
Impact Evaluation of Rural Water Supply to Sinyerere Villages, Kenya

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Abstract

*The paper discusses the significance of water in economic development, making the argument that greater access to water supply will influence food productivity and improve overall health and related MDG poverty indicators, linking it as the single most important factor to the achievement of the MDGs. More specifically, the research focuses on one goal of the Millennium Development Goals - **Water & Sanitation** - identifying it as the pillar on which to anchor the fight against food security and other progenitors of poverty.*

Keywords: Rural households . Water. Supply. Demand. MDGs

1 INTRODUCTION

“Among the many things I learnt as president, was the centrality of water in the social, political and economic affairs of the country, the continent and the world”.

Nelson Mandela,

World Summit on Sustainable Development, 2002 (UN, 2006: 172).

According to the UN (2006: 173) , an issue with important implications for human development and global poverty reduction is how to manage water resources to meet the rising food needs while protecting the access of poor and vulnerable people to the water that sustains their livelihood. The report further cautions that “outcomes for the poorest, most vulnerable people in society will be determined by the way institutions mediate and manage rival claims – and by whether governments put equity concerns at the centre of national policies UN (2006: 17). The report points out that two key trends are discernable, 1) as urban centers and industry increase their demand for water, agriculture is losing out, and 2) within agriculture, competition for water is intensifying. As a result, several policy options need to be considered UN (2006: 16-19)

1. Mediating through economic and political structures.
2. Balancing efficiency and equity.
3. Managing allocations and licensing
4. Balancing formal and customary rights
5. Giving more attention to equity
6. Addressing deep seated gender inequalities.
7. Reaching the poor.

In addition to its use for production, water has other poverty related implications. Thus, the challenge of providing water where it is needed most is at the heart of the Millennium Development Goals. In 2002, 1.1 billion people lacked access to improved water sources such as a protected well or piped water, and an additional 2.6 billion people, approximately 40% of the global population, lack adequate sanitation (UNICEF/WHO 2004). This lack of basic services, combined with inadequate hygiene, exposes people to bacteria, viruses, and parasites in water. The Millennium Development Goals (MDGs) seek to reduce by half the proportion of people who do not have access to improved water sources and adequate sanitation by the year 2015 (UN 2000) in order to contribute to the goal of reducing extreme poverty also known as Target #10 UN (2004: 29). Improved access to water and sanitation is a target of Goal 7, to ensure environmental sustainability. Rheingans *et.al* (2006 1:31-38) note that meeting this target is essential for other aspects of poverty reduction and health improvement MDGs, through increased productivity and income generation activities (Goal 1); improved access to education, especially for girls (Goal 2); decreased water collection times for women and greater gender equity (Goal 3); reduced childhood diarrheal disease morbidity and mortality (Goal 4); decreased prevalence of vector breeding areas, disease transmission, and injuries during water collection (Goals 5 and 6); and a promotion of participatory, community-focused approaches to development (Goal 8).

To help the international community as a whole reach the Millennium Development Goals, the United Nations established the Millennium Project, which focuses on the question “what will it take to achieve the MDGs?” (UN 2004: 17, 110). The report extensively highlights the paramount importance of improving water resources management as a critical factor for meeting most of the goals, which include eradicating extreme poverty and hunger; achieving universal primary education; promoting gender equality and women’s empowerment; reducing child mortality; improving maternal health; combating major diseases; and improving environmental sustainability.

This study will examine the significance of improved water supply as a pillar on which to anchor the fight against food security and other progenitors of poverty. The study is based on the premise that while the fight against poverty must be multidimensional, the strategy needs to be anchored on at least one primary agent as the pillar on which other agents of economic transformation spread from. The purpose of this study is therefore to investigate the factors influencing water supply in rural areas and its impact on food security and other MDG related health and poverty indicators. More specifically, the key objectives of the study will be to; 1) identify the determinants of improved water supply for rural households and to what extent do rural households participate in decision-making about improved water supply, 2) examine the influence of improved water

supply on agricultural productivity with respect to food security in rural areas, 3) assess the implications of improved water supply in rural areas with respect to health and other MDG related indicators.

The study will use a combination of descriptive and case study methods based on the concept of Millennium Villages, MVP (2007). The case study will include the review of lessons learned from the MV Project in Sauri with respect to factors influencing water supply in rural areas and its impact on food security and other MDG related poverty progenitors.

