural residents. Moreover, it is interesting to point out that Tanzania was among the 17 countries who failed to meet the MDG quotas and by a 21 percent marginal deficit.<sup>62</sup> Tanzania would have to seek more efficient methods if it is to aim for universal access to water, as stated in the SDG-6, which ICT-based water projects could provide the answer to. Figure 8 below compares Tanzania's water coverage rates for not only the national average, but also those for urban and rural coverage rates of 1990 and 2016.

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<sup>61</sup> "Reaching for the SDGs: The Untapped Potential of Tanzania's Water Supply, Sanitation, and Hygiene Sector". (2018). Washington DC, USA. World Bank

<sup>62</sup> Ibid

**[Figure 8.]** Tanzania national, urban, and rural water coverage rates, 1990 & 2016 (Percentage)



Source: Author's work based on World Bank's "Reaching for the SDGs: The Untapped Potential of Tanzania's Water Supply, Sanitation, and Hygiene Sector". (2018)

Secondly, though the current water coverage rates and past performances were fairly low, the country, nonetheless, has a respectable passion for pursuing water and ICT provision, policy-wise. Similar to Kenya's 2010 national constitution, Tanzania's Water Supply and Sanitation Act of 2009, which acts as a legal framework for the nation's water sector, states in article 4.1 that the citizens of Tanzania are all entitled to adequate quantity and quality of water supply and sanitation. Thus, the MWI of Tanzania's passion for universal access to water and the spirit of SDG-6 cannot be doubted.

Moreover, regarding ICT development, in May of 2016, Tanzania's Ministry of Works, Transport, and Communications, released their National Information and Communications Technology Policy, in line with the Tanzania Development Vision 2025. The

National ICT Policy 2016 recognizes the pivotal role that ICT plays within economic development. Article 2.1 discusses the policy vision, mission, and objectives, which points to transforming Tanzania to a developed economy with universal access to ICT. The main vision of the ministry is for the economic, social, and cultural development of its citizens through the use of ICT in the society, for a yearning for an ICT-pervasive society can be seen.

Lastly, Tanzania was chosen, due to its respectable number of ICT-based water projects hosted. Of the 23 notable ICT-based water projects mentioned in World Bank's Water and Sanitation Program report, seven were implemented in Tanzania<sup>63</sup>. Hence, though the figures are not as impressive as those of Kenya's, still with a respectable number to analyze, Tanzania was a suitable choice for the second case study selection.

Of the seven ICT-based water projects implemented in Tanzania, Human Sensor Web was specially chosen, due to its exceptionally poor evaluation in WaterAid's 2015 report on ICT and sustainability in water service. In the report's three main criteria of evaluation: problem reporting, issue processing, and repair services, Human Sensor Web was

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<sup>63</sup> Ndaw, M. (2015). "Unlocking the Potential of Information Communications Technology to Improve Water and Sanitation Services". Water and Sanitation Program. World Bank Group

the project, which received the lowest scoring on all three sections.<sup>64</sup> HSW provides a stark contrast with Maji Voice, despite the similar superficial conditions, to allow for a better analysis on figuring out the determining factors of success and failure.

## **VI. Findings and Discussion**

According to the World Bank's Water and Sanitations Program report in 2015, though the introduction of ICT into the water sector projects presents an innovative solution, there still exist several obstacles, which prevent their success. The report stated that the main reasons for the failures of ICT-based water projects were poverty, weak institutions, and lack of infrastructures.<sup>65</sup> Hence, it can be said that the current water sector and ICT experts' general consensus on the reasons for failures are the superficial factors, or the initial factors at the inception of the projects, such as socio-economic and political factors.

To verify the validity of the above claim, the research looked into the possible superficial factors that could affect the success of the ICT-

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<sup>64</sup> Welle, K. et al. (2015). "Testing the Waters: A Qualitative Comparative Analysis of the Factors Affecting Success in Rendering Water Services Sustainable Based on ICT Reporting". Making All Voices Count. WaterAid

<sup>65</sup> Ndaw, M. (2015). "Unlocking the Potential of Information Communications Technology to Improve Water and Sanitation Services". Water and Sanitation Program. World Bank Group

based water projects in the two case study nations of Kenya and Tanzania. In classifying the superficial factors, they could largely be summed into three categories of economic, social, and political factors. As poverty was the first mentioned factor in the report, the research would start off with providing the economic superficial factors.

During the research on both the economic conditions of Kenya and Tanzania, there seemed to be a peculiar similarity in the two nations, which could not explain the success of Maji Voice and the failure of the Human Sensor Web initiative. First, when observing the raw economic indicators, such as GNI per capita, Kenya's figures were at 1134.4 USD<sup>66</sup> and in Tanzania's case, it was 915.4 USD<sup>67</sup>, both in 2017 statistics. Moreover, the research set out to see if poverty affected the disparity in the mobile penetration rates of the two countries. The results showed that while Kenya did have a slight upper hand, no significant differences could be found, since both nations' rates outpaced those of the Sub-Saharan African average.

After looking into the possible economic disparities, the research focused in on the social aspects of the superficial factors, as poor infrastructure was one of the above stated reasons for failure. The first

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<sup>66</sup> World Bank. (2020). "GNI per capita (Constant 2010 US\$) – Kenya". World Development Indicators. Retrieved from <https://data.worldbank.org/indicator/NY.GNP.PCAP.KD?locations=KE>

<sup>67</sup> World Bank. (2020). "GNI per capita (Constant 2010 US\$) – Tanzania". World Development Indicators. Retrieved from <https://data.worldbank.org/indicator/NY.GNP.PCAP.KD?locations=TZ>

indicator that was used to track social disparities was culture, and found that due to several factors, such as geographic proximity and shared historic roots, there existed a cultural similarity between Kenya and Tanzania. This could be seen by the use of Swahili and English, as the official languages of both countries (with Arabic used in Zanzibar, Tanzania as an exception). Moreover, as to the two countries' proximity to the Indian Ocean to the east, historically, the two countries were able to have cultural exchange with the Arabs and absorb certain parts of their cultures.<sup>68</sup> Hence, this is the reason why the two countries share the "Sheha" Culture, which means chief in Swahili. As mentioned prior in the case study backgrounds, the sheha culture is prevalent in the rural parts of the East African countries where political matters are practiced in an informal manner by the village sheha.<sup>69</sup>

Some of the other indicators to seek social disparities are gender inequality and literacy rates, in terms of both linguistic and digital. In regards to gender inequality, the surprising results showed that as of 2020, as stated in the World Economic Forum's Global Gender Gap Index, Kenya ranked 109<sup>th</sup> in the world and 20<sup>th</sup> in the region of Sub-Saharan Africa, receiving a score of 0.671 out of 1.0.<sup>70</sup> This, however,

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<sup>68</sup> Kilonzo, J. (2001). "Islam, Indigenous Traditions, and Adventism in Kenya: A Comparative Study to Determine Effective Approaches to Evangelize Kenyan Muslims". Michigan, USA. Andrews University

<sup>69</sup> Ibid

<sup>70</sup> "Global Gender Gap Report 2020". (2019) Geneva, Switzerland. World Economic Forum

contrasts with Tanzania's ranking of 68<sup>th</sup> in global terms, and 11<sup>th</sup> in region, earning the score of 0.713.<sup>71</sup> One would expect that ICT-based water projects, if gender inequality was a contributing factor, would fare better in Tanzania, but the result of the Human Sensor Web initiative shows otherwise.

Lastly, in the social indicators, regarding digital and linguistic literacy rates, there currently does not exist many research done on digital literacy in the Sub-Saharan regions. For, the only supporting research found was the IMD World Digital Competitiveness Rankings of 2019, which factors into account "knowledge and know-how necessary to understand new technologies".<sup>72</sup> The report showed that neither Kenya nor Tanzania was listed in the global rankings, hinting at the similarly low levels of digital literacy in both countries. When it came to linguistic literacy, the World Bank Africa Development Forum's report shows the adult illiteracy rates of Kenya and Tanzania, as of 2020, and found that differences were negligible. The rates in Kenya were at 22% for aged 15 and above and 20% for Tanzania.<sup>73</sup>

As weak institutions were cited as one of the reasons for ICT-based water project failures, political indicators must also be reviewed, in order to better understand its impacts. The first indicator is the level

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<sup>71</sup> Ibid

<sup>72</sup> "IMD World Digital Competitiveness Ranking 2019". (2019). IMD World Competitiveness Center. IMD

<sup>73</sup> Choi, J. et al. (2019). "The Future of Work in Africa: Harnessing the Potential of Digital Technologies for all". Africa Development Forum. World Bank Group

of corruption in each respected country's governments. The World Bank's CPIA database, which showcases the levels of transparency, accountability, and corruption in the public sector, revealed that the 2018 figures for both Kenya and Tanzania were identical at three, on a one to six scale.<sup>74</sup> Also, the World Bank's database shows that government effective index of 2016, which measures the general perceptions of the citizens regarding the effectiveness, punctuality, and transparency of their governments<sup>75</sup>, showed that the figures for Kenya and Tanzania were -0.32 and -0.55, respectively, on a scale from -2.5 to 2.5.<sup>76</sup>

With the above indicators in mind, the claim made above by the Water and Sanitations Program must be questioned. Though it is true that both Kenya and Tanzania may suffer from poverty, weak institutions, and poor infrastructures, these factors, alone, cannot be attributed to explain the success or failure of ICT-based water projects, since they fail to explain why Maji Voice succeeded in Kenya and Human Sensor Web failed in Tanzania, despite having highly similar economic, social, and political conditions. Thus, a more underlying

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<sup>74</sup> World Bank. (2020). "CPIA Transparency, Accountability, and Corruption in the Public Sector Rating (1=low to 6=high) – Kenya, Tanzania". World Development Indicators. Retrieved from <https://data.worldbank.org/indicator/IQ.CPA.TRAN.XQ?locations=KE-TZ>

<sup>75</sup> World Bank. (2020). "Government Effectiveness". Worldwide Governance Indicators. Retrieved from [https://govdata360.worldbank.org/indicators/h580f9aa5?country=KEN&indicator=388&countries=TZA&viz=line\\_chart&years=1996,2018](https://govdata360.worldbank.org/indicators/h580f9aa5?country=KEN&indicator=388&countries=TZA&viz=line_chart&years=1996,2018)

<sup>76</sup> Ibid



factor, which cannot be seen superficially, must be observed in the research.