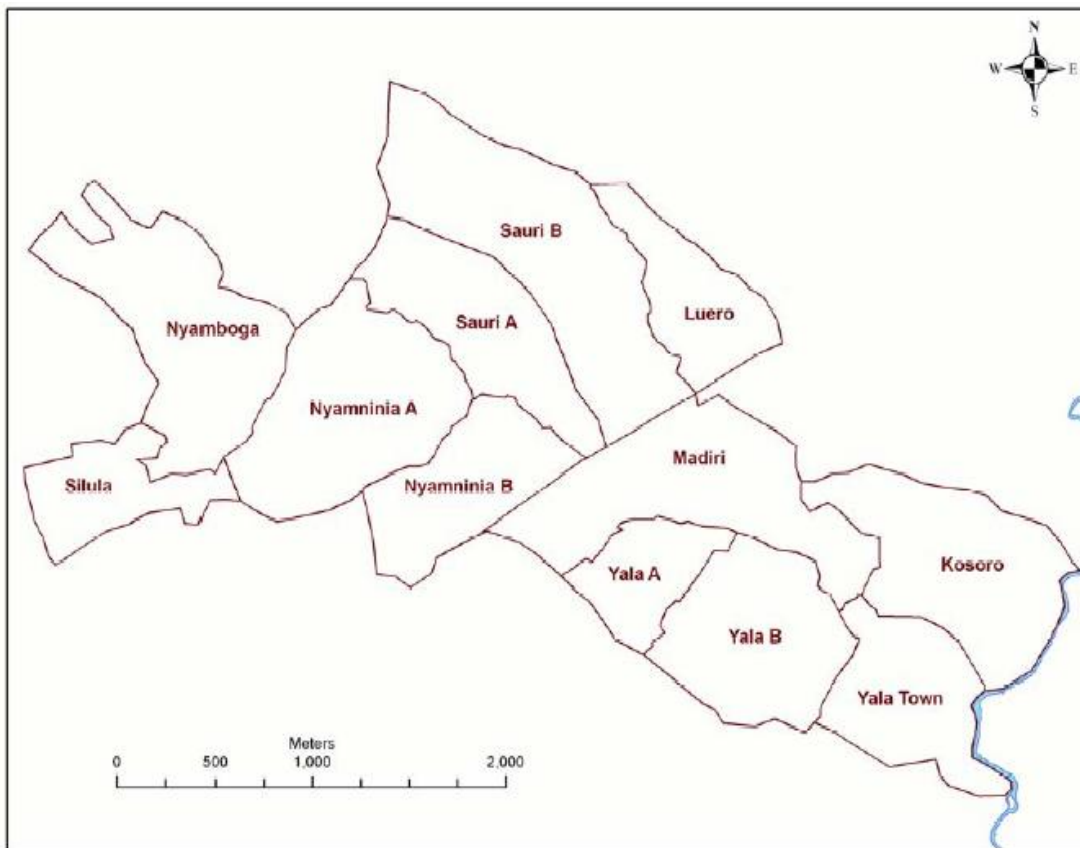


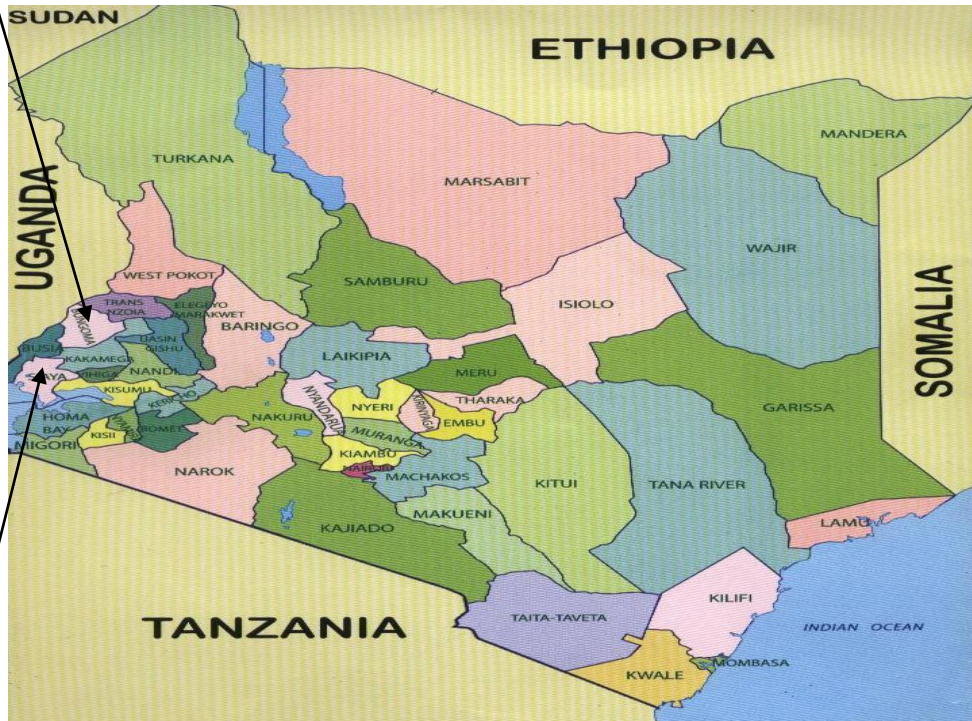
Figure 1: Source: Sauri Baseline Report, 2007

Sauri Villages

Sauri is located 40 km from Kisumu, the nearest city. Although Kisumu is a potential center for markets and other resources, few Sauri residents have access to the city mainly because of transport costs.

It is a conglomerate of 11 villages (Nyamboga, Silula, Nyamninia A, Nyamninia B, Sauri A, Sauri B, Luero, Madiri, Yala A, Yala B, Kosoro, and Yala Town) covering 8 sq km with 5,000 people. It is located in Yala Township location, in Siaya County. There are 614 homesteads within Sauri, with an average of 1.6 households in each homestead.

Trans Nzoia County (Sinyerere)



Siaya County (Sauri) Figure 2, Source: SoftKenya

Using the Sauri villages experience as the guiding baseline, the study will collect primary data from Sinyerere in Trans Nzoia county and make reference to case studies for rural populations of Pakistan, Ghana, Madagascar and Philippines, in order to compare and identify their challenges and recommend relevant improved water supply strategies for enhancing food security and fight against other progenitors of poverty.

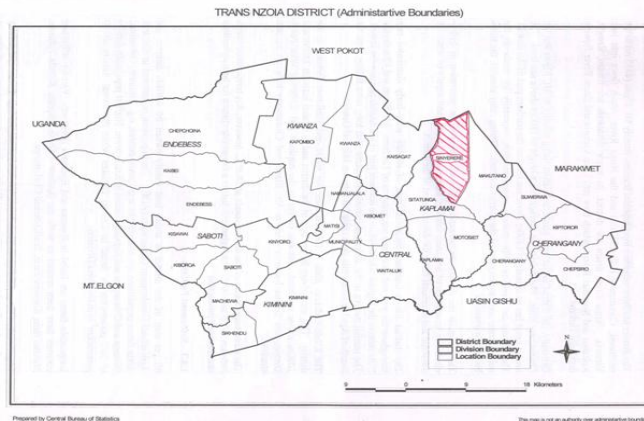


Figure 3, Source: Central Bureau of Statistics, Government of Kenya

Trans Nzoia lies between latitudes $0^{\circ} 52'$ and $1^{\circ} 18'$ north and longitudes $34^{\circ} 18'$ and $35^{\circ} 23'$ east. It covers an area of 2487.3 km^2 , which represents 0.4 per cent of the County. The County has three important topographical features, namely Mt. Elgon (4313m) to the northwest, Cherengany Hills (3371m) and the Nzoia River, which flows into lake Victoria. Nzoia River drains the county. Its major tributaries are Ewaso, Rongai, Koitabos, and Nogomet Rivers, which flow into Lake Victoria. The rivers are perennial and could be used for generation of hydroelectricity, promotion of irrigation farming, fisheries and permanent supply of water for domestic and in general foster the development of the county (Government of Kenya, (2004). The shaded area in Figure 3 is Sinyerere sub-location, site of the research study with the eight villages namely Musemwa, Nzoia, Mitoto, Makindu, Kiriita, Sitatunga, Mwago and Michai with a total population of approximately 5,500 people.