The first possible underlying factor, which could be considered, is simply the location of the projects implemented. Not to be confused with geography, the main concern regarding the location is whether the projects were practiced in an urban or rural landscape. Regarding the location, the research shows that the Maji Voice Project was implemented in four urban cities of Kenya, such as Nairobi, Nakuru, Mathira, and Thika.<sup>77</sup> When looking at the locations of the Human Sensor Web initiative, implementation took place in the island of Zanzibar of Tanzania, focusing on 50 urban water kiosks.<sup>78</sup>

The next speculative factor that could be decisive is the status of the project's formal ownership. For Maji Voice, the World Bank introduced and funded the project, but the Nairobi Water Company holds formal ownership.<sup>79</sup> Likewise, in the case of Human Sensor Web, though there were numerous donor organizations, ownership stayed with the Zanzibar Water Authorities.<sup>80</sup> Closely related to formal ownership status, another possible underlying factors the research

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<sup>77</sup> Hirn, M. (2015). "MajiVoice: A New Accountability Tool to Improve Public Services". Nairobi, Kenya. Water and Sanitation Program. World Bank Group

<sup>78</sup> Verplanke, J. et al. (2010). "HSW Final Report: Empowering Communities in East Africa in Water Service Provision Through Information from Human Sensor Webs". Enschede, Netherlands. UN-Habitat and University of Twente

<sup>79</sup> Welle, K. et al. (2015). "Testing the Waters: A Qualitative Comparative Analysis of the Factors Affecting Success in Rendering Water Services Sustainable Based on ICT Reporting". Making All Voices Count. WaterAid

<sup>80</sup> Ibid

looked into was the number of stakeholders. In Maji Voice, there was one donor organization, the World Bank, and one recipient party, the Nairobi Water Company. In the Human Sensor Web initiative, however, there were seven donor parties for just one recipient, the Zanzibar Water Authorities.

After looking at the involved parties, the research set out to see if any underlying factors could be present at the very operating mechanisms of the ICT-based water projects, themselves. The two indicators, regarding the operating mechanisms were the methods of initiation and functionality. First, the method of initiation simply refers to how and by whom the ICT-based tool operation is initiated, once implemented. The findings show that in both cases, the Maji Voice and the Human Sensor Web, they were done through the “crowdsourcing” method of initiation, meaning that actual users were the ones who initiated the operating phase. Rather than being government, WSP, or stakeholder-led, the initiation depended on the voluntary actions of the water users.<sup>81</sup> Secondly, in terms of method of functionality, this refers to how the ICT-based water projects are functioned, whether it be automatic, partially automatic, or manual. Unlike the ICT-based hand

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<sup>81</sup> Welle, K. et al. (2015). “Testing the Waters: A Qualitative Comparative Analysis of the Factors Affecting Success in Rendering Water Services Sustainable Based on ICT Reporting”. Making All Voices Count. WaterAid

pumps, which require manual action, the real-time nature of both Maji Voice and Human Sensor Web is functioned at a fully automatic method.

The last possible underlying factor, when it comes to determining the true factors of success or failure of ICT-based water projects, was the quantity and the quality of accountability mechanisms from not only the donor organizations but also the recipient parties. Prior to looking at the accountability mechanisms of the case studies, the mechanisms set forth by the more well-known multilateral donor organizations shall be mentioned, as they provide a good rule of thumb.

Among the renowned multilateral donor organizations, the World Bank can be said to be the gold standard when it comes to international accountability mechanisms, with the creation of its Inspection Panel.<sup>82</sup> The World Bank group, however, goes above and beyond when it comes to ensuring accountability, as shown by its linkages with various CSOs. Platforms, such as the Global Partnership for Social Accountability Support Channels; Civil Society Policy Forum; Citizens Engagement Framework; Health, Nutrition, and Population CSO Consultative Group; and Climate Investment Funds, all showcase how the World Bank coordinates with CSOs for information sharing, narrative policies,

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<sup>82</sup> Kim, T. (2018). "Oppositional Coexistence: The Asiatic Reproduction of Global Accountability". Seoul, Korea. SNU Press

strategic consulting, institutional partnership, and project implementation cooperation.<sup>83</sup>

Going back to the case studies, the quantity and quality of accountability mechanisms of Kenya and Maji Voice proved to differ from those of Tanzania and Human Sensor Web. When looking at the country as a whole, there exist various accountability mechanisms in Kenya, when it comes to the water sector. According the IRC WASH's 2018 Kenya briefing note on SDG-6, there exists six mechanisms, consisting of the following: National Steering Committee on SDG-6, Global Analysis and Assessment of Sanitation and Drinking Water Country Reporting, African Ministers' Council on Water Annual Reporting, the Annual Water Conference, Inter-Agency Coordination Committee, and Kenya Water and Sanitation Civil Society Network.<sup>84</sup> Furthermore, two additional accountability mechanisms could be found in the legal framework of the water sector, which is the Water Act of 2002. The Act demands the establishment of the Water Appeals Board for water-related dispute settlements, as well as mandating the creation of a complaint arbitration<sup>85</sup>, under Clause 7.2 of the Service Provision Agreement Licenses.<sup>86</sup>

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<sup>83</sup> Ibid

<sup>84</sup> "National Accountability Mechanisms for SDG 6 in Kenya: A Briefing Paper". (2018). Briefing Note. IRC WASH

<sup>85</sup> "IMPACT: A Performance Review of Kenya's Water Services Sector 2011-2012". (2013). Nairobi, Kenya. WASREB

<sup>86</sup> Ibid

When it comes to looking at the accountability mechanisms set forth by Maji Voice's donor organization, one only has to look in one direction, the World Bank, due to the project having only one donor. According to the World Bank's homepage, there currently exists eight accountability policies and mechanisms, comprising of the following: 1) annual reports, 2) Access to Information, 3) Corporate Scorecards, 4) Integrity Vice Presidency, 5) Inspection Panel, 6) Grievance Redress Service, 7) Independent Evaluation Group, and 8) Compliance Advisor Ombudsman.

First, in the World Bank, annual reports regarding various measures, regarding monitoring and evaluation are mandated. Second, Access to Information is a landmark disclosure policy, where it requires information and knowledge to be publicly available.<sup>87</sup> Third, Corporate Scorecards shows the general results and progress via different indicators.<sup>88</sup> Fourth, Integrity Vice Presidency is responsible for the handling of acts of corruption and other unlawful activities in the projects throughout various sanction methods.<sup>89</sup> Fifth, the Inspection Panel can be said to be the World Bank's main accountability

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<sup>87</sup> World Bank. (2020). "Access to Information Home". Retrieved from <https://www.worldbank.org/en/access-to-information>

<sup>88</sup> World Bank. (2020). "World Bank Group Corporate Scorecards". Retrieved from <https://scorecard.worldbank.org/>

<sup>89</sup> World Bank. (2020). "Integrity Vice Presidency". Retrieved from <https://www.worldbank.org/en/about/unit/integrity-vice-presidency>

mechanism, which consists of 10 safeguard mechanism.<sup>90</sup> Sixth, in the Grievance Redress Service receives personal, as well as communal complaints and enquiries regarding the World Bank projects in their area.<sup>91</sup> Seventh, The Independent Evaluation Group evaluates the development effectiveness of the World Bank.<sup>92</sup> Lastly, the Compliance Advisor Ombudsman “helps address the concerns of communities who believe they are affected by IFC (International Finance Corporations) and MIGA (Multilateral Investment Guarantee Agency) projects”.<sup>93</sup>

In the world of World Bank’s accountability mechanisms, there exists what is known as a “project cycle”, or the steps involved from inception to completion. Even for each of these steps, the according document is required by the World Bank for evaluation and accountability. The cycle has a total of six following stages: Identification, Preparation, Appraisal, Negotiations and Board Approval, Implementation and Support, and Completion and Evaluation.<sup>94</sup> The first stage requires the Project Concept Note. This is followed by technical, economic, and institutional capacity assessment documents in

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<sup>90</sup> Kim, T. (2017). “On Global Accountability: A Theoretical Revisit to Accountability Mechanisms for Development Partnerships”. *Development and Society* Volume 46 Number 2

<sup>91</sup> World Bank. (2020). “Grievance Redress Service”. Retrieved from <https://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service>

<sup>92</sup> World Bank. (2020). “Independent Evaluation Group”. Retrieved from <http://ieg.worldbankgroup.org/>

<sup>93</sup> “Our Mandate”. (n.d.). CAO. Retrieved from <http://www.cao-ombudsman.org/>

<sup>94</sup> “World Bank Project Cycle”. (n.d.). Retrieved From <https://www.worldbank.org/en/projects-operations/products-and-services/brief/projectcycle>

the preparation stage. Third, in the appraisal stage, first draft of the Project Appraisal Document is required. In the negotiations and board approval stage, the final draft of the Project Appraisal Document is presented. The fifth stage would require the Implementation Status and Results Report (ISR), and lastly upon project completion, the Implementation Completion and Results Report is submitted. Currently, since Maji Voice still has not reached completion, the latest available accountability document is the ISR, which was archived on December of 2018.<sup>95</sup>

In the case of the quantity and quality accountability mechanisms for Tanzania and Human Sensor Web, there was a stark discrepancy from those of Kenya and Maji Voice. First, when looking at the existing national accountability mechanisms of Tanzania, it comprises of the following: the annual Joint Water Sector Reviews, the biannual Water Sector Development Program Supervision Missions, and the CSO, named TAWASANET.<sup>96</sup>