2 STATEMENT OF THE PROBLEM

According to the UN (2006:17), there is a danger that agriculture in general, and poor rural households in particular will suffer in adjustment to competition for water. Thus, despite urbanization, most of the world's extreme poor still live in rural areas, and small farmers and agricultural laborers account for the bulk of global malnutrition. And from a health perspective, it is estimated that 1.8 million child deaths each year are related to unclean water and poor sanitation which dwarfs the casualties associated with violent conflict and that no act of terrorism generates economic devastation on the scale of the crisis in water and sanitation UN (2006:3).

The report presents seven key issues of concern with respect to competition for water UN (2006 28-31).

1. *Mediating through economic and political structures*, i.e., as competition for water intensifies, future access will increasingly reflect the strength of claims from different actors. Outcomes from the poorest, most vulnerable people will be determined by the way institutions mediate and manage rival claims – and by whether governments put equity concerns at the center of national policies.

2. *Balancing efficiency and equity*, i.e., cities and industries are extending their hydrological reach into rural areas, giving rise to disputes and occasionally violent protest. While development of water rights through private markets is seen by some as the solution to balancing efficiency and equity, it is argued that this offers a questionable solution to a systemic problem.
3. *Managing allocations and licensing*, i.e., while it is applauded that some governments are seeking to manage adjustment pressures through quantitative allocations and licenses, it is also argued that formal and informal power imbalances often undermine the position of the poor.
4. *Balancing formal and customary rights*, i.e., in Sub-Saharan Africa, governments are seeking to expand the irrigation and establish formal systems of rights as a supplement or replacement of customary rights, but evidence in Sahel region shows that smallholders can often lose out in competition for irrigation to larger scale commercial producers. Customary rights too pose problems such as in Senegal River valley where customary rights holders have used their power to maintain social exclusion.
5. *Giving more attention to equity*, i.e., while irrigation is said to increase productivity, it is argued that land inequality is a major factor of increasing inequality. Hence, there is no inherent trade off between increasing productivity and reducing poverty in irrigation.
6. *Addressing deep-seated gender inequalities*, i.e., women are typically disadvantaged in irrigation systems due to lack of formal rights to land, and hence excluded from irrigation system management.
7. *Reaching the poor*, i.e., the greatest challenge is to ensure that strategies for enhancing water productivity extend to the poor since technology is not neutral in its distributional effects. It is argued that the danger is that efforts to get more crops per drop from water resources will bypass poor households. .

While these challenges are general, there are also specific target area challenges that are also worth considering. For example, one of the challenges is that some households are typically out of food long before the next harvest. In a survey by Millennium Villages, of the 301 Sauri respondents, 75% of households reported that their harvest after the long rains was not sufficient to provide food for the family until the next harvest and 85% reported that their harvest after the short rains was not sufficient. In either case, a threat to food access. The MV Project has used several indicators for measuring food access, such as total income and crop income. Maize, the staple food in Sauri, was used as a proxy for food availability assuming that 1 kg of edible maize provides 3,530 calories MVP (2007:35)

According to the MVP Baseline Report , (2007:34) , 244 households reported that they store their food (81% of survey sample) and 222 (91% of those who store food) reported storage within the house as the method of storage. Only 4 households reported storing food in a traditional granary. In terms of food preservation, for beans, 73% reported drying, and 22% reported preservation with ash. For maize, 75% reported drying, 20% reported preservation with ash. For millet, 61% report drying and 17% preservation with ash. For wheat, 13% report preservation with ash, and 81% reported “Other” i.e., milling and/or grinding. For fish, 49% reported smoking, 12% drying, and 10% salting while for meat, 44% reported smoking, 16% salting, and 11% drying.

Another challenge is with respect to health risks, especially as regards sustainable access to improved sources for drinking water, i.e., piped water, public tap, borehole or pump, protected well, protected spring, or rainwater. “unimproved” sources include unprotected wells, unprotected springs, vendor-provided water, bottled water, and tanker truck provided water. The UNICEF/WHO (2005 :91-92) defines sustainable access

to water as the availability of 20 liters per capita per day at a distance no longer than 1,000 meters and that these 20 liters must be of high enough quality to safely use for drinking, cooking, and washing.

For example, in Sauri, the majority of household water is collected from springs and rainwater harvesting systems (when rain is available) which is considered an improved source. However, long distances to water sources and large amounts of time spent collecting water are major obstacles to improving food security, community health and local economy since time spent collecting water could otherwise be spent on economic activities, child rearing, educational activities, etc.

Similarly, WHO has shown that when it takes more than a 30 minute trip to reach a water source, the amount of water collected is not enough to reach the minimum amount required for drinking, cooking, and personal hygiene. UNICEF/WHO (2005:26). But according to the MV project in Sauri, the average time spent collecting water is 2.9 hours per person per day during the wet season and 4.3 hours per person per day during the dry season. An average of 1.7 people per household is responsible for collecting water.

Although Rheingans *et al* (2006 31-38) improving water and sanitation coverage impacts many of the MDG targets, and while the MDG indicators provide important benchmarks for monitoring, they may not be sufficient to ensure that improvements in water and sanitation have an impact on health, poverty alleviation, and gender equality,. Hence, in view of these challenges, it is critical that information is developed to provide a good understanding of the negative impact of limited water supply and the respective mitigation strategies for managing water resources with respect to food security, health risks and other MDG related indicators.

3 OBJECTIVES OF THE STUDY

The purpose of this study is to investigate the factors determining water supply in rural areas and its impact on food security and other MDG related health and poverty indicators among households. More specifically, the study seeks to answer the following research questions:

1. What are the determinants of improved water supply for rural households and to what extent do rural households participate in decision-making about improved water supply?
2. How has improved water supply influenced agricultural productivity with respect to food security in rural areas?
3. What are the implications of improved water supply in rural areas with respect to health and other MDG related indicators?

This study will investigate lessons learned from the Millennium Village Project in the Sauri sublocation of Siaya district in Nyanza province. The study of Sauri has been selected primarily as the first village to undergo real life experimentation of MDG specific goals through the Millennium Villages (MV) project. Besides having a good established baseline data, the population is anticipated to be more receptive to, and appreciative of the importance of data collection and research studies. Additionally, the study will investigate case studies of South African villages aimed at addressing the MDG requirements for comparative purposes as well.

Although Sara *et al* (1998: 4) point out the importance of access to improved water supply for rural households and employing a “demand-responsive approach”, where users make choices and commit resources in support of these choices, it is difficult to find in literature studies that have an empirical account of the “Differential Diagnosis” approach to domestic water access and sanitation services of Kenya’s rural household population Sachs (2005: 82-89). Indeed, little or no literature is also available on constraints in the management of water resources among rural households (UN 2004: 20).