When looking at the accountability mechanisms set forth by the Human Sensor Web initiative's donor organizations, it was found that four of the seven donor parties did not possess any form of accountability mechanisms/policies. The major donors, UN Habitat and

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<sup>95</sup> "Water and Sanitation Development Project (P156634)". (2018). Implementation Status & Results Report. World Bank Group

<sup>96</sup> "Water Supply and Sanitation in Tanzania: Turning Finance into Services for 2015 and Beyond". (2011). Water and Sanitation Program. UNICEF

Google.org, were grouped together, since they embarked on a co-initiative known as h2.0.<sup>97</sup> Despite being non-obligatory, the h2.0 had three accountability mechanisms. First, there is the Benchmarking of Service Providers, which builds on existing benchmarking mechanisms of service providers, such as questionnaires and surveys, from various organizations and countries.<sup>98</sup> Secondly, there is the Urban Inequality Surveys, which is “a comprehensive set of information on a majority of MDG indicators provided by each country’s National Statistics Bureaus”.<sup>99</sup> Last are the Citizen Report Cards, which provides the consumer perceptions regarding the effectiveness and quality of their national public services. This generates a database of feedback on services that is placed in the public domain, which is used to design and lobby improvements”.<sup>100</sup> Unlike the World Bank, the UN is less explicit in their accountability mechanisms, and furthermore, the UN Evaluation Group currently only provides evaluation reports for projects supported by 10 different UN organizations, and excludes the UN Habitat.

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<sup>97</sup> “h2.0 Monitoring Services to Inform and Empower”. (n.d.). UN Habitat. Retrieved from <https://mirror.unhabitat.org/content.asp?cid=7656&catid=635&typeid=24&subMenuId=0>

<sup>98</sup> Ibid

<sup>99</sup> Ibid

<sup>100</sup> “h2.0 Monitoring Services to Inform and Empower”. (n.d.). UN Habitat. Retrieved from <https://mirror.unhabitat.org/content.asp?cid=7656&catid=635&typeid=24&subMenuId=0>



The remaining party among minor donors of the Human Sensor Web initiative that included some kind of accountability mechanism was 52 Degree North. According to the group's Memorandum and Articles of Association Article 7.4.b, an annual report on company assessment is required.<sup>101</sup> Though the Twente Institute for Wireless and Mobile Communications and University of Twente did not explicitly have any accountability mechanisms, the two parties did, however, publish a final report<sup>102</sup>, as well as the survey questionnaire and results<sup>103</sup> that were used during the implementation stage, respectively. Lastly, according to Hutchings et al.'s 2012 report of the Human Sensor, it was interesting to see that the Human Sensor Web initiative lacked any evaluation metrics in its initial design and solely focused on system operation.

#### 1. Analysis: Positive Correlation Between Accountability Input and Output

Revisiting the two case studies of Kenya and Tanzania, as well as their respective Maji Voice and Human Sensor Web initiatives, analysis

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<sup>101</sup> "Shareholders Agreement". (2006). 52 Degrees North. Retrieved from <https://52north.org/about-us/profile/shareholders-agreement/>

<sup>102</sup> Verplanke, J. et al. (2010). "HSW Final Report: Empowering Communities in East Africa in Water Service Provision Through Information from Human Sensor Webs". Enschede, Netherlands. UN-Habitat and University of Twente

<sup>103</sup> Yusra, S. (2011). "Assessing the Motivation to Submit VGI: Case Study of a Human Sensor Web in Zanzibar". Enschede, Netherlands. University of Twente

of the discussion is now finally possible, utilizing the findings and the theoretical framework.

As previously hypothesized, the previously thought reasons of success and failure of ICT-based water projects were not as superficial as expected. As World Bank's Water and Sanitations Program report in 2015 stated, the primary reasons attributed for the unreliability of ICT-based water projects were "poverty, weak institutions, and poor infrastructures".<sup>104</sup> These claims, however, must not be taken at face value, since when examining the superficial (contextual) factors of the research's case studies, no significant differences were to be found in all three spheres of economy, society, and politics. Both Kenya and Tanzania had relatively similar GNI per capital, economic classifications, mobile penetration rates, gender inequality, corruption levels, geo-cultural aspects, and so on.

After failing to find any significant disparities in the superficial factors, the research examined the more underlying factors, which might exist in the projects, themselves. Factors, such as location, ownership status, and operating mechanisms had no explanatory power, since there were no disparities between Maji Voice and Human Sensor Web. There were, however, the factors of stakeholder numbers and quantity and

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<sup>104</sup> Ndaw, M. (2015). "Unlocking the Potential of Information Communications Technology to Improve Water and Sanitation Services". Water and Sanitation Program. World Bank Group

quality of existing accountability mechanisms which were different and could justify the success and failure of the two ICT-based water projects.

First, the number of stakeholders, which there was only one for Maji Voice and seven for Human Sensor Web, had high explanatory power, when also looking at how the number of stakeholders affected other notable ICT-based water projects. From the 2015 report by WaterAid, comparing eight different notable ICT-based water projects, it was found that the average number of stakeholders for the six successful cases were 1.67, excluding the recipient government, whereas the figure for the two unsuccessful cases were 5, excluding the recipient government, thus showing the negative correlation between the number of stakeholders and the level of success. This idea is reaffirmed by above-mentioned 2x2 buck-passing matrix, which states that as there are fewer partners (two in this case) involved in an infrastructure-based cooperation, the possibility of buck-passing decreases and that the provider is in a way forced to require the recipient party for evaluation assessments, even in the absence of stringent accountability mechanisms.<sup>105</sup> Figure 9 below shows the total and average number of stakeholders involved in each of the success and failure cases of ICT-

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<sup>105</sup> Kim, T. and Lim, S. (2017). "Forging 'Soft' Accountability in Unlikely Settings: A Contextual Analysis of Mutual Accountability in the Context of South-South Cooperation". *Global Governance*, 23 (2)

based water projects, portraying the relationship between the number of stakeholders and the possibility of success or failure.

**[Figure 9.]** Total and average number of stakeholders in each ICT-based water projects

Success Cases		Failure Cases	
Smart Handpumps	2	Maji Matone	3
M4W	4	Human Sensor Web	7
Maji Voice	1		
SIBS	1		
Re-imagining Reporting	1		
Next Drop	1		
<b>Average</b>	<b>1.67</b>	<b>Average</b>	<b>5</b>

Source: Author's work based on Welle, K. et al. (2015)

The number of stakeholders is a delicate issue in the current international development cooperation, since now, more than ever, more participation is needed to meet the goals that “tackle our common future”,<sup>106</sup> such as those mentioned in the SDG's. Surely, greater number of cooperating partners is beneficial, but at times can lead to less efficiency, since as the number of stakeholders to cooperation increases, each donor's leverage in the said projects would, in turn, decrease.<sup>107</sup> Hence, the once tightly-knit principal-agent relationship of a bilateral development aid is now loosened as it becomes more multilateral.

<sup>106</sup> Kim, T. (2017). “On Global Accountability: A Theoretical Revisit to Accountability Mechanisms for Development Partnerships”. *Development and Society* Volume 46 Number 2

<sup>107</sup> Ibid

The second underlying factor found to have an impact in the success or failure of ICT-based water project was the quantity and quality of existing accountability mechanisms. As seen previously in the case of Maji Voice, as it was funded by the World Bank, it was subject to countless stringent accountability mechanism, which were all obligatory. Moreover, the hosting nation of Kenya outnumbered its counterpart's number of existing accountability mechanisms by six to three. In the case of the Human Sensor Web initiative, though there were, however, a few accountability mechanisms in place by some of its stakeholders, such as UN Habitat, they were non-compulsory. Moreover, the fact that any type of evaluation metric was excluded from the Human Sensor Web planning phase shows that there exists a positive correlation between the quantity and quality of accountability mechanisms and the success possibilities of an ICT-based water project.

Both the quantity and quality of accountability mechanisms are vital to the success of any ICT-based water projects, when taking into account the rational choice institutionalist rhetoric, as well as the principal-agent theory. The former postulates that institutions provide the meaning for its rational actors to maximize their benefits and minimize their losses. In the field of international development cooperation, however, there is no overarching governing structure to do so, for there needs to be some sort of institution set in place. Accountability mechanisms can serve as the needed institutions to

minimize the detrimental effects of the collective action dilemma. By a similar token, stringent accountability mechanisms can also tackle the moral hazards possible from the principal-agent relationship, since without them, the principal does not have a direct say in the actions of the agent.

The emphasis on quantity and quality of accountability mechanisms is also stated in Taekyoon Kim's work, *On Global Accountability* (2017), which "treats accountability mechanisms as a necessary condition to not only preclude itself from being just a political rhetoric but also make it more sustainable and transparent".<sup>108</sup> The author also states that the issue of accountability deficit is pervasive in the field today, due to the difficulties arising from political and geographic distances between the stakeholders.<sup>109</sup> Hence, he calls for the eradication of such deficit, since by doing so, a more sustainable multilateral development cooperation, as well as improved international relations, could be achieved.<sup>110</sup>

As quoted earlier in the research from the UK Commission on Public Private Partnership, the concept of accountability is both a means

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<sup>108</sup> Kim, T. (2017). "On Global Accountability: A Theoretical Revisit to Accountability Mechanisms for Development Partnerships". *Development and Society* Volume 46 Number 2

<sup>109</sup> Ibid

<sup>110</sup> Kim, T. (2017). "On Global Accountability: A Theoretical Revisit to Accountability Mechanisms for Development Partnerships". *Development and Society* Volume 46 Number 2

and an end.<sup>111</sup> This idea is pivotal, especially for ICT-based water projects, since one of the main objectives of these projects, other than fostering cost-efficient methods of water management, is spurring greater accountability through increased social participation and surveillance. Hence, in this case, one of the “end” of the projects undoubtedly is accountability. The prior findings and the above analysis, however, also shows that to obtain a successful “end”, quantity and quality of accountability is also vital, meaning that accountability is also a “means” in achieving itself. The idea of accountability is especially important for the recipient governments, since they act as both a principal to the multilateral donors, as well as an agent to its citizens. Hence, all stakeholders involved in the projects, especially the recipient governments, must increase their accountability input if they are to expect any increase in accountability output, since the two factors are evidently positively correlated. Figure 10 below summarizes the overall similarities and differences of superficial and underlying factors of the two case studies of Kenya and Tanzania, as well as Maji Voice and Human Sensor Web. The significant disparities are underlined, whereas non-underlined factors symbolize overall similarity.