Arising from the relevance of safe water to community health and the stipulations of the other 9 Millennium Development Goals, the motivation of this study emanates from the fact that the disparity between improved water supply and the demand responsiveness to the quantity and quality of water is unequal. This inequality suggests that different types of policies may be needed for access to water supply in order to ensure food security and community health among rural households in Kenya. Secondly, much of the recent interest in supply of water for agriculture and safe drinking water as the basis for food security and community health stems from the recognition that water is critical to other facets of sustainable development (UN 2004: 21-33). Thirdly, this study will instigate the Government of Kenya and policy makers elsewhere to proactively take measures to improve water supply and sanitation services in rural households to reduce incidences of drought and water-borne diseases.

But most importantly, this research aims at addressing the MDG requirements of which Kenya and by extension South Africa are strongly committed to. The findings would provide alternative strategies for achieving MDG goals. Thus, the research will give a good anatomy of the status of the two nations as well as villages in terms of the eight MDG areas, the extent to which villagers may be willing to participate in MV type of programs and possible preference rankings or perspectives of the eight MDG goals.

In addition, the study will have a direct impact on applicable national government policies and scaling-up plans for millions of people by 2015.

4 JUSTIFICATION OF THE STUDY

Although Sara *et al*. (1998: 4) point out the importance of access to improved water supply for rural households and employing a “demand-responsive approach”, where users make choices and commit resources in support of these choices, it is difficult to find in literature studies that have an empirical account of the “Differential Diagnosis” approach to domestic water access and sanitation services of Kenya’s rural household population (Sachs 2005: 82-89). Sachs emphasizes “a seven-part diagnostic checklist that should be part of the ‘physical

exam' of any impoverished country". Indeed, little or no literature is available on constraints in the management of water resources among rural households (UN 2004: 20).

Arising from the relevance of safe water to community health and the stipulations of the other nine MDGs, the motivation of this study emanates from the fact that the disparity between improved water supply and the demand responsiveness to the quantity and quality of water is unequal. This inequality suggests that different types of policies may be needed for access to water supply in order to ensure food security and community health among rural households in Kenya. Secondly, much of the recent interest in supply of water for agriculture and safe drinking water as the basis for food security and community health stems from the recognition that water is critical to other facets of sustainable development (UN 2004: 21-33). The report of Millennium Villages Project further lists environmental protection and food security to increased tourism and investment, empowerment of women and education of girls to reductions in productivity losses due to morbidity and malnutrition.

The rationale for the selecting the Sinyerere village communities is based on a casual village need assessment, available and willing community contacts, existing efforts/interest in farming and education projects as well as available in-kind resource infrastructures. Most importantly, this study aims at addressing the MDG requirements of which Kenya has strongly committed to.

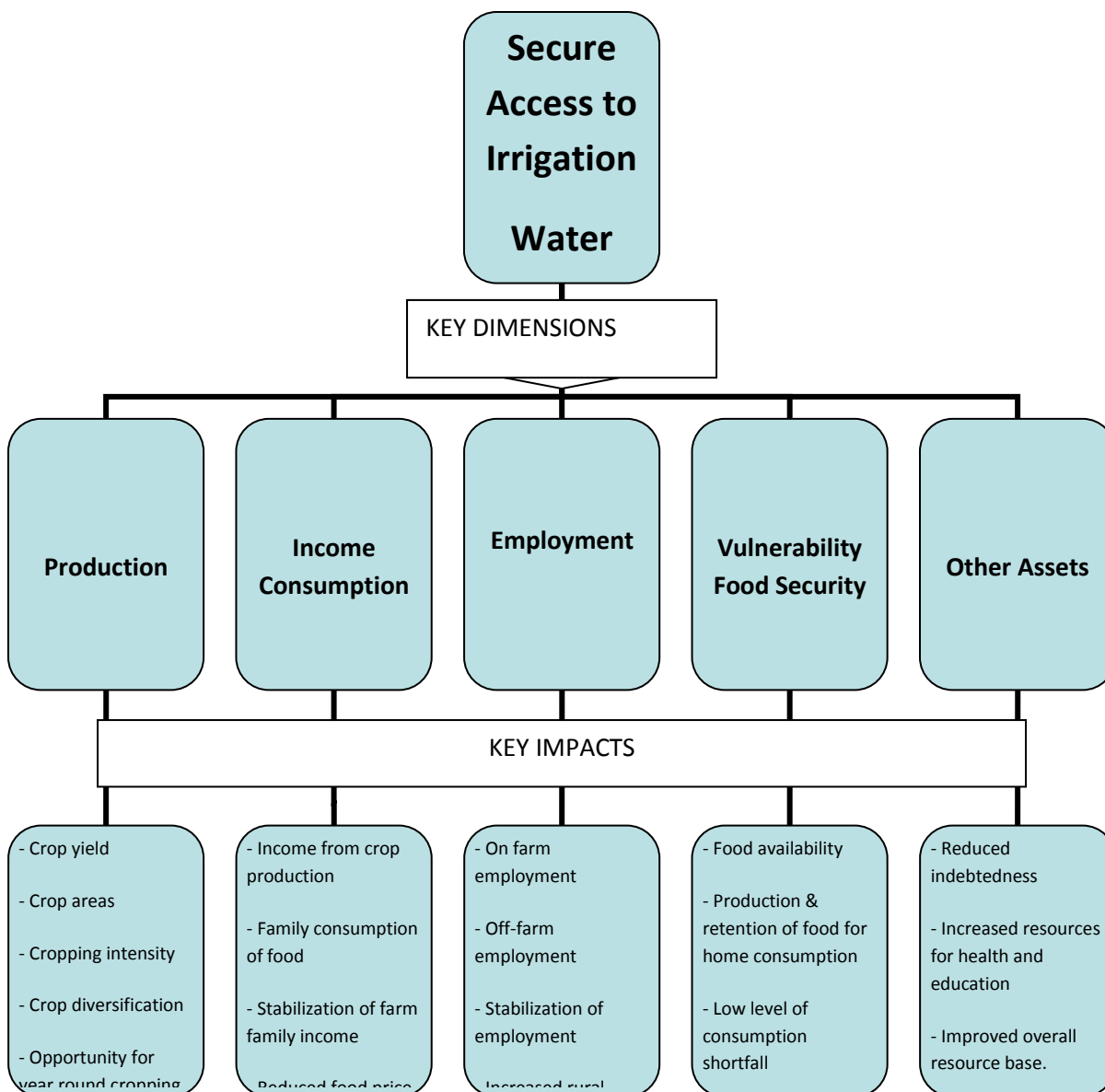
5 LITERATURE REVIEW

The significance of water towards the achievement of the Millennium Development Goals (MDGs) can not be underestimated. Indeed, it is the thesis of this proposal that the supply of water may constitute a critical pillar from which other MDG objectives may be achieved. According to a UN report, investments in water resources development and management can contribute to meeting the MDGs as a whole both through broad interventions designed to promote sustainable development on an area basis...and through targeted actions...both types of interventions are important for making many of the MDGs a reality; indeed, holistic approaches to water resources development and management can help to deliver the MDGs more cheaply and sustainably (UN, 2005:128)