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<sup>111</sup> “Building Better Partnerships: The Final Report of the Commission on Public Private Partnerships”. (2001). Commission on Public Private Partnerships, Institute for Public Policy Research

**[Figure 10.]** Summary table of superficial and underlying factors

<b>Superficial Factors</b>		
	<b>Kenya</b>	<b>Tanzania</b>
GNI per capita	1134.4 USD	915.4 USD
Mobile Penetration Rate	Above Average	Above Average
Language	English, Swahili	English, Swahili, Arabic
Culture	"Sheha"	"Sheha"
Gender Inequality	0.671	0.713
Illiteracy Rates	22%	20%
WB CPIA Transparency, Accountability, Corruption Index	3	3
Government Effective Index	-0.32	-0.55
<b>Underlying Factors</b>		
	<b>Maji Voice</b>	<b>Human Sensor Web</b>
Location	Urban	Urban
Formal Ownership	Local government	Local government
<u>Number of Stakeholders (Total)</u>	<u>2</u>	<u>8</u>
Operating Mechanisms	Crowdsourcing & Automatic	Crowdsourcing & Automatic
<u>Quantity and Quality of Accountability Mechanisms</u>	<u>14 (Donor) + 8 (Recipient) + Compulsory</u>	<u>4 (Donor) + 3 (Recipient) + Non-compulsory</u>

Source: Author's work based on previously discussed findings and according sources



## **VII. Conclusion**

### **1. Policy Implications**

When it comes to deciphering what to do for future ICT-based water projects, the research provides a valuable lesson to be learned from the two case studies of Kenya and Tanzania's respective Maji Voice and Human Sensor Web. In the previous sections, it has been shown that it was not the superficial or contextual factors of the hosting nations that were determining variables for the success or failure of the projects. Hence, when the research examined whether any underlying factors related to the actual projects, themselves, or their involved policies, provided explanation, it was found that two factors, consisting of the number of involved stakeholders and the quantity and quality of accountability mechanisms, were the main disparities responsible for the differing performances of the two case study projects.

Future implementers of ICT-based water projects must keep in mind the above findings, and focus less on the superficial factors, such as the economic, social, and political conditions, of the prospective project hosts. What they should be aware of are issues, consisting of but not limited to possible moral hazards of principal-agent relations, buck-passing possibilities, collective action dilemmas. For, the ideal conditions for the success of ICT-based water projects seem to be to

maximize the amount of accountability input, and this can be achieved through keeping a relatively small number of stakeholders in a given project, and/or increasing the quantity and quality of related accountability mechanisms.

## 2. Limitations

Though the paper was able to illustrate the research done to compare the successful and failure cases of Maji Voice and Human Sensor Web, respectively, the lack of a larger sample size of the research proved to be a limitation when attempting to uncover more underlying factors or even an overarching theme that is present in successful and failed cases of ICT-based water projects. The limited sample size was due to most projects, when being classified as a failure by its stakeholders, had their details non-disclosed to the public. Hence, a more thorough examination among a larger number of successful and failed ICT-based water project proved to be a difficult task.

Moreover, as the concept of incorporating ICT into the field of water management is relatively novel, the existing research and literature were highly limited. By the same token, in the field of social sciences, since the topic of ICT, itself, is also a new concept, a similar difficulty was faced. This led to most literatures and research being done on the technical aspects of the ICT-based water projects, as well as

their proposed benefits, with research and literature on the maintenance and evaluation, which also looks into the determining factors of failure, being rare.

### 3. Summary

Despite the global efforts on tackling humanity-related issues, such as water, being more prevalent than ever, the visible results seem to be lagging far behind the passion. Though initiatives, such as the SDG-6, are aiming for universal access to clean water and sanitation, the rates in poverty-stricken areas, such as Sub-Saharan Africa, show that nearly half of the population still lack access. With the traditional methods of proper water management failing due to several factors, such as high levels of conflict, corruption, poverty, and lack of adequate infrastructure, there needed to be an innovative and efficient alternative.

The water experts of multilateral donor organizations and recipient nations found the answer in ICT. With the utilization of said technology into the water sector, more cost-efficient water management was possible, as well as greater public participation, which is conducive to sustainability. Though the solution seemed infallible at first, not all ICT-based water projects were performing equally. Due to the limited amount of existing literature and research based on ICT implementation

in the water sector, a clear underlying reason for success or failure of the projects was unclear.