The core premise of the Poverty Environment Partnership (PEP) report was that water management was the key factor in the global battle to remove the scourge of extreme poverty and build a secure and prosperous life for hundreds of millions of people in the developing world. They argued that the potential of water management as an engine, not just of poverty reduction, environmental sustainability and improved health, but also of straightforward economic growth and livelihoods development and that this is not well understood, (PEP, 2005/6: 11). Their report was based on a conceptual framework developed in earlier papers through the analysis of the contribution of water management to four key dimensions of poverty reduction, i.e., enhanced livelihoods security, reduced health risks, reduced vulnerability, and pro-poor economic growth. According to a report (UN 2006: 175), water security pervades all aspects of human development. It states that water can not be considered in isolation from wider capabilities such as health and education, or from access to other productive assets, including land, capital and infrastructure. The report further argues that access to a reliable supply of water makes it possible for people to diversify their livelihoods, increase productivity and reduce the risks associated with drought . It enables producers to enter higher value added areas of production and creates income and employment, and it gives people the security to undertake investments (see Figure 1, pg. 9).

Among the challenges, the report points out that over the next few decades, many developing countries face the prospect of intensified competition for water from population growth, rising incomes, changing dietary patterns, urbanization and industrial development all of which will increase demand for a fixed supply of water. It further argues that Agriculture, the major user of water and the source of food for growing populations will be a focal point of these pressures, and that power and voice will strongly influence how the adjustment process affects the poor.

Figure 4: Access to irrigation water can reduce poverty and vulnerability



Source: UN (2006:175) Adapted from Hussain & Hanjira 2003

Rheingans *et al.* (2006 1(1):31-48) emphasize the use of existing social structures that are largely unexplored and are capable of reaching large portions of the population, including schools, health care systems, and markets. Approximately half of the schools in low- and middle-income countries do not have safe water and appropriate sanitation facilities. The lack of gender-appropriate sanitation in schools is often cited as a cause of declining enrolment of girls, especially after puberty. The report further argues that school-based interventions could include: hygiene education, hand-washing facilities, sanitation, water treatment and safe storage, and improved water supply. The direct benefits for students, school-based interventions can potentially leverage change beyond the immediate school environment. While few long-term studies of health impacts are available, evaluations of existing school projects suggest that behavior and attitudinal changes in school result in changes in the home. The evaluation of a school hygiene and sanitation project in Bangladesh found an increase in the proportion of homes with latrines and the proportion of family members using latrines, as well as improved hand-washing behaviors among adult family members following the intervention. Rheingans *et al.* (2006 1(1):31-48) argue that school-based water supply improvements can also serve as a source of improved water for the surrounding community or as a distribution point (or vendor) of point-of-use water treatment supplies.

Larson, *et al.* (2006) state that achieving the poverty, education and drinking water targets to meet the Millennium Development Goals are not independent endeavors and that reducing poverty and improving education will alter household choices related to water access. For water, it is noted, access is only an intermediate target, while expanding actual water use by households is the intended result. By increasing quantities of potable water used by households, for example, by expanding uses for hygienic purposes, reductions in under-five mortality rates might be achieved (MDG four, target five). Larson, *et al.* (2006) emphasize little empirical analysis exists identifying the complementarities among these MDG targets and that if governments want to achieve these MDG targets, insights on such complementarities are important to prioritize actions and to help in the design of policies to achieve the stated targets.

Furthermore, Larson, *et al.* (2006) assert that household water demand is derived from some underlying household decision making process. A model of a household as a joint production and consumption unit provides a logical framework for developing insights in water demand (see, for example, Singh, Squire, and Strauss, 1986; Pearce and Turner 1990; and Berhman and Deolalikar, 1998). The end result of a household model (see, for example, Acharya and Barbier, 2002) is that a reduced-form water demand function for a household, conditional on water source (water supply technology), can be

stated simply in the basic econometric model as follows:

$$y_i = \varphi (p_i; x_i; z_i);$$

where y_i is water consumed at home by household i , p_i represents a vector of market prices for all goods and services, $z_i = 1$ if the household's water source is a private connection at their home and 0 if the household collects water from outside the home, and x_i represents a vector of all exogenous variables affecting household welfare including household specific factors such as household size and community or location specific factors

such as distance to water source (as measured by travel time) and quality of water available (Larson, *et al.* (2006)).

Agenora *et al.* 2005 posit that South Africa is one of the bright spots on the African continent and has a fair chance of achieving the targets set for 2015 with the possible exception of targets relating to HIV/Aids, (South Africa MDG country report, 2005). The MDG report for 2005 indicates a vast overall improvement in access to safe drinking water and sanitation (South Africa MDG report, 2005:49). In this regard, Table 1 shows the proportion of urban and rural populations that have access to improved water sources and basic sanitation.

Table 1: Indicators of access to water supply and sanitation

Indicators	1994	2004	2015 Target	Progress Towards Target
Proportion of total population with access to improved water source (%)	60.1	78.7	80.1	Good
Proportion of <i>rural</i> population with access to improved water source (%)	44.4	63.6	72.2	Good
Proportion of <i>urban</i> population with access to improved water source (%)	70.3	63.6	85.2	Achieved
Proportion of total population with access to basic sanitation (%)	48.7	63.7	74.4	Good
Proportion of <i>rural</i> population with access to basic sanitation(%)	32.5	44.5	66.3	Slow
Proportion of <i>urban</i> population with access to basic sanitation (%)	58.7	76.9	79.4	Good

Source: South Africa MDG Report, p 49

According to Kearney and Odusola (2011:58) one of the targets of MDG seven focuses on increasing the proportion of the population with access to improved water sources, and sanitation and the South African government has made significant progress towards achieving the target since the abolishment of apartheid. It is argued that under the Reconstruction and Development Programme (RDP) the percentage of households with access to water increased from 61.7 percent to 84.7 percent, and access to basic services has increased from 59 percent of the population in 1994 to 94 percent in 2007 (UN 2007:44).

Kearney and Odusola (2011:58) assert that achieving MDG seven has further feedback effects for the overall achievement of the MDGs, such as improved health and agree with Sbrana (2009) who identifies the variables wealth, area (rural or urban), spending per capita on water and sanitation, and access to infrastructure as factors that influence an individual’s probability to have access to improved water and sanitation services.

According to their model below, logistic regressions are run for access to water and sanitation based on characteristics identified as follows:

$$y = \alpha_1 Income + \alpha_2 Province + \alpha_3 Popgrp + \alpha_4 PercapItaSpendInfr + \alpha_5 AccessInfrastr$$

where

<i>y</i>	access to improved water and sanitation
<i>Income</i>	income per capita
<i>Province</i>	variable specifying the province in which the individual lives
<i>Popgrp</i>	variable indicating the population group of the individual
<i>PercapItaSpendInfr</i>	variable specifying the per capita spending by government by province on improved water and sanitation
<i>AccessInfrastr</i>	indicates the access to infrastructure; the value is 0 if the individual do not have access to infrastructure and 1 if the individual have access to one source of infrastructure, 2 if individual have access to 2 sources of infrastructure and 3 if the individual have access to water, sanitation and electricity infrastructure.

Engel *et al.* (2005: 1-8) examine rural households in Ghana using the supply and demand characteristics for improved water supply and find quality perceptions play an important role in households' choice of water source. The rural households were one of the first countries to introduce a community-based approach to rural water supply on a large scale. Specifically, households that consider the unimproved source to be of bad quality are significantly more likely to choose the improved source as their main water source. The study determined that differences in quality perceptions across households can be due to either actual quality differences or to differences in awareness. Interestingly, another study found that sustainability was markedly higher in communities where household members made informed choices about whether to build a system and what type and which level of service they preferred. Community and household surveys indicated that projects were sometimes supply-driven (not offering community members options or informing them of expected costs or responsibilities) and at other times were demand-responsive (spending time informing communities about their options and giving them a lead role in the decision making process), UNDP-World Bank (1998: 1-8).

6.1 PREVIOUS RESEARCH ON RURAL COMMUNITY HOUSEHOLDS

Despite the importance of rural community households meeting the objectives of Millennium Development Goals, relatively little research has been given to linking water to the achievement of specific time-bound targets UN (2006: 22). It appears that most studies focus on achieving specific targets attributable to the Goal itself without necessarily linking water and sanitation as a determinant MA (2003: 554). As such there is no established theory that successfully describes the impact of water and sanitation with the achievement of the MDG's. The absence of strong empirical-based evidence on water and sanitation highlights the importance of this research. In fact, there is no known study of such comprehensiveness that has been done anywhere in the world. The targets set provide a useful frame of reference for understanding the linkages between progress in different areas—and the critical importance of progress in water and sanitation UN (2006 : 22).

In a study by Wambalaba *et al* (2009), the source of water for rural households of the Sikulu group of villages, in Kenya, was from wells followed by river and that their water source does not dry. It was also noted that almost half of the respondents live about half a kilometer away from their water source but a considerable number live about one kilometer from homesteads. Many do not use taps nor borehole water as water sources and there are none or few handwashing facilities in schools, health centres, market places etc. and most people do not wash hands after going to toilet. A significant number of respondents reported that they do not treat their drinking water. It is also of significance that households place water highly in the order of importance for the prevention of death in family.

6.2 DETERMINANTS LINKING WATER AND SANITATION TO THE ACHIEVEMENT OF MILLENNIUM DEVELOPMENT GOALS AMONG SINYERERE HOUSEHOLDS IN KENYA

According to the UN (2006 :22) multifaceted targets set under the Millennium Development

Goals cut across a vast array of interlinked dimensions of development ,ranging from the reduction of extreme poverty to gender equality to health, education and the environment. Each dimension is linked through a complex web of interactions. The report emphasizes that sustained progress in any one area depends critically on advances across all the other areas and lack of progress in any one area can hold back improvements across a broad front. The report stresses that water and sanitation powerfully demonstrate the linkages. More detail and references on the determinants can be found in Table 2.

Furthermore, according to a publication by the author of this proposal (Nerubucha, 2011: 653-654), the lack of basic services, combined with inadequate hygiene, exposes people to bacteria, viruses, and parasites in water and faeces and, that the Millennium Development Goals (MDGs) seek to reduce by half the proportion of people who do not have access to improved water sources and adequate sanitation by the year 2015 in order to contribute to the goal of reducing extreme poverty also known as Target #10.

With brevity, this study proposes that the benchmarks for Sinyerere households can be achieved by 2015 and, possibly beyond.

Table 2: Determinants linking water and sanitation to the achievement of Millennium Development Goals among Sinyerere households in Kenya.

MDG	Determinant	Link the MDG through:	References
Goal 1	Eradicate extreme poverty and hunger	<ul style="list-style-type: none"> • Introducing “lifeline tariffs”, cross-subsidies and investments in standpipes to ensure that nobody is denied access to water because of poverty, with a target ceiling of 3% for the share of household income spent on water. • Regulating water utilities to improve efficiency, enhance equity and ensure accountability to the poor. • Introducing public policies that combine sustainability with equity in the development of water resources for agriculture. • Supporting the development and adoption of pro-poor irrigation Technologies 	UN 2006:22

Goal 2	Achieve universal primary education	<ul style="list-style-type: none"> • Making sanitation and hygiene parts of the school curriculum, equipping children with the knowledge they need to reduce health risks and enabling them to become agents of change in their communities. • Establishing public health programmes in schools and communities that prevent and treat water-related infectious diseases. 	UN 2006:22
Goal 3	Promote gender equality and empower women	<ul style="list-style-type: none"> • Supporting sanitation campaigns that give women a greater voice in shaping public investment decisions and household spending. 	UN 2006:23
Goal 4	Reduce child mortality	<ul style="list-style-type: none"> • Establishing explicit linkages between targets for lowering child mortality and targets for expanding access to water and sanitation. • Prioritizing the needs of the poorest households in public investment and service provision strategies for water and sanitation. 	UN 2006:23
		<ul style="list-style-type: none"> • Treating water and sanitation provision as a key component in 	