To solve this issue, the research utilized the comparative case study methodology to compare the two nations of Kenya and Tanzania, which are hosts to the ICT-based water projects of Maji Voice and Human Sensor Web, respectively. The former country was chosen, due to its heavy emphasis on both water and ICT, as stated in its national legislations. Moreover, the country is one of the hosts with the largest number of notable ICT-based water projects, with Maji Voice standing as one of its exemplary success. Tanzania, the latter case study nation, was chosen due to similar factors, such as geographic proximity, socio-economic similarities, as well as equally emphasized fields of ICT and water. Though not as much as Kenya, Tanzania is home to a respectable number of ICT-based water projects, with Human Sensor Web serving as a representative example of failure, which allows for a suitable testing ground to uncover why certain projects perform poorly in equal conditions.

Previously, the water experts from multilateral donor agencies, such as the World Bank, proposed that the primary reasons for the failure of ICT-based water projects can be seen as “poverty, weak

institutions, and poor infrastructure”.<sup>112</sup> Thus, to test if this is really the case, the superficial, or the contextual conditions of economic, social, and political factors of the two case studies were examined. The results were that no significant disparities of superficial factors existed between the two.

The research went on to find that there were several underlying factors worth examining, such as location, operating mechanisms, ownership status, accountability, and etc., and found that notable differences in the number of stakeholders and quantity and quality of accountability mechanisms were present. Analyzing the key differences with theories and concepts, such as the principal-agent theory, rational choice institutionalism, and buck-passing possibilities, it was concluded that the a relatively small number of stakeholders and abundant and stringent accountability mechanisms were responsible for increasing the likelihood of ICT-based water projects.

With this in mind, policy guidance that could be given to future implementers of ICT-based water projects is that relatively fewer number of stakeholders in a given project is crucial to prevent the possibilities of “buck-passing”, which can be highly detrimental to a

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<sup>112</sup> Ndaw, M. (2015). “Unlocking the Potential of Information Communications Technology to Improve Water and Sanitation Services”. Water and Sanitation Program. World Bank Group

project's performance and sustainability.<sup>113</sup> Moreover, as one of the major goals of ICT-based water projects is spurring greater accountability through public participation, on top of cost-efficient water management, it can be summarized that accountability input is positively correlated to accountability output.

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<sup>113</sup> Kim, T. and Lim, S. (2017). "Forging 'Soft' Accountability in Unlikely Settings: A Contextual Analysis of Mutual Accountability in the Context of South-South Cooperation". *Global Governance*, 23 (2)

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## 국문 초록

ICT 기반 물 프로젝트에 이로운 근원적 요인:

케냐와 탄자니아의 사례연구 비교

엄 대 성

서울대학교 국제대학원

국제협력 전공

깨끗한 물 확보와 같은 인류 공통의 문제를 근절하기 위한 세계적인 노력이 증가하고 있음에도 불구하고, 일부 지역의 발전은 기껏해야 평범하다. SDG-6 와 같은 이니셔티브는 깨끗한 물에 대한 보편적 접근을 강조하지만, 사하라 이남 아프리카와 같은 지역은 여전히 만연한 물 위기로 고통 받고 있다. 계속되는 갈등, 부패, 빈곤, 그리고 불충분한 기반 시설 때문에, 그 지역의 전통적인 물 관리 방식은 충분하지 않다.

최근 물 분야에서의 ICT 활용에 대한 혁신적인 대안이 제시되었다. ICT 기반 물 프로젝트는 효율적인 물 관리 방법과 공공 참여를 통한 책무성 증대라는 부가적인 혜택을 제공했기 때문에 틀림없는 해결책으로 보였다. 그러나 케냐와 탄자니아의 Maji Voice 와 Human Sensor Web 등 두 가지 사례 연구 결과에서 알 수 있듯이 모든 ICT 기반 물 프로젝트가 성공하는 것은 아니다.

아프리카 ICT 기반 물 프로젝트의 성공에 도움이 되는 요소를 파악하기 위해 위의 두 사례 연구로 구성된 연구 분석이 실시되었다. 더욱이 경제적, 사회적, 정치적 등 피상적인 요소가 변수를 결정짓는 것이 아닌가 하는 의문이 제기되었다. 결과는 피상적인 요소들 간에 유의미한 차이가 아닌, 이해당사자 수와 책무성 메커니즘의 양과 질에 대한 유의미한 불균형의 발견이다.

주로 주인-대리인 이론, 합리적 선택 제도주의, 책임회피의 개념을 활용한 이번 연구는 두 가지



불균형이 아프리카에서의 ICT 기반 물 프로젝트의 전반적인 성공에 기여하고 있음을 입증하기 위해 노력했다. 이러한 발견을 통해, ICT 기반 물 프로젝트의 미래 이행자에 대한 정책적 함의도 주어지며, 이것은 책임회피를 줄이기 위해 이해관계자의 수를 제한하는 것에 대한 강조 뿐만 아니라, 더 큰 책무성 아웃풋에 대한 책무성 인풋을 증가시키는 것에 대한 강조를 강화한다.

**주요 단어:** SDG-6, 사하라 이남 아프리카, ICT, 물, 이해관계자, 책무성

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