Goal 5	Improve maternal health	<p>strategies for gender equality.</p> <ul style="list-style-type: none"> • Empowering women to shape decisions on water and sanitation at the household, local and national levels. 	UN 2006:23
Goal 6	Combat HIV/AIDS, malaria and other diseases	<ul style="list-style-type: none"> • Ensuring that households caring for people with HIV/AIDS have access to at least 50 litres of free water. • Investing in the drainage and sanitation facilities that reduce the presence of flies and mosquitoes. 	UN 2006:23
Goal 7	Ensure environmental sustainability	<ul style="list-style-type: none"> • Empowering independent regulators to hold service providers to account for delivering efficient and affordable services to the poor. 	UN 2006:24
Goal 8	Develop a global partnership for development	<ul style="list-style-type: none"> • Empowering local governments and local communities through decentralization, capacity development and adequate financing, with at least 1% of GDP allocated to water and sanitation through public spending. 	UN 2006:24

7 RESEARCH DESIGN AND METHODOLOGY

The purpose of this study is to investigate the factors influencing water supply in rural areas and its impact on food security and other MDG related health and poverty indicators. More specifically, the study seeks to answer the following research questions:

1. What are the determinants of improved water supply for rural households and to what extent do rural households participate in decision-making about improved water supply?

2. How has improved water supply influenced agricultural productivity with respect to food security in rural areas?
3. What are the implications of improved water supply in rural areas with respect to other MDG related indicators?

7.1 DATA COLLECTION

This research project places emphasis on a holistic bottom up approach as envisioned in the Millennium Villages' Project. Therefore, to achieve the objectives of this research, primary and secondary research will be undertaken. The study will rely on relevant secondary data of the Sauri Millennium Villages Project based on Household Socioeconomic Characteristics Census (*Demography, Income, Assets & Expenditures*), a survey designed by Earth Institute, Columbia University. In addition, international and national data searches will be done by the Library of the Nelson Mandela Metropolitan University as well as the United States International University library.

The primary data for the Sinyerere villages will be collected by using questionnaires administered to households.

While primarily anchored on water implications to food security, other seven MDG areas of focus will include but not limited to; 1) Poverty (energy, transportation, and finance), 2) Hunger (agriculture, nutrition, and markets), 3) Education and Gender, 4) Child and Maternal Mortality, 5) Health, 6) Combat HIV/AIDS & Other diseases, 7) Environmental Sustainability 8) Global Partnership.

The data collection will involve door to door data collection by local people under the supervision of the researchers. For specific elements of data collection, see Appendix 1.

7.2 RESEARCH PROCESS

The study will initially emulate the Sauri village project in Kenya by assessing its strategies and implications to other villages. Next will be collection of respective data from Sinyerere villagers for a comparative analysis with secondary data of South African villagers to identify their challenges and recommend relevant improved water supply strategies for enhancing their food security and fight against other progenitors of poverty.

The objective of this later segment is to identify poverty strains using a differential diagnosis approach and making investment recommendations for donors, private sector and government. It will primarily involve obtaining of community consent, identifying the level and sources of poverty, and using of a *differential diagnosis* (Sachs, 2005:82-84) approach to develop prescriptive strategies for cutting the level of poverty by half within a five year period in Sinyerere villages. Key elements of the research will include;

1. What is the nature or status of the eight key areas in Sinyerere villages with respect to water supply?
2. To what extent would the local communities (villagers) be interested in the MV program?
3. What would be the communities' (villagers) priority areas of the MV program activities?

The study will be carried out in the villages of Sinyerere, in Transzoia district in Rift Valley Province. The research process will primarily involve obtaining of community consent, identifying the level and sources of poverty using a differential diagnosis approach and developing prescriptive strategies for cutting the level of

poverty by half within a five year period in the Sinyerere villages. Areas of focus will include but not limited to the investigation about the nature and extent eight key areas as outlined in the MDG, i.e., 1) Poverty (energy, transportation, and finance), 2) Hunger (agriculture, nutrition, and markets), 3) Education and Gender, 4) Child and Maternal Mortality, 5) Health, 6) Environmental Sustainability, 7) Water and Sanitation, and 8) Global Partnership. This process will be based on the guidelines set by the Millennium Villages' Projects as follows:

Community consent will be obtained through a series of discussions with (stakeholders) elected and appointed officials, community committees, and open forums at the local level. Discussions will entail a description of the Millennium Development Goals (MDGs), a brief summary of the UN MDG Task Force Recommendations for meeting the MDGs, and the concept of the Millennium Village Project. Stakeholders will be asked for their thoughts, concerns, and reactions to becoming a MV site. If the ensuing discussions and reactions are positive, then the stakeholders will be asked to convene some committees, groups in the 'village', in a more open forum, for further discussions and reactions. An open dialogue with the committees/groups will cover topics such as local problems as related to the MDGs, constraints and opportunities for achieving the MDG at their 'village' level, initial discussions on possible solutions and approaches for achieving the MDGs, and general impressions/ consensus about being included as a MV site. The village dialogue beginning with the needs assessment is a means of assuring transparency and will be continued throughout the course of the research.

An added dimension to the research process is the anticipated/unanticipated impact of accessibility to improved water supply by households in the Sinyerere location. Specifically, the construction of a water supply infrastructure by a Chinese contractor – already completed - that will be under the management of Nzoia Water Supply Company, (NZOWASCO) in the Trans Nzoia District. The post assessment of the impact of the impact on livelihoods of the villagers in the Sinyerere location in comparison with Sauri villages with the related MDG's is therefore likely to be significant and of interest.

7.3 RESEARCH ANALYSIS

This research will employ a *differential diagnosis* approach to develop a descriptive study by not only searching for patterns in the data collected but also evaluating the forward and backward impacts of water supply and its inter-relationships with other MDG objectives. It will also rely on the case study method to underscore the comprehensiveness and interdependent nature of progenitors of poverty and agents of economic transformation.

The SPSS software will be used to analyze data using descriptive statistics where frequencies and percentages are calculated and the data presented accordingly. However, due to the comparative nature in the econometric

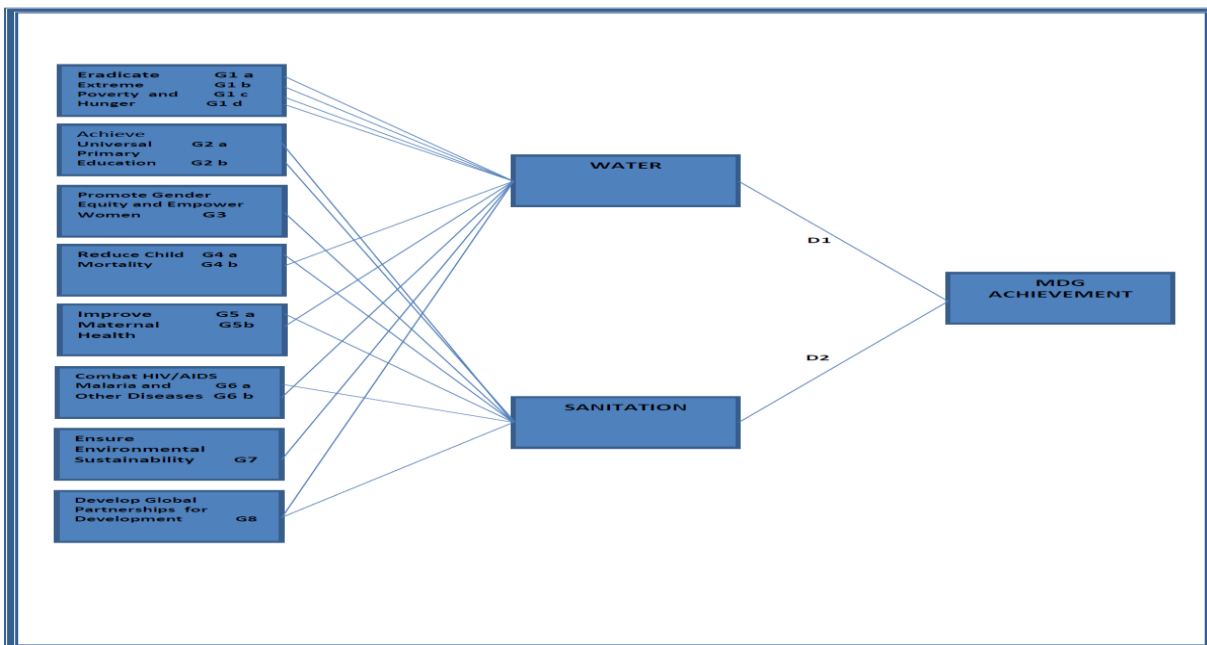
analysis of the study, Eviews is preferred since it offers accurate and broader query features for particular databases of interest.

The focus will be on the households’s main domestic water source, even for specific uses, and where no other improved source is available. However, by using the *Differential Diagnosis* (Sachs, 2005:84) approach, the model and estimation technique is of interest in determining the hypothesized direction of the household’s choice of water source.

8 PROPOSED THEORETICAL MODEL AND HYPOTHESES

Literature review reveals that there are a number of determinants influencing the success of Millennium Development Goals (see Table 2). The following proposed theoretical model is based on the determinants as shown in Figure 2.

Figure 2: Determinants linking water and sanitation to the achievement of Millennium Development Goals among Sinyerere village households in Kenya.



The model shows extreme poverty and hunger, universal primary education, gender equality and women empowerment, child mortality, maternal health HIV/AIDS, malaria, and other diseases, environmental sustainability and global partnerships for development as impacting water and sanitation as influential variables for the achievement of Millennium Development Goals. The dependent variable, MDG achievement, will be described as the extent or degree to which the specific targets are being met and addressed at the household, village and county level.

The direction which the hypothesis will take will be to test the relationships between the variables to water and sanitation as follows:

G1a,b,c,d: *There is a positive relationship between investments in standpipes and eradication of extreme poverty and hunger*

G2a,b: *There is a positive relationship between making sanitation and hygiene parts of the school curriculum, health programmes and achieving universal primary education.*

G3: *There is a positive relationship between support of sanitation campaigns and promotion of gender equality and women empowerment.*

G4a,b: *There is a positive relationship between access to water and sanitation facilities together with public investment programmes and child mortality.*

G5a,b: *There is a positive relationship between the improvement of maternal health and treating water and sanitation as a key component of gender equality and empowerment of women.*

G6a,b: *There is a positive relationship between access to a minimum of at least 50 litres of free water, investments in drainage and sanitation facilities with the reduction of malaria and other diseases.*

G7: *There is a positive relationship between delivery of efficient affordable services to the poor with environmental sustainability*

G8: *There is a positive relationship between empowering local communities through decentralization, capacity development and adequate financing with global partnerships.*

Whereas the independent variable *Province* is used in South Africa's analysis, Sbrana (2009), it will be substituted for the *County* variable for the Sinyerere study in Kenya. The regression will thus be as follows:

$$y = \text{Income} + \text{County} + \text{Villagepopln} + \text{PerpcapitaSpendin} + \text{Accessinfra}$$

where:

<i>Y</i>	access to improved water and sanitation
<i>Income</i>	income per capita
<i>County</i>	variable specifying the county in which the individual lives
<i>Villagepopln</i>	variable indicating the population group of the individual
<i>PerpcapitaSpendin</i>	variable specifying the per capita spending by government by county on improved water and sanitation
<i>Accessinfra</i>	indicates the access to infrastructure; the value is 0 if the individual do not have access to infrastructure and 1 if the the individual have access to one source of infrastructure, 2 if the individual have access to 2 sources of infrastructure and 3 if the individual have access to water, sanitation and electricity infrastructure.

9 SCOPE OF THE STUDY

Five groups of variables supposed to influence water supply are analyzed in the study: variables related to access to household water sources; variables related to type of water use (drinking, washing/bathing, animals): variables capturing characteristics of end-users (schools, hospitals, size of household, women): variables capturing participation in decisions on improved water supply (communal well or communal/coop water tank, rivers and/or streams); and variables capturing per capita consumption of improved water. After identifying the variables of importance, the following hypothesis will be tested:

Greater access to water supply will influence food productivity and improve overall health and related MDG poverty indicators.

10 CONTRIBUTION OF THE STUDY

According to the UN (2004:85) South Africa has used a combination of policy instruments and investments to expand coverage quickly and dramatically in just eight years and that the experience of South Africa should not be viewed as a model than can simply be transferred to other settings; however, it does provide important insights regarding attainment of the Millennium Development Goals.

This study intends to utilize the knowledge-based, crest of success “how to” principles of South Africa’s experience in the attainment of the MDG’s 2015 deadline. Since the findings of this study will be useful to the policy makers, donors, researchers and rural farming households, besides educating the local communities during implementation phases, the researcher will also participate in various forums (colloquiums) to present papers and workshops to policy makers and researchers. The final output will also be presented for publication in academic journals and made available to scale-up water provision services.

